



**Fairbanks North Star Borough School District**

# **CAREER & TECHNICAL EDUCATION**



# **APPENDIX**

**May 21, 2019**

# TABLE OF CONTENTS

## Transportation, Distribution, & Logistics

### Appendix

ASE Maintenance and Light Repair (MLR) Task List .....	2
Equipment & Engine Training Council (EETC) Category 1, Section 4 .....	15
EETC Program Assessment Manual – Category 1, Section 4 .....	16
Program of Study .....	18
Small Gasoline Engines .....	18
Collision Repair .....	22
Diesel Operations and Technology .....	25
Standards .....	29
Abbreviation Keys for Standards .....	30
Alaska Employability Standards .....	32
Alaska Cultural Standards .....	34
Alaska English/ Language Arts Standards .....	58
Alaska Mathematical Standards .....	83
CTE Common Career Technical Core Standards .....	134
Textbooks .....	156
Tool Lists .....	157
Automotive Technology Tool List .....	158
Collision Repair – Basic Tool List .....	165
Diesel Technology Tool List .....	167

# ASE Maintenance and Light Repair (MLR) Task List

School: \_\_\_\_\_

Instructor(s): \_\_\_\_\_

Courses:

1. Small Engines 1A/1B
2. Small Engines 2A/2B
3. Basic Automotive Technology 1A/1B
4. Advanced Automotive Technology (two semesters, two periods per semester)

Text:

- A. Small Gas Engine
- B. Modern Automotive Technology
- C. Halderman Text
- D. Halderman/Deeter Text

## Engine Repair

For every task in Engine Repair, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

### General

✓	Task	Course	Text	Lab	Priority
	1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.				P-1
	2. Verify operation of the instrument panel engine warning indicators.				P-1
	3. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.				P-1
	4. Install engine covers using gaskets, seals, and sealers as required.				P-1
	5. Verify engine mechanical timing.				P-2
	6. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert.				P-1
	7. Identify service precautions related to service of the internal combustion engine of a hybrid vehicle.				P-2

### Cylinder Head and Valve Train

✓	Task	Course	Text	Lab	Priority
	1. Adjust valves (mechanical or hydraulic lifters).				P-3
	2. Identify components of the cylinder head and valve train.				P-1

<b>Lubrication and Cooling Systems</b>					
✓	Task	Course	Text	Lab	Priority
	1. Perform cooling system pressure and dye tests to identify leaks; check coolant condition and level; inspect and test radiator, pressure cap, coolant recovery tank, heater core, and galley plugs; determine necessary action.				P-1
	2. Inspect, replace, and/or adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.				P-1
	3. Remove, inspect, and replace thermostat and gasket/seal.				P-1
	4. Inspect and test coolant; drain and recover coolant; flush and refill cooling system; use proper fluid type per manufacturer specification; bleed air as required.				P-1
	5. Perform engine oil and filter change; use proper fluid type per manufacturer specification; reset maintenance reminder as required.				P-1
	6. Identify components of the lubrication and cooling systems.				P-1

## Automatic Transmission and Transaxle

For every task in Automatic Transmission and Transaxle, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

### General

✓	Task	Course	Text	Lab	Priority
	1. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.				P-1
	2. Check fluid level in a transmission or a transaxle equipped with a dip-stick.				P-1
	3. Check fluid level in a transmission or a transaxle not equipped with a dip-stick.				P-1
	4. Check transmission fluid condition; check for leaks.				P-2
	5. Identify drive train components and configuration.				P-1



<b>In-Vehicle Transmission/Transaxle</b>					
✓	Task	Course	Text	Lab	Priority
	1. Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch.				P-2
	2. Inspect for leakage at external seals, gaskets, and bushings.				P-1
	3. Inspect, replace and/or align power train mounts.				P-2
	4. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification.				P-1

<b>Off-Vehicle Transmission and Transaxle</b>					
✓	Task	Course	Text	Lab	Priority
	1. Describe the operational characteristics of a continuously variable transmission (CVT).				P-3
	2. Describe the operational characteristics of a hybrid vehicle drive train.				P-3

## Manual Drive Train and Axles

For every task in Manual Drive Train and Axles, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

### General

✓	Task	Course	Text	Lab	Priority
	1. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.				P-1
	2. Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer specification.				P-1
	3. Check fluid condition; check for leaks.				P-2
	4. Identify manual drive train and axle components and configuration.				P-1

### Clutch

✓	Task	Course	Text	Lab	Priority
	1. Check and adjust clutch master cylinder fluid level; use proper fluid type per manufacturer specification				P-1
	2. Check for hydraulic system leaks.				P-1

<b>Transmission/Transaxle</b>					
✓	Task	Course	Text	Lab	Priority
	1. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle.				P-2

<b>Drive Shaft, Half Shafts, Universal Joints, and Constant-Velocity (CV) Joints (Front, Rear, All, and Four-Wheel Drive)</b>					
✓	Task	Course	Text	Lab	Priority
	1. Inspect, remove, and/or replace bearings, hubs, and seals.				P-2
	2. Inspect, service, and/or replace shafts, yokes, boots, and universal/CV joints.				P-2
	3. Inspect locking hubs.				P-3
	4. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification.				P-2

<b>Differential Case Assembly</b>					
✓	Task	Course	Text	Lab	Priority
	1. Clean and inspect differential case; check for leaks; inspect housing vent.				P-1
	2. Check and adjust differential case fluid level; use proper fluid type per manufacturer specification.				P-1
	3. Drain and refill differential housing.				P-1
	4. Inspect and replace drive axle wheel studs.				P-1

## Suspension and Steering

For every task in Suspension and Steering, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

### General

✓	Task	Course	Text	Lab	Priority
	1. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.				P-1
	2. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.				P-1
	3. Identify suspension and steering system components and configurations.				P-1

Related Suspension and Steering Service					
✓	Task	Course	Text	Lab	Priority
	1. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.				P-1
	2. Inspect power steering fluid level and condition.				P-1
	3. Flush, fill, and bleed power steering system; use proper fluid type per manufacturer specification.				P-2
	4. Inspect for power steering fluid leakage.				P-1
	5. Remove, inspect, replace, and/or adjust power steering pump drive belt.				P-1
	6. Inspect and replace power steering hoses and fittings.				P-2
	7. Inspect pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper.				P-1
	8. Inspect tie rod ends (sockets), tie rod sleeves, and clamps.				P-1
	9. Inspect upper and lower control arms, bushings, and shafts.				P-1
	10. Inspect and replace rebound and/or jounce bumpers.				P-1
	11. Inspect track bar, strut rods/radius arms, and related mounts and bushings.				P-1
	12. Inspect upper and lower ball joints (with or without wear indicators).				P-1
	13. Inspect suspension system coil springs and spring insulators (silencers).				P-1
	14. Inspect suspension system torsion bars and mounts.				P-1
	15. Inspect and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links.				P-1
	16. Inspect, remove, and/or replace strut cartridge or assembly; inspect mounts and bushings.				P-2
	17. Inspect front strut bearing and mount.				P-1
	18. Inspect rear suspension system lateral links/arms (track bars), control (trailing) arms.				P-1
	19. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts.				P-1
	20. Inspect, remove, and/or replace shock absorbers; inspect mounts and bushings.				P-1
	21. Inspect electric power steering assist system.				P-2
	22. Identify hybrid vehicle power steering system electrical circuits and safety precautions.				P-2
	23. Describe the function of steering and suspension control systems and components, (i.e., active suspension, and stability control).				P-3

Wheel Alignment					
✓	Task	Course	Text	Lab	Priority
	1. Perform pre-alignment inspection; measure vehicle ride height.				P-1
	2. Describe alignment angles (camber, caster and toe)				P-1

Wheels and Tires					
✓	Task	Course	Text	Lab	Priority
	1. Inspect tire condition; identify tire wear patterns; check for correct tire size, application (load and speed ratings), and air pressure as listed on the tire information placard/label.				P-1
	2. Rotate tires according to manufacturers' recommendations including vehicles equipped with tire pressure monitoring systems (TPMS).				P-1
	3. Dismount, inspect, and remount tire on wheel; balance wheel and tire assembly.				P-1
	4. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor.				P-1
	5. Inspect tire and wheel assembly for air loss; determine necessary action.				P-1
	6. Repair tire following vehicle manufacturer approved procedure.				P-1
	7. Identify indirect and direct tire pressure monitoring systems (TPMS); calibrate system; verify operation of instrument panel lamps.				P-2
	8. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system (TPMS), including relearn procedure.				P-1

## Brakes

For every task in Brakes, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

General					
✓	Task	Course	Text	Lab	Priority
	1. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins.				P-1
	2. Describe procedure for performing a road test to check brake system operation, including an anti-lock brake system (ABS).				P-1
	3. Install wheel and torque lug nuts.				P-1

	4. Identify brake system components and configuration.				P-1
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## Hydraulic System

✓	Task	Course	Text	Lab	Priority
	1. Describe proper brake pedal height, travel, and feel.				P-1
	2. Check master cylinder for external leaks and proper operation.				P-1
	3. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, wear, and loose fittings/supports.				P-1
	4. Select, handle, store, and fill brake fluids to proper level; use proper fluid type per manufacturer specification.				P-1
	5. Identify components of hydraulic brake warning light system.				P-3
	6. Bleed and/or flush brake system.				P-1
	7. Test brake fluid for contamination.				P-1

## Drum Brakes

✓	Task	Course	Text	Lab	Priority
	1. Remove, clean, and inspect brake drum; measure brake drum diameter; determine serviceability.				P-1
	2. Refinish brake drum and measure final drum diameter; compare with specification.				P-1
	3. Remove, clean, inspect, and/or replace brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.				P-1
	4. Inspect wheel cylinders for leaks and proper operation; remove and replace as needed.				P-2
	5. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings; make final checks and adjustments.				P-1

## Disc Brakes

✓	Task	Course	Text	Lab	Priority
	1. Remove and clean caliper assembly; inspect for leaks and damage/wear; determine necessary action.				P-1
	2. Inspect caliper mounting and slides/pins for proper operation, wear, and damage; determine necessary action.				P-1
	3. Remove, inspect, and/or replace brake pads and retaining hardware; determine necessary action.				P-1
	4. Lubricate and reinstall caliper, brake pads, and related hardware; seat brake pads and inspect for leaks.				P-1

	5. Clean and inspect rotor and mounting surface, measure rotor thickness, thickness variation, and lateral runout; determine necessary action.				P-1
	6. Remove and reinstall/replace rotor.				P-1
	7. Refinish rotor on vehicle; measure final rotor thickness and compare with specification.				P-1
	8. Refinish rotor off vehicle; measure final rotor thickness and compare with specification.				P-1
	9. Retract and re-adjust caliper piston on an integral parking brake system.				P-2
	10. Check brake pad wear indicator; determine necessary action.				P-1
	11. Describe importance of operating vehicle to burnish/break-in replacement brake pads according to manufacturers' recommendation.				P-1

### Power-Assist Units

✓	Task	Course	Text	Lab	Priority
	1. Check brake pedal travel with, and without, engine running to verify proper power booster operation.				P-2
	2. Identify components of the brake power assist system (vacuum and hydraulic); check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.				P-1

### Related Systems (i.e., Wheel Bearings, Parking Brakes, Electrical)

✓	Task	Course	Text	Lab	Priority
	1. Remove, clean, inspect, repack, and install wheel bearings; replace seals; install hub and adjust bearings.				P-1
	2. Check parking brake system components for wear, binding, and corrosion; clean, lubricate, adjust and/or replace as needed.				P-2
	3. Check parking brake operation and parking brake indicator light system operation; determine necessary action.				P-1
	4. Check operation of brake stop light system.				P-1
	5. Replace wheel bearing and race.				P-2
	6. Inspect and replace wheel studs.				P-1

<b>Electronic Brake, Traction Control, and Stability Control Systems</b>					
✓	Task	Course	Text	Lab	Priority
	1. Identify traction control/vehicle stability control system components.				P-3
	2. Describe the operation of a regenerative braking system.				P-3

## Electrical/ Electronic Systems

For every task in Electrical/Electronic Systems, the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

### General

✓	Task	Course	Text	Lab	Priority
	1. Research vehicle service information including vehicle service history, service precautions, and technical service bulletins.				P-1
	2. Demonstrate knowledge of electrical/electronic series, parallel, and series-parallel circuits using principles of electricity (Ohm's Law).				P-1
	3. Use wiring diagrams to trace electrical/electronic circuits.				P-1
	4. Demonstrate proper use of a digital multimeter (DMM) when measuring source voltage, voltage drop (including grounds), current flow, and resistance.				P-1
	5. Demonstrate knowledge of the causes and effects from shorts, grounds, opens, and resistance problems in electrical/electronic circuits.				P-1
	6. Use a test light to check operation of electrical circuits.				P-2
	7. Use fused jumper wires to check operation of electrical circuits.				P-2
	8. Measure key-off battery drain (parasitic draw).				P-1
	9. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.				P-1
	10. Repair and/or replace connectors, terminal ends, and wiring of electrical/electronic systems (including solder repair)				P-1
	11. Identify electrical/electronic system components and configuration.				P-1

<b>Battery Service</b>					
✓	Task	Course	Text	Lab	Priority
	1. Perform battery state-of-charge test; determine necessary action.				P-1
	2. Confirm proper battery capacity for vehicle application; perform battery capacity and load test; determine necessary action.				P-1
	3. Maintain or restore electronic memory functions.				P-1
	4. Inspect and clean battery; fill battery cells; check battery cables, connectors, clamps, and hold-downs.				P-1
	5. Perform slow/fast battery charge according to manufacturers' recommendations.				P-1
	6. Jump-start vehicle using jumper cables and a booster battery or an auxiliary power supply.				P-1
	7. Identify safety precautions for high voltage systems on electric, hybrid-electric, and diesel vehicles.				P-2
	8. Identify electrical/electronic modules, security systems, radios, and other accessories that require reinitialization or code entry after reconnecting vehicle battery.				P-1
	9. Identify hybrid vehicle auxiliary (12v) battery service, repair, and test procedures.				P-2

<b>Starting System</b>					
✓	Task	Course	Text	Lab	Priority
	1. Perform starter current draw test; determine necessary action.				P-1
	2. Perform starter circuit voltage drop tests; determine necessary action.				P-1
	3. Inspect and test starter relays and solenoids; determine necessary action.				P-2
	4. Remove and install starter in a vehicle.				P-1
	5. Inspect and test switches, connectors, and wires of starter control circuits; determine necessary action.				P-2
	6. Demonstrate knowledge of an automatic idle-stop/start-stop system.				P-3

<b>Charging System</b>					
✓	Task	Course	Text	Lab	Priority
	1. Perform charging system output test; determine necessary action.				P-1
	2. Inspect, adjust, and/or replace generator (alternator) drive belts; check pulleys and tensioners for wear; check pulley and belt alignment.				P-1



	3. Remove, inspect, and/or replace generator (alternator).				P-2
	4. Perform charging circuit voltage drop tests; determine necessary action.				P-2

## Lighting, Instrument Cluster, Driver Information, and Body Electrical Systems

✓	Task	Course	Text	Lab	Priority
	1. Inspect interior and exterior lamps and sockets including headlights and auxiliary lights (fog lights/driving lights); replace as needed.				P-1
	2. Aim headlights.				P-2
	3. Identify system voltage and safety precautions associated with high-intensity discharge headlights.				P-2
	4. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation.				P-1
	5. Remove and reinstall door panel.				P-1
	6. Describe the operation of keyless entry/remote-start systems.				P-3
	7. Verify operation of instrument panel gauges and warning/indicator lights; reset maintenance indicators.				P-1
	8. Verify windshield wiper and washer operation; replace wiper blades.				P-1

## Heating, Ventilation, and Air Conditioning (HVAC)

For every task in Heating, Ventilation and Air Conditioning (HVAC), the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

### General

✓	Task	Course	Text	Lab	Priority
	1. Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins.				P-1
	2. Identify heating, ventilation and air conditioning (HVAC) components and configuration.				P-1

## Refrigeration System Components

✓	Task	Course	Text	Lab	Priority
	1. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; visually inspect A/C components for signs of leaks; determine necessary action.				P-1
	2. Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions.				P-2
	3. Inspect A/C condenser for airflow restrictions; determine necessary action.				P-1

## Heating, Ventilation, and Engine Cooling Systems

✓	Task	Course	Text	Lab	Priority
	1. Inspect engine cooling and heater systems hoses and pipes; determine necessary action.				P-1

## Operating Systems and Related Controls

✓	Task	Course	Text	Lab	Priority
	1. Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; determine necessary action.				P-1
	2. Identify the source of A/C system odors.				P-2

## Engine Performance

For every task in Engine Performance the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

### General

✓	Task	Course	Text	Lab	Priority
	1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins.				P-1
	2. Perform engine absolute manifold pressure tests (vacuum/boost); document results.				P-2
	3. Perform cylinder power balance test; document results.				P-2
	4. Perform cylinder cranking and running compression tests; document results.				P-2
	5. Perform cylinder leakage test; document results.				P-2
	6. Verify engine operating temperature.				P-1
	7. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.				P-1

<b>Computerized Controls</b>					
✓	Task	Course	Text	Lab	Priority
	1. Retrieve and record diagnostic trouble codes (DTC), OBD monitor status, and freeze frame data; clear codes when applicable.				P-1
	2. Describe the use of the OBD monitors for repair verification.				P-1

<b>Fuel, Air Induction, and Exhaust Systems</b>					
✓	Task	Course	Text	Lab	Priority
	1. Replace fuel filter(s) where applicable.				P-2
	2. Inspect, service, or replace air filters, filter housings, and intake duct work.				P-1
	3. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine necessary action.				P-1
	4. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine necessary action.				P-1
	5. Check and refill diesel exhaust fluid (DEF).				P-2

<b>Emissions Control Systems</b>					
✓	Task	Course	Text	Lab	Priority
	1. Inspect, test, and service positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform necessary action.				P-2

# **Equipment & Engine Training Council (EETC)**

## **Category 1, Section 4**

### **Two- and Four-Stroke Gasoline Engines**

#### **100 – Small Engine Fundamentals**

- 101 – Engine Identification
- 102 – Two-Stroke Engine
- 103 – Four-Stroke Engine
- 104 – Engine Components

#### **200 – Maintenance**

- 201 – Lubrication Fundamentals
- 202 – Lubrication – Engine Maintenance
- 203 – Cooling System – Engine Maintenance
- 204 – Fuel System – Engine Maintenance
- 205 – Start System – Engine Maintenance
- 206 – Exhaust System – Engine Maintenance

#### **300 – Two-Stroke Gasoline Engine**

- 301 – Test a Two-Stroke Engine

#### **400 – Two-Stroke Gasoline Engine Overhaul**

- 401 – Disassembly Inspection and Repair

#### **500 – Four-Stroke Gasoline Engine Diagnosis**

#### **600 – Four Stroke Gasoline Engine Service**

#### **700 – Failure Analysis**

# **EETC Program Assessment Manual – Category 1, Section 4**

## **Power Equipment Technology**

**Two- and Four-Stroke Gasoline Engines  
School Accreditation**

**Training Facility  
Program Instructor  
Subject Matter**

Updated 2013

The Equipment and Engine Training Council (EETC) has granted permission for the FNSBSD to use the EETC Program Assessment Manual – Category 1, Section 4 – in the Appendix of the Transportation, Distribution, and Logistics Curriculum. This manual will be posted in the final **printed** document and available to teachers. However, the FNSBSD does not have permission to post this on the website.

**To view the EETC manual, please visit the Dept. of Teaching and Learning at the FNSBSD Administrative Center, 520 Fifth Avenue (second floor), Fairbanks, AK 99701.**

# Program of Study

## Small Gasoline Engines

<b>Career Cluster &amp; Pathway Description: TDL Small Gasoline Engines</b>		<b>Developed By</b> Tom Boyarsky and Joni Simpson <b>Date:</b> February 2019
<b>Middle School Exploratory Options (OPTIONAL)</b>		
<b>6th</b> AKCIS Jr. Portfolio Other Career Guidance/Planning/Information Activities	<b>7th</b> Career Clusters Interest Inventory AKCIS Jr. Portfolio Other Career Guidance/Planning/Information Activities	<b>8th</b> AKCIS Jr. Portfolio + HS Course Planner Career Interest Inventory Other Career Guidance/Planning/Information Activities

### SECONDARY PROGRAM COMPONENTS (CTE courses are designated in **Boldface font**; state-required assessments are show in ***Boldface-italic font***)

<b>9<sup>th</sup> Grade</b>		<b>10<sup>th</sup> Grade</b>		<b>11<sup>th</sup> Grade</b>		<b>12<sup>th</sup> Grade</b>	
<i>PEAKS</i> , Career Clusters Interest Inventory, AKCIS Portfolio, PLCP		<i>PEAKS</i> , Career Interest Inventory, AKCIS Portfolio, PLCP		WorkKeys, PSAT, SAT, ACT, Accuplacer/Compass, AKCIS Portfolio, PLCP		SAT, ACT, WorkKeys, Accuplacer/Compass, AKCIS Portfolio, PLCP	
<b>Courses</b>		<b>Courses</b>		<b>Courses</b>		<b>Courses</b>	
<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>	<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>	<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>	<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>
English 9 or English 9 Honors	English 9 or English 9 Honors	English 10 or English 10 Honors	English 10 or English 10 Honors	Early American Literature or English 11 Honors	Modern American Literature or Advanced Composition	British Literature or UAF's Writing 111	World Literature, Journalism, or Speech & Debate
Earth and Space Science or Biology	Earth and Space Science or Biology	Biology, Chem Tech, or Chemistry	Biology, Chem Tech, or Chemistry	Chemistry or Human Anatomy	Chemistry or Intro to Pathophysiology	Physics or Marine Biology	Physics or Microbiology/Botany
Careers & Employability	Alaska Studies	World History	World History	US History	US History	Government	Economics
Algebra I	Algebra I	Geometry	Geometry	Algebra II	Algebra II	Functions & Analysis	Trigonometry
Health	PE	PE	PE			<b>Advanced Automotive Technology, semester 1 (2 periods)</b>	<b>Advanced Automotive Technology, semester 2 (2 periods)</b>
<b>Small Engines 1A</b>	<b>Small Engines 1B</b>	<b>Small Engines 2A</b>	<b>Small Engines 2B</b>	<b>Basic Automotive Technology 1A</b>	<b>Basic Automotive Technology 1B</b>		
<u>Technical Skills Assessment(s)</u>		<u>Technical Skill Assessment(s)</u> EETC Two-Stroke Gasoline Engines EETC Four-Stroke Gasoline Engines		<u>Technical Skills Assessment(s)</u>		<u>Technical Skill Assessment(s)</u> ASE Student Certification	

**OPTIONAL PROGRAM COMPONENTS**

Work-Based Learning Opportunities	Career-Technical Student Organizations	Certifications
Apprenticeship Cooperative Education Job Shadowing Paid/Unpaid Internship School-Based Enterprise Service Learning		ASE Student Certification

**GENERAL POSTSECONDARY OPTIONS**

One or Two-Year Postsecondary Programs	Adult Registered Apprenticeships	Four-Year College and University Programs	Occupational Certifications & License	On the Job Training, Skill Training Certificates, etc,
<ul style="list-style-type: none"><li>• <a href="http://www.ctc.uaf.alaska.edu">www.ctc.uaf.alaska.edu</a></li><li>• UAF Automotive Technology Certificate</li></ul>	<ul style="list-style-type: none"><li>• <a href="http://www.jobs.state.ak.us/apprentice">www.jobs.state.ak.us/apprentice</a></li></ul>	<ul style="list-style-type: none"><li>• UAF</li><li>• UAA</li></ul>	<ul style="list-style-type: none"><li>•</li></ul>	<ul style="list-style-type: none"><li>• ASE Certification</li><li>• I-CAR Certification</li><li>• EETC Certification</li></ul>



# Program of Study – Automotive Technology

Career Cluster & Pathway Description: TDL Small Gasoline Engines		Developed By: Joni Simpson & Jen Morgan Date: March 2019	
Specific Postsecondary Details (OPTIONAL) (Classes possible to complete at high school level are designated by <b>BOLDFACE</b> .)			
Name of Postsecondary Partner: University of Alaska Fairbanks- Community & Technical College			
Name of Postsecondary Program: Automotive Technology, Certificate			
Year 13		Year 14	
Semester 1	Semester 2	Semester 1	Semester 2
Fundamentals of Oral Communication COJO F131X or F141X (3 credits) or Writing Across Contexts WRTG F111X (3 credits) or <b>H.S. - AP English Language &amp; Composition</b> (If meets university qualifications, equivalent to WRTG F111X = 3 credits) or <b>H.S. - AP English Literature &amp; Composition</b> (If meets university qualifications, equivalent to WRTG F111X = 3 credits)	Mathematics for the Trades TTCH (3 credits)	Individual, Society, & Culture ANTH F100X (3 credits) or Introduction to Sociology SOC F101X (3 credits)	Automotive Practicum I AUTO F190 (1-6 credits)
Introduction to Automotive Technology AUTO F102 (3 credits)	Engine Theory & Diagnosis AUTO F122 (3 credits)	Auto Fuel & Emissions Systems AUTO F202 (4 credits)	Automotive Engine Performance AUTO F222 (3 credits)
Basic Electrical Systems AUTO F110 (3 credits)	Automotive Electric II AUTO F131 (3 credits)	Automotive Electrical III AUTO F227 (3 credits)	
Suspension Alignment AUTO F162 (4 credits)	Brake Systems AUTO F150 (4 credits)		
13 Credits	13 credits	10 Credits	4 – 9 Credits
Outcome:			
Total Credits: 40 - 45			
Possible number of completed credits from high school career program: 3			

# Program of Study – Automotive Technology

Career Cluster & Pathway Description: TDL Small Gasoline Engines			Developed By: Joni Simpson & Jen Morgan	Date: March 2019
<b>Specific Postsecondary Details (OPTIONAL)</b> (Classes possible to complete at high school level are designated by <b>BOLDFACE</b> .)				
<b>Name of Postsecondary Partner:</b> University of Alaska - Anchorage				
<b>Name of Postsecondary Program:</b> Associate of Applied Science in Automotive Technology				
Year 13		Year 14		
Semester 1	Semester 2	Semester 1	Semester 2	
Fundamentals of Oral Communication COMM A111 (3 credits)	Writing Across Contexts WRTG A111 (3 credits) or <b>H.S. - AP English Language &amp; Composition</b> (If meets university qualifications, equivalent to WRTG A111 = 3 credits)	Writing & the Sciences WRTG A213 (3 credits)	An additional 6 credits in humanities, math, natural sciences, or social sciences (courses must be at the 100 level or higher).	
Introduction to Automotive Technology ADT A102 (3 credits) or <b>H.S. Advanced Automotive Technology CTEE100</b>	Engine Theory & Diagnosis ADT A122 (3 credits) or <b>H.S. Advanced Automotive Technology CTEE100</b>	Automotive Engine Repair ADT A140 (3 credits)		
Basic Electrical Systems ADT A121 (3 credits) or <b>H.S. Advanced Automotive Technology CTEE100</b>	Manual Drive Trains & Axles ADT A160 (4 credits)	Mobile Heating, Ventilation, & Air Conditioning Systems ADT A225 (3 credits)	Auto Fuel & Emissions Systems ADT A202 (4 credits)	
Auto Electrical II ADT A131 (3 credits)	Suspension & Alignment ADT A162 (4 credits)	Auto Electrical III ADT A227 (3 credits)	Automotive Engine Performance ADT A222 (3 credits)	
Brake Systems ADT A150 (4 credits)	Automotive Practicum I ADT A195 (2 credits)	Automotive Practicum I ADT A195 (2 credits)	Electronic & Automatic Transmissions ADT A260 (3 credits) and/or Automotive Practicum II ADT A295 (3 credits)	
Automotive Practicum I ADT A195 (2 credits)			(Students admitted to the ASSET or the ASEP options must complete both ADT A260 and ADT A295.)	
<b>18 Credits</b>	<b>16 credits</b>	<b>14 Credits</b>	<b>16 – 19 Credits</b>	
<b>Outcome:</b>				
<b>Total Credits: 64 - 67</b>				
Possible number of completed credits from high school career program: 12				

# Program of Study: Collision Repair

<b>Career Cluster &amp; Pathway Description: Collision Repair</b>		<b>Developed By</b> Tom Boyarsky and Joni Simpson <b>Date:</b> February 2019
<b>Middle School Exploratory Options (OPTIONAL)</b>		
<b>6th</b> AKCIS Jr. Portfolio Other Career Guidance/Planning/Information Activities	<b>7th</b> Career Clusters Interest Inventory AKCIS Jr. Portfolio Other Career Guidance/Planning/Information Activities	<b>8th</b> AKCIS Jr. Portfolio + HS Course Planner Career Interest Inventory Other Career Guidance/Planning/Information Activities

## SECONDARY PROGRAM COMPONENTS (CTE courses are designated in **Boldface font**; state-required assessments are show in ***Boldface-italic font***)

<b>9<sup>th</sup> Grade</b>		<b>10<sup>th</sup> Grade</b>		<b>11<sup>th</sup> Grade</b>		<b>12<sup>th</sup> Grade</b>	
<i>PEAKS</i> , Career Clusters Interest Inventory, AKCIS Portfolio, PLCP		<i>PEAKS</i> , Career Interest Inventory, AKCIS Portfolio, PLCP		WorkKeys, PSAT, SAT, ACT, Accuplacer/Compass, AKCIS Portfolio, PLCP		SAT, ACT, WorkKeys, Accuplacer/Compass, AKCIS Portfolio, PLCP	
<b>Courses</b>		<b>Courses</b>		<b>Courses</b>		<b>Courses</b>	
<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>	<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>	<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>	<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>
English 9 or English 9 Honors	English 9 or English 9 Honors	English 10 or English 10 Honors	English 10 or English 10 Honors	Early American Literature or English 11 Honors	Modern American Literature or Advanced Composition	British Literature or UAF's Writing 111	World Literature, Journalism, or Speech & Debate
Earth and Space Science or Biology	Earth and Space Science or Biology	Biology, Chem Tech, or Chemistry	Biology, Chem Tech, or Chemistry	Chemistry or Human Anatomy	Chemistry or Intro to Pathophysiology	Physics or Marine Biology	Physics or Microbiology/ Botany
Careers & Employability	Alaska Studies	World History	World History	US History	US History	Government	Economics
Algebra I	Algebra I	Geometry	Geometry	Algebra II	Algebra II	Functions & Analysis	Trigonometry
Health	PE	PE	PE			<b>Painting &amp; Refinishing 1A</b>	<b>Painting &amp; Refinishing 1B</b>
<b>Introduction to Collision Repair</b>		<b>Structural Analysis &amp; Damage Repair 1A</b>	<b>Structural Analysis &amp; Damage Repair 1B</b>	<b>Non-Structural Analysis &amp; Damage Repair 1A</b>	<b>Non-Structural Analysis &amp; Damage Repair 1B</b>	<b>Plastics &amp; Adhesives 1A</b>	<b>Plastic &amp; Adhesives 1B</b>
<u>Technical Skills Assessment(s)</u> Hazardous Airborne Pollutant Reduction; I-CAR		<u>Technical Skill Assessment(s)</u> Steel Structural Technician		<u>Technical Skills Assessment(s)</u> Non-Structural Technician		<u>Technical Skill Assessment(s)</u> Refinishing Technician; Non-Structural Technician	

### OPTIONAL PROGRAM COMPONENTS

Work-Based Learning Opportunities	Career-Technical Student Organizations	Certifications
Apprenticeship Cooperative Education Job Shadowing Paid/Unpaid Internship School-Based Enterprise Service Learning		I-CAR Certification

### GENERAL POSTSECONDARY OPTIONS

One or Two-Year Postsecondary Programs	Adult Registered Apprenticeships	Four-Year College and University Programs	Occupational Certifications & License	On the Job Training, Skill Training Certificates, etc,
<ul style="list-style-type: none"> <li><a href="http://www.ctc.uaf.alaska.edu">www.ctc.uaf.alaska.edu</a></li> <li></li> <li></li> <li></li> </ul>	<ul style="list-style-type: none"> <li><a href="http://www.jobs.state.ak.us/apprentice">www.jobs.state.ak.us/apprentice</a></li> <li></li> </ul>	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> </ul>	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> </ul>	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> </ul>

## Program of Study – Collision Repair

<b>Career Cluster &amp; Pathway Description:</b>		<b>Developed By:</b> <b>Date:</b>	
<b>Specific Postsecondary Details (OPTIONAL)</b> (Classes possible to complete at high school level are designated by <b>BOLDFACE</b> .)			
<b>Name of Postsecondary Partner:</b> University of Alaska Fairbanks- Community & Technical College			
<b>Name of Postsecondary Program:</b>			
<b>Year 13</b>		<b>Year 14</b>	
<b>Semester 1</b>	<b>Semester 2</b>	<b>Semester 1</b>	<b>Semester 2</b>
<b>-- Credits</b>	<b>-- credits</b>	<b>-- Credits</b>	<b>-- Credits</b>

<b>Outcome:</b>
<b>Total Credits: --</b>
Possible number of completed credits from high school career program: --

# Program of Study:

## Diesel Operations and Technology

<b>Career Cluster &amp; Pathway Description: Diesel Operations &amp; Technology</b>		<b>Developed By</b> Tom Boyarsky and Joni Simpson <b>Date:</b> February 2019
<b>Middle School Exploratory Options (OPTIONAL)</b>		
<b>6th</b> AKCIS Jr. Portfolio Other Career Guidance/Planning/Information Activities	<b>7th</b> Career Clusters Interest Inventory AKCIS Jr. Portfolio Other Career Guidance/Planning/Information Activities	<b>8th</b> AKCIS Jr. Portfolio + HS Course Planner Career Interest Inventory Other Career Guidance/Planning/Information Activities

### SECONDARY PROGRAM COMPONENTS (CTE courses are designated in **Boldface font**; state-required assessments are show in ***Boldface-italic font***)

<b>9<sup>th</sup> Grade</b>		<b>10<sup>th</sup> Grade</b>		<b>11<sup>th</sup> Grade</b>		<b>12<sup>th</sup> Grade</b>	
<i>PEAKS</i> , Career Clusters Interest Inventory, AKCIS Portfolio, PLCP		<i>PEAKS</i> , Career Interest Inventory, AKCIS Portfolio, PLCP		WorkKeys, PSAT, SAT, ACT, Accuplacer/Compass, AKCIS Portfolio, PLCP		SAT, ACT, WorkKeys, Accuplacer/Compass, AKCIS Portfolio, PLCP	
<b>Courses</b>		<b>Courses</b>		<b>Courses</b>		<b>Courses</b>	
<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>	<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>	<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>	<b>1<sup>st</sup> Semester</b>	<b>2<sup>nd</sup> Semester</b>
English 9 or English 9 Honors	English 9 or English 9 Honors	English 10 or English 10 Honors	English 10 or English 10 Honors	Early American Literature or English 11 Honors	Modern American Literature or Advanced Composition	British Literature or UAF's Writing 111	World Literature, Journalism, or Speech & Debate
Earth and Space Science or Biology	Earth and Space Science or Biology	Biology, Chem Tech, or Chemistry	Biology, Chem Tech, or Chemistry	Chemistry or Human Anatomy	Chemistry or Intro to Pathophysiology	Physics or Marine Biology	Physics or Microbiology/Botany
Careers & Employability	Alaska Studies	World History	World History	US History	US History	Government	Economics
Algebra I	Algebra I	Geometry	Geometry	Algebra II	Algebra II	Functions & Analysis	Trigonometry
Health	PE	PE	PE				
<b>Small Engines 1A</b>	<b>Small Engines 1B</b>	<b>Small Engines 2A</b>	<b>Small Engines 2B</b>	<b>Basic Automotive Technology 1A</b>	<b>Basic Automotive Technology 1B</b>	<b>Diesel Operations &amp; Technology 1A</b>	<b>Diesel Operations &amp; Technology 1B</b>
<u>Technical Skills Assessment(s)</u>		<u>Technical Skill Assessment(s)</u> EETC Two-Stroke Gasoline Engines EETC Four-Stroke Gasoline Engines		<u>Technical Skills Assessment(s)</u>		<u>Technical Skill Assessment(s)</u>	

**OPTIONAL PROGRAM COMPONENTS**

Work-Based Learning Opportunities	Career-Technical Student Organizations	Certifications
Apprenticeship Cooperative Education Job Shadowing Paid/Unpaid Internship School-Based Enterprise Service Learning		EETC Certifications

**GENERAL POSTSECONDARY OPTIONS**

One or Two-Year Postsecondary Programs	Adult Registered Apprenticeships	Four-Year College and University Programs	Occupational Certifications & License	On the Job Training, Skill Training Certificates, etc,
<ul style="list-style-type: none"><li>• <a href="http://www.ctc.uaf.alaska.edu">www.ctc.uaf.alaska.edu</a></li><li>• UAF Diesel/Heavy Equipment Certificate</li><li>• UAA</li></ul>	<ul style="list-style-type: none"><li>• <a href="http://www.jobs.state.ak.us/apprentice">www.jobs.state.ak.us/apprentice</a></li></ul>	<ul style="list-style-type: none"><li>• UAA</li><li>• UAF</li></ul>	<ul style="list-style-type: none"><li>•</li><li>•</li><li>•</li></ul>	<ul style="list-style-type: none"><li>• ASE Certificates</li><li>• EETC Certificates</li><li>• I-CAR Certificates</li></ul>

# Program of Study – Diesel Operations and Technology

<b>Career Cluster &amp; Pathway Description: TDL Diesel Operations &amp; Technology</b>		<b>Developed By:</b> Joni Simpson & Jen Morgan <b>Date:</b> March 2019	
<b>Specific Postsecondary Details (OPTIONAL)</b> (Classes possible to complete at high school level are designated by <b>BOLDFACE</b> .)			
<b>Name of Postsecondary Partner:</b> University of Alaska Fairbanks- Community & Technical College			
<b>Name of Postsecondary Program:</b> Diesel/Heavy Equipment, Certificate			
<b>Year 13</b>		<b>Year 14</b>	
<b>Semester 1</b>	<b>Semester 2</b>	<b>Semester 1</b>	<b>Semester 2</b>
Fundamentals of Oral Communication COJO F131X or F141X (3 credits) or Writing Across Contexts WRTG F111X (3 credits) or <b>H.S. - AP English Language &amp; Composition</b> (If meets university qualifications, equivalent to WRTG F111X = 3 credits) or <b>H.S. - AP English Literature &amp; Composition</b> (If meets university qualifications, equivalent to WRTG F111X = 3 credits)	Mathematics for the Trades TTCH (3 credits)	Individual, Society, & Culture ANTH F100X (3 credits) or Introduction to Sociology SOC F101X (3 credits)	Engine DSLTL F254 (5 credits)
Safety Including Rigging & Lifting DSLTL F101 (1 credit)	Preventive Maintenance DSLTL F105 (3 credits)	Manual Transmissions & Differentials DSLTL F201 (3 credits)	Hydraulics MECN F210 (3 credits)
Basic Equipment & Truck Operation DSLTL F103 (1 credit)	Diesel Emissions DSLTL F111 (2 credits)	Heavy Duty Automatic Transmissions DSLTL F202 (2 credits)	
Basic Electrical Systems & Electronic Fuel Injection DSLTL F107 (3 credit)	Heavy Duty Braking Systems DSLTL F123 (3 credits)	Heavy Equipment Fabrication DSLTL F210 (2 credits)	
Basic Industrial Fabrication DSLTL F110 (2 credits)	Diesel Fuel Injection DSLTL F154 (3 credits)	Starting & Charging Systems MECN F103 (3 credits)	
<b>10 Credits</b>	<b>14 credits</b>	<b>13 Credits</b>	<b>8 Credits</b>
<b>Outcome:</b>			
<b>Total Credits: 45</b>			
Possible number of completed credits from high school career program: 3			



# Program of Study – Diesel Power Technology

Career Cluster & Pathway Description: TDL Diesel Operations & Technology		Developed By: Joni Simpson & Jen Morgan Date: March 2019	
Specific Postsecondary Details (OPTIONAL) (Classes possible to complete at high school level are designated by <b>BOLDFACE</b> .)			
Name of Postsecondary Partner: University of Alaska - Anchorage			
Name of Postsecondary Program: Associate of Applied Science in Diesel Power Technology			
Year 13		Year 14	
Semester 1	Semester 2	Semester 1	Semester 2
Fundamentals of Oral Communication COMM A111 (3 credits)	Writing Across Contexts WRTG A111 (3 credits) or <b>H.S. - AP English Language &amp; Composition</b> (If meets university qualifications, equivalent to WRTG A111 = 3 credits)	Writing & the Sciences WRTG A213 (3 credits)	An additional 6 credits in humanities, math, natural sciences, or social sciences (courses must be at the 100 level or higher).
Introduction to Automotive Technology ADT A102 (3 credits) or <b>H.S. Advanced Automotive Technology CTEE100</b>	Medium/Heavy-Duty Diesel Engines ADT A153 (4 credits)	Gas & Arc Welding WELD A101 (3 credits) or Shielded Metal Arc Welding WELD A112 (3 credits)	
Basic Electrical Systems ADT A121 (3 credits) or <b>H.S. Advanced Automotive Technology CTEE100</b>	Heavy-Duty Brake Systems ADT A155 (4 credits)	Mobile Heating, Ventilation, & Air Conditioning Systems ADT A225 (3 credits)	Heavy-Duty Diesel Engine Performance ADT A267 (4 credits)
Auto Electrical II ADT A131 (3 credits)	Heavy-Duty Maintenance & Inspection ADT A156 (3 credits)	Auto Electrical III ADT A227 (3 credits)	Mobile Hydraulic Systems ADT A268 (4 credits)
Heavy-Duty Suspension & Steering ADT A152 (4 credits)	Automotive Practicum I ADT A195 (2 credits)	Automotive Practicum I ADT A195 (2 credits)	Heavy-Duty Drive Trains ADT A269 (3 credits)
Automotive Practicum I ADT A195 (2 credits)			
18 Credits	16 credits	14 Credits	17 Credits
Outcome:			
Total Credits: 65 Possible number of completed credits from high school career program: 9			

# Standards

# Abbreviation Keys for Standards

## **ALASKA EMPLOYABILITY STANDARDS:**

- A - Section A under Employability
- B - Section B under Employability

## **ALASKA CULTURAL STANDARDS:**

- A - Section A under Cultural Standards
- B - Section B under Cultural Standards
- C - Section C under Cultural Standards
- D - Section D under Cultural Standards
- E - Section E under Cultural Standards

## **ALASKA CONTENT STANDARDS:**

- LA - English / Language Arts
- M - Mathematics
- S - Science
- G - Geography
- Gov - Government and Citizenship
- H - History
- HL - Healthy Life Skills
- A - Art
- WL - World Languages
- T – Technology

## **ALASKA PERFORMANCE STANDARDS:**

- R - Reading
- W - Writing
- S - Science:
  - .A = Facts & Concepts
  - .B = Investigations
  - .C = Nature & History
  - .D = Applications
- M - Mathematics:
  - .A1 Numeration
  - .A2 Measurement
  - .A3 Estimation and Computation
  - .A4 Function and Relationships
  - .A5 Geometry
  - .A6 Statistics/Probability
  - .B Problem Solving
  - .C Communications
  - .D Reasoning
  - .E Connections

# All Aspects of Industry Keys

<b>Planning</b>	<b>= Planning</b> <ul style="list-style-type: none"><li>• Assessment</li><li>• Goals/objectives</li><li>• Strategic planning</li></ul>
<b>Management</b>	<b>= Management</b> <ul style="list-style-type: none"><li>• Corporate culture</li><li>• Mission statement</li><li>• Organizational structure</li></ul>
<b>Finance</b>	<b>= Finance</b> <ul style="list-style-type: none"><li>• Capital acquisitions</li><li>• Financial operations</li></ul>
<b>Technical Skills</b>	<b>= Technical and Production Skills</b> <ul style="list-style-type: none"><li>• Basic academic skills</li><li>• Specific production skills</li><li>• Team player skills</li><li>• Applied Technology</li></ul>
<b>Technology</b>	<b>= Principles of Technology</b> <ul style="list-style-type: none"><li>• Continued professional training</li><li>• Technology in the workplace</li></ul>
<b>Labor</b>	<b>= Labor Issues</b> <ul style="list-style-type: none"><li>• Job descriptions</li><li>• Employee's rights and responsibilities</li><li>• Role of organized labor</li></ul>
<b>Community</b>	<b>= Community Issues</b> <ul style="list-style-type: none"><li>• Community activities and issues</li><li>• The organizations role in the community</li></ul>
<b>Health/Safety</b>	<b>= Health, Safety, and Environments</b> <ul style="list-style-type: none"><li>• Regulatory issues</li><li>• Workplace safety</li></ul>
<b>Work Habits</b>	<b>= Personal Work Habits</b> <ul style="list-style-type: none"><li>• Positive attitude</li><li>• Personal fitness and appearance</li><li>• Readiness to work</li></ul>

# **Alaska Employability Standards**

**Adopted September 1998**

# Alaska Employability Standards

**Adopted by Alaska State Board of Education**

**September 29, 1998**

Employability Standards are a critical part of student learning. Proficiency in achieving Alaska's content standards is fundamental to creating an employable individual. These employability standards are to be used in conjunction with Alaska's academic content and performance standards to ensure Alaska students have the skills and knowledge necessary to be good citizens, effective parents, productive workers, and most of all, life-long learners. Alaska students are expected to learn how to learn and apply their skills and knowledge in a variety of settings to create a satisfying and productive life. These standards are designed to promote successful student transition from school to work.

**A**

student should be able to develop and be able to use employability skills in order to effectively make the transition from school to work and life-long learning.

***A student who meets this standard should:***

1. Develop and maintain a work ethic necessary for success in the workplace that includes honesty, integrity, dependability, punctuality, self discipline, initiative, reliability, accuracy, productivity, respect and perseverance;
2. Understand how to apply skills and academic knowledge in a variety of work settings;
3. Understand the process for seeking employment including resume development, application completion, interview skills and appropriate dress for work settings;
4. Understand the process for developing self-employment opportunities including marketing studies, business plan development, and managing business finances;
5. Understand how an individual job fits into the overall organization and how the organization fits into the overall economy;
6. Understand the need for safe practices in workplaces;
7. Understand employer and employee rights and responsibilities.

**B**

A student should be able to identify career interests and plan for career options.

***A student who meets this standard should:***

1. Identify and appreciate personal interests, aptitudes, abilities, and priorities;
2. Identify possible career options, considering both employment and self employment and understand how changes in the workplace affect career choice;
3. Use labor market information to identify occupational and economic trends and opportunities, and evaluate possible career options;
4. Identify education and/or training needed for career options and advancement, and develop a career plan;
5. Identify resources available to support education and training related to career possibilities.

## **Alaska Cultural Standards**

# **CULTURE** — **IN THE** — **CLASSROOM**

**Indicators and Evidences for Evaluating Culturally Responsive Teaching  
Using the Alaska Cultural Standards for Educators**

December 2012

# Alaska Cultural Standards and Indicators for Teacher Evaluation

<b>Cultural Standard A</b> <b>Culturally responsive educators incorporate local ways of knowing and teaching in their work.</b>	<b>Cultural Standard B</b> <b>Culturally responsive educators use the local environment and community resources on a regular basis to link what they are teaching to the everyday lives of the students.</b>	<b>Cultural Standard D</b> <b>Culturally responsive educators work closely with parents to achieve a high level of complementary educational expectations between home and school.</b>	<b>Cultural Standard E</b> <b>Culturally responsive educators recognize the full educational potential of each student and provide the challenges necessary for them to achieve that potential.</b>
<b>CA1</b> The educator plans lessons that incorporate knowledge of students' cultural background/practices into the teaching of content.	<b>CB1</b> The educator has a planning process that incorporates the linking of the local environment, community resources, and issues to instructional content.	<b>CD1</b> The educator plans culturally sensitive ways to build relationships with parents/guardians to achieve complementary expectations of students.	<b>CE1</b> The educator plans for academic rigor that will challenge each student regardless of cultural background.
<b>CA2</b> The educator integrates and connects traditions, customs, values, and practices of the students when interacting with new content.	<b>CB2</b> The educator engages students in learning experiences that integrate the local environment, community resources, and issues when interacting with content.	<b>CD2</b> The educator communicates with homes to better understand the student's educational needs, concerns, and strengths.	<b>CE2</b> The educator provides rigorous learning opportunities for students that combines higher order thinking skills and student autonomy (from teacher-directed to student-directed).
<b>CA3</b> The educator's uses the students' cultural traditions, customs, values and practices when designing the classroom environment.	<b>CB3</b> The educator reflects on the effectiveness of using the local environment, community resources, and issues to help students connect content to their daily lives.		<b>CE3</b> The educator demonstrates value and respect for all students of all cultures and challenges them to strive for educational excellence.
<b>CA4</b> The educator uses students' traditions, customs, values, and practices to engage them in their learning.	<b>CB4</b> The educator seeks guidance regarding the local environment, community resources, and issues and how it connects to the everyday lives of the students		<b>CE4</b> The educator reflects on student performance based assessments, both formative and summative to identify areas for academic rigor.
<b>CA5</b> The educator reflects on the effectiveness of applying their knowledge of students' traditions, customs, values, and practices when teaching.			
<b>CA6</b> The educator seeks guidance regarding knowledge about and use of students' traditions, customs, values, and practices when teaching.			



**Standard A: Culturally-responsive educators incorporate local ways of knowing and teaching in their work.**

**Standard B: Culturally-responsive educators use the local environment and community resources on a regular basis to link what they are teaching to the everyday lives of the students.**

**Standard C: Culturally-responsive educators participate in community events and activities in appropriate and supportive ways.**

**Standard D: Culturally-responsive educators work closely with parents to achieve a high level of complementary educational expectations between home and school.**

**Standard E: Culturally-responsive educators recognize the full educational potential of each student and provide the challenges necessary for them to achieve that potential.**

# Alaska Cultural Standard A

## Cultural Connections

### A. Culturally-responsive educators incorporate local ways of knowing and teaching in their work.

#### Description of the Standard:

Cultural Standard A addresses incorporating knowledge of students' culture into an educator's pedagogical practice. Educators should strive to know about the cultural background and heritage of the students they teach. The educator uses this knowledge in their teaching practice to engage and anchor students in their learning. Knowledge of students' background and heritage should guide the choices educators make about strategies and practices they use with their students.

Focus Statement	Desired Outcome
The educator uses students' cultural traditions, customs, values, and practices in their teaching.	Educators are guided by their knowledge of students' background and heritage when making decisions about strategies and practices they will use in their teaching.

Indicator #	Cultural Indicator	Reflection Question
<b>CA1</b>	The educator plans lessons that incorporate knowledge of students' cultural background/practices into the teaching of content.	How will I include more cultural traditions, customs, values and practices of the students in my classroom when I plan?
★ <b>CA2</b>	The educator integrates and connects traditions, customs, values, and practices of the students when interacting with new content.	How will I incorporate the local traditions, customs, values and practices when teaching new content?
★ <b>CA3</b>	The educator's uses the students' cultural traditions, customs, values and practices when designing the classroom environment.	What can I do to make my classroom environment more representative of the culture(s) of my students?
★ <b>CA4</b>	The educator uses students' traditions, customs, values, and practices to engage them in their learning.	What more can I do to use the cultural traditions, customs, values, and practices of my students to effectively engage them?
<b>CA5</b>	The educator reflects on the effectiveness of applying their knowledge of students' traditions, customs, values, and practices when teaching.	What evidence do I have that incorporating the students' culture into my lessons is effective?
<b>CA6</b>	The educator seeks guidance regarding knowledge about and use of students' traditions, customs, values, and practices when teaching.	How and from whom will I seek advice for the appropriate use of students' traditions, customs, values, and practices in my teaching?

★ Denotes indicators that can be observed in the classroom.

Indicator #	
<b>CA1</b>	The educator plans lessons that incorporate knowledge of students' cultural background/practices into the teaching of content.
Desired Outcome	
Educators' plans include references and/or activities and assignments that connect to students' backgrounds and heritage for the purpose of improving student achievement and increasing student engagement.	
Example Evidences of Planning	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator's unit plans include specific activities and assignments that connect students' backgrounds and heritage to the content.</li> <li><input type="checkbox"/> Educator can show evidence of data collection, related to students' backgrounds and heritage. (i.e. parent surveys, student bios, etc.)</li> <li><input type="checkbox"/> Educator analyzes data collected about students' backgrounds and heritage and uses it for planning.</li> <li><input type="checkbox"/> Educator planning includes scheduling of community members to support connecting students' backgrounds and heritage to the content.</li> <li><input type="checkbox"/> Educator can explain the process used to gather information about students' cultural heritage and backgrounds.</li> <li><input type="checkbox"/> Educators incorporate information gathered about students' cultural backgrounds into written lesson plans.</li> </ul>	

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator's plans do not incorporate knowledge of students' cultural background(s)/practices into the teaching of their content.	The educator incorporates knowledge of students' background into the planning process, however there isn't a statement of how the activity, lesson, or reference will connect to the content.	The educator incorporates knowledge of students' background into the planning process, and there is a statement of how the activity, lesson, or reference will connect to the content.	The educator's plans use the students' cultural background(s) in unique and creative ways to make connections to the content.

Indicator #	
★CA2	The educator integrates and connects traditions, customs, values, and practices of the students when interacting with new content.
Desired Outcome	
Students make connections between their cultural backgrounds and new content.	
Example Student Behaviors	Example Educator Behaviors
<ul style="list-style-type: none"> <li><input type="checkbox"/> Students discuss their traditions, customs, values, and practices and how it relates to new content.</li> <li><input type="checkbox"/> Students are highly engaged.</li> <li><input type="checkbox"/> Student artifacts demonstrate cultural connections to the content being taught.</li> <li><input type="checkbox"/> Students can explain how the content connects to their cultural background and heritage.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator uses previewing activities and or relevant "hooks" to help students make connections between content and their traditions, customs, values, and practices.</li> <li><input type="checkbox"/> Educator involves community guests to illuminate connections between content and the students' traditions, customs, values, and practices.</li> <li><input type="checkbox"/> Educator can describe how cultural connections within the unit contribute toward understanding of the content.</li> <li><input type="checkbox"/> Educator integrates cross-curricular cultural connections to content.</li> <li><input type="checkbox"/> Educator asks questions of students that require students to make inferences between their cultural background and content.</li> </ul>

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator's use of cultural traditions, customs, values, and practices was not appropriately connected to the introduction of new content.	The educator makes cultural connection(s) to the content but the majority of the students cannot state how the connection relates to their cultural traditions, customs, values, and practices.	The educator makes cultural connection(s) to the content and the majority of the students can state how the connection relates to their cultural traditions, customs, values, and practices.	The educator makes cultural connections to the content in unique and creative ways so that all students were able to state how the content connects to their cultural backgrounds.

Indicator #	
★ <b>CA3</b>	The educator's uses the students' cultural traditions, customs, values and practices when designing the classroom environment.
Desired Outcome	
Students can recognize representation of their culture in the physical environment of the classroom	
Example Student Behavior	Example Educator Behaviors
<ul style="list-style-type: none"> <li>❑ Students can describe how their traditions, customs, values, and/or practices are represented in the classroom, i.e. work products, posters, routines, etc.</li> <li>❑ Students can explain how the classroom environment makes them feel comfortable, safe, included, valued, and respected.</li> </ul>	<ul style="list-style-type: none"> <li>❑ Educator involves members of community to participate in classroom design.</li> <li>❑ Educator displays interpretations and/or cultural products of student work that reflect the students' traditions, customs, values, and practices. (student work)</li> <li>❑ Educator incorporates the traditions, customs, values, and practices of students represented in the classroom in their visual displays and decor. (i.e. posters)</li> <li>❑ Educator includes the traditions, customs, values, and practices of students into the development of classroom routines and rules.</li> <li>❑ Educator provides cultural resources on a regular basis, i.e., books, web sites, brochures, speakers, that students can access.</li> </ul>

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator's use of students' cultural traditions, customs, values and practices in the design of the classroom environment was not used appropriately.	The educator uses cultural knowledge of students' cultural traditions, customs, values and practices in the design of the classroom, but the majority of students cannot recognize representation of their culture in the physical environment of the classroom.	The educator uses cultural knowledge of students' cultural traditions, customs, values and practices in the design of the classroom, and the majority of students can recognize representation of their culture in the physical environment of the classroom	The educator uses knowledge of students' cultural traditions, customs, values and practices in unique and creative ways in the design of the classroom, and all students recognize representation of their culture in the physical environment of the classroom.

Indicator #	
★CA4	The educator uses students' traditions, customs, values, and practices to engage them in their learning.
Desired Outcome	
Students are highly engaged and motivated to learn as a result of connections to their traditions, customs, values, and practices.	
Example Student Behavior	Example Educator Behaviors
<ul style="list-style-type: none"> <li><input type="checkbox"/> Students participate in activities that incorporate their traditions, customs, values, and practices with learning content.</li> <li><input type="checkbox"/> Students can tell how making cultural connections to content is engaging.</li> <li><input type="checkbox"/> Students' non-verbal body language expresses engagement.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator uses activities related to traditions, customs, values, and practices of the students in their class, i.e. music, language, foods, etc.</li> <li><input type="checkbox"/> Educator demonstrates awareness of the nonverbal communication appropriate to the customs of the students in their classroom.</li> <li><input type="checkbox"/> Educator has discussions with students about topics in which they are interested.</li> <li><input type="checkbox"/> Educator builds student interests into lessons.</li> </ul>

Rating Scale			
Unsatisfactory	Basic	Proficient	Exemplary
The educator does not use students' traditions, customs, values, and practices to engage students with the content.	The educator uses the students' traditions, customs, values, and practices, but the majority of students do not display engagement and/or motivation to learn.	The educator makes connections between the students' traditions, customs, values, and practices, and the majority of the students are engaged and motivated to learn.	The educator uses cultural connections to students' traditions, customs, values, and practices in unique and creative ways so that all students are engaged and motivated to learn.

Indicator #	
<b>CA5</b>	The educator reflects on the effectiveness of applying their knowledge of students' traditions, customs, values, and practices when teaching.
Desired Outcome	
Through reflection, educators can identify ways to become more culturally responsive in their teaching.	
Example Evidences	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator identifies this indicator as an area for personal growth.</li> <li><input type="checkbox"/> Educator documents the steps they have taken toward personal growth in this indicator. i.e.. logs, journals, actions plans, etc.</li> <li><input type="checkbox"/> Educator identifies observable measures that would demonstrate growth in this indicator. i.e. benchmarks, timelines, student data.</li> <li><input type="checkbox"/> Educator identifies a goal(s) for this indicator.</li> </ul>	

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator lacks reflection on his/her teaching and therefore does not identify ways to become more culturally responsive in their teaching.	The educator reflects on how to use students' traditions, customs, values, and practices but does not identify specific ways to become more culturally responsive.	The educator reflects on how to use students' traditions, customs, values, and practices and identifies specific ways to become more culturally responsive.	The educator reflects on how to use students' traditions, customs, values, and practices and how to adapt culturally responsive practices in order to reach all students in the classroom.

Indicator #	
<b>CA6</b>	The educator seeks guidance regarding knowledge about and use of students' traditions, customs, values, and practices when teaching.
Desired Outcome	
The cultural content is accurate and credible, and the delivery correctly follows cultural protocols.	
Example Evidences	
<ul style="list-style-type: none"> <li><input type="checkbox"/> The educator understands that they need to seek out protocols for guidance in cultural knowledge.</li> <li><input type="checkbox"/> The educator adheres to the cultural and intellectual property rights that pertain to all aspects of the local knowledge by citing and documenting resources.</li> <li><input type="checkbox"/> The educator keeps a record of specific instances when and from whom they sought mentorship.</li> <li><input type="checkbox"/> Educator consults with community members to guide and support planning that incorporates students' cultural backgrounds and heritage with the content.</li> <li><input type="checkbox"/> Educator collaborates with staff when planning to incorporate students' cultural backgrounds in their teaching.</li> </ul>	

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator does not seek guidance in the use of or the knowledge of students' cultural traditions, customs, values, and practices.	The educator seeks guidance in the use of cultural information relating to students' traditions, customs, values, and practices but the information used is not accurate or the delivery of the lesson does not follow cultural protocols.	The educator seeks guidance in the use of cultural information relating to students' traditions, customs, values, and practices and the information used is accurate and the delivery of the lesson does follow cultural protocols.	The educator seeks guidance and collaborates with peers and community members to ensure accurate information of cultural content in their teaching.



# Alaska Cultural Standard B

## Authentic Local Resources

**B. Culturally responsive educators use the local environment and community resources on a regular basis to link what they are teaching to the everyday lives of the students.**

Description of the Standard:

Cultural Standard B addresses the educator using the authentic environment on regular basis as a bridge to new learning. The authentic environment is the local community that all students are members of regardless of their cultural heritage. The resources available for an educator may include people, environment, businesses, and organizations (hospitals, clinics, corporations, etc.). Educators that successfully link the authentic environment with the curriculum help students develop connections between content and their everyday lives.

Focus Statement	Desired Outcome
The educator regularly uses local resources helping students make connections between the content and their everyday lives.	Students connect classroom learning to their daily lives.

Indicator #	Cultural Indicator	Reflection Question
<b>CB1</b>	The educator has a planning process that incorporates the linking of the local environment, community resources, and issues to instructional content.	How can I improve my planning process to be more inclusive of the local environment, community resources, and issues with instructional content?
★ <b>CB2</b>	The educator engages students in learning experiences that integrate the local environment, community resources, and issues when interacting with content.	What can I do to broaden my understanding of the local environment and community resources so that I can help my students interact with knowledge/content more effectively?
<b>CB3</b>	The educator reflects on the effectiveness of using the local environment, community resources, and issues to help students connect content to their daily lives.	What evidence do I have that incorporating the local environment, community resources, and issues are helping my students connect content with their everyday lives?
<b>CB4</b>	The educator seeks guidance regarding the local environment, community resources, and issues and how it connects to the everyday lives of the students.	How and from whom will I seek guidance about the appropriate use of local resources?

★ *Denotes indicators that can be observed in the classroom.*

Indicator #	
<b>CB1</b>	The educator has a planning process that incorporates the linking of the local environment, community resources, and issues to instructional content.
Desired Outcome	
Educator's plans include references and activities connecting content to the local environment.	
Example Evidences	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator's plans reflect using the local environmental resources on a regular basis; i.e. speakers, field</li> <li><input type="checkbox"/> Educator's plans integrate the content standards with cultural standards utilizing local resources.</li> <li><input type="checkbox"/> Educator's plans reflect the use of the local environment's seasonal activities; i.e. traditional uses of resources for different seasons.</li> <li><input type="checkbox"/> Educator's plans includes elements to make connections between the students and the local environment, i.e. field trips, guest speakers, out of doors, activities, etc.</li> </ul>	

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator's plans do not incorporate knowledge of the students' local environment, community resources, and issues in the teaching of their content.	The educator incorporates knowledge of students' local environment, community resources, and issues into the planning process, however there isn't a statement of how the activity, lesson, or reference will connect to the content.	The educator incorporates knowledge of students' local environment, community resources, and issues into the planning process, and there is a statement of how the activity, lesson, or reference will connect to the content.	The educator's plans use the students' local environment, community resources, and issues in unique and creative ways to make connections to the content.

Indicator #	
★ <b>CB2</b>	The educator engages students in learning experiences that integrate the local environment, community resources, and issues when interacting with content.
Desired Outcome	
Students make connection between their local environment, community resources, community issues and the content.	
Example Student Behaviors	Example Educator Behaviors
<ul style="list-style-type: none"> <li>❑ Student artifacts reflect the knowledge of the local environment.</li> <li>❑ Students demonstrate interest and engagement when using the local environment and or resources.</li> <li>❑ Students' attitudes and or behaviors demonstrate respect for the local community resources; i.e. respecting land area, personal property, other persons, etc.</li> </ul>	<ul style="list-style-type: none"> <li>❑ Educators' activities/ assignments facilitate making connections to the local environment and culture.</li> <li>❑ Educator uses the local environment, i.e. out-of-doors lessons, field trips, place based investigations, etc.</li> <li>❑ Educator organizes students to interact with the local resources being presented; i.e. groups, prepared questions, graphic organizers, etc.</li> </ul>

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator's use of the local environment, community resources, and/or issues was not appropriately connected to the introduction of content.	The educator makes cultural connection(s) to the content but the majority of the students cannot state how the connection relates to the local environment, community resources, and/or issues.	The educator makes cultural connection(s) to the content and the majority of the students can state how the connection relates to the local environment, community resources, and/or issues.	The educator makes cultural connections to the content in unique and creative ways so that all students are able to state how the content connects to the local environment, community resources, and/or issues.

Indicator #	
<b>CB3</b>	The educator reflects on the effectiveness of using the local environment, community resources, and issues to help students connect content to their daily lives.
Desired Outcome	
Educator monitors effectiveness of using authentic local resources as a result of student learning.	
Example Evidences	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator can explain the effectiveness of strategies used to make cultural connections.</li> <li><input type="checkbox"/> Educator maintains records on how the local environment, community resources, and issues are being incorporated into lessons.</li> <li><input type="checkbox"/> Educator uses informal student assessments to evaluate the effectiveness of incorporating the local cultural environment and/or resources.</li> <li><input type="checkbox"/> Educator debriefs with peers, presenter, students, etc. to gain feedback on successes, challenges, or changes.</li> </ul>	

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator lacks reflection on his/her teaching and therefore does not identify ways to become more effective in using the local environment, community resources, and/or issues to connect content to students' daily lives.	The educator reflects on how to use the local environment, community resources, and/or issues but does not identify specific ways connect content to students' daily lives.	The educator reflects on how to use the local environment, community resources, and/or issues and identifies specific ways to connect content to students' daily lives.	The educator reflects on how to use the local environment, community resources, and/or issues and how to adapt them to connect content to students' daily lives.in order to reach all students in the classroom.

Indicator #	
<b>CB4</b>	The educator seeks guidance regarding the local environment, community resources, and issues and how it connects to the everyday lives of the students.

Desired Outcome
Educator accurately uses authentic community resources and cites sources used.
Example Evidences
<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator maintains records of their efforts to seek guidance on using authentic local resources.</li> <li><input type="checkbox"/> Teacher participates in continuing education courses and/or workshops that help them learn about local resources and issues.</li> <li><input type="checkbox"/> Educator has a mentor that shows or tells them what is the correct use of local areas and/or resources.</li> <li><input type="checkbox"/> Educator meets with the guest presenters in advance of their visits to preview content and/or to clarify expectations.</li> </ul>

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator does not seek guidance in the use of or the knowledge of the local environment, community resources, and/or issues.	The educator seeks guidance in the use of cultural information relating to the local environment, community resources, and/or issues but the information used is not accurate.	The educator seeks guidance in the use of cultural information relating to the local environment, community resources, and/or issues and the information used is accurate.	The educator seeks guidance and collaborates with peers and community members to ensure accurate information of the local environment, community resources, and/or issues in their teaching.

# Alaska Cultural Standard C

Standard C is not mandated for evaluation since it cannot be observed in the classroom. Nevertheless, many school districts have adapted Standard C to make it a part of their teacher evaluation.

## Community Connections

### C. Culturally-responsive educators participate in community events and activities in appropriate and supportive ways.

#### Description of the Standard:

Cultural Standard C addresses the importance of educators being connected to their students' environments, and developing relationships with the people who interact with them in those environments. Although this standard isn't part of an educator's evaluation because it isn't observable in the classroom, it is the cornerstone standard. All four of the other cultural standards depend upon the educator building a knowledge base about their students and developing meaningful relationships within the community so the educator is perceived as a contributing member who respectfully gleans knowledge about the students' "place".

Indicator #	Cultural Indicator
CC1	Become active members of the community in which they teach and make positive and culturally appropriate contributions to the well being of that community.
CC2	Exercise professional responsibilities in the context of local cultural traditions and expectations.
CC3	Maintain a close working relationship with and make appropriate use of the cultural and professional expertise of their co-workers from the local community.



## Alaska Cultural Standard D

### Home Connections

#### **D. Culturally responsive educators work closely with parents to achieve a high level of complementary educational expectations between home and school.**

##### Description of the Standard:

Cultural Standard D addresses the collaboration between home and school so there is mutual support for the expectations of the student. The word complementary in the standard is defined as, combining in such a way as to enhance the qualities of each other. Based on this definition, both the educator and the parent share a responsibility in communication and support of the student's educational expectations. The educator seeks parent/guardian input and acts upon their concerns so that the student's educational needs are met and supported. Educators should maintain open communication with parents regarding educational expectations for students and feedback on student progress. It is the educator's responsibility to persistently work with all parents, including those who are less involved with the educational process, to provide suggestions/resources to parents, which help promote student success.

Focus Statement	Desired Outcome
The educator works collaboratively with parents in coordinating efforts to support student expectations.	Parents and the educators cooperate to support the child's education.

Indicator #	Cultural Indicator	Reflection Question
<b>CD1</b>	The educator plans culturally sensitive ways to build relationships with parents/guardians to achieve complementary expectations of students.	What will I do to strengthen my relationship with parents/guardians to ensure that expectations set for students are mutually supported and understood?
<b>CD2</b>	The educator communicates with homes to better understand the student's educational needs, concerns, and strengths.	How will I collaborate with parents/guardians to learn about student strengths and discover areas of need or concern?



Indicator #	
<b>CD1</b>	The educator plans culturally sensitive ways to build relationships with parents/guardians to achieve complementary expectations of students.
Desired Outcome	
Educator learns and uses culturally sensitive ways to develop relationships with all parents.	
Example Evidences	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator communicates with parents in ways that are culturally responsive. ( i.e. translators, web based translation of newsletters)</li> <li><input type="checkbox"/> During teacher/parent interactions, parents are informed of upcoming plans, and are invited to participate.</li> <li><input type="checkbox"/> Parents visit the classroom.</li> <li><input type="checkbox"/> Classroom physical environment reflects an attitude that parents are welcome.</li> <li><input type="checkbox"/> Parents contribute as classroom helpers, etc.</li> <li><input type="checkbox"/> The educator demonstrates integrity, confidentiality, respect, flexibility, fairness, and trust when building relationships with parents.</li> <li><input type="checkbox"/> Educator responds to parent requests for support, assistance and/or clarification regarding their child in a timely manner.</li> <li><input type="checkbox"/> The educator uses technology to build collaborative relationships between home and school.</li> <li><input type="checkbox"/> Educator can produce evidence of furthering their understanding of the culture, ie. reading material, classes, professional learning groups, etc.</li> </ul>	

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator's plans do not reflect culturally sensitive ways to build relationships with parents/guardians.	The educator plans culturally sensitive ways to interact with parents/guardians, but does not work toward building complementary expectations with the parent for the student.	The educator plans culturally sensitive ways to interact with the majority of parents/guardians, and builds complementary expectations with the parent for the student.	The educator plans ways to interact with <b><i>all</i></b> parents/guardians and adapts culturally sensitive strategies that support and respect families in achieving educational outcomes for students.



Indicator #	
<b>CD2</b>	The educator communicates with homes to better understand the student's educational needs, concerns, and strengths.
Desired Outcome	
The educator uses information about students' backgrounds to meet student needs.	
Example Evidences	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator's plans show multiple ways to get input from families. (family night, emails, web site, conferencing, phone calls, surveys, etc.).</li> <li><input type="checkbox"/> Educator seeks to continuously learn about and build upon the cultural knowledge that students bring with them from their homes and community.</li> <li><input type="checkbox"/> Educator plans for the needs of students who come from home environments that offer little support for schooling.</li> <li><input type="checkbox"/> When assigning homework, the educator takes into consideration the students' family resources.</li> <li><input type="checkbox"/> Educator can describe instances when he or she interacted positively with students and parents.</li> <li><input type="checkbox"/> Students and parents can describe positive interactions they have had with that educator.</li> <li><input type="checkbox"/> When communicating with the home, the educator takes into consideration family and language resources.</li> <li><input type="checkbox"/> Educator maintains an web-based site where assignments, upcoming events, etc are posted for student-home access.</li> <li><input type="checkbox"/> Educator is culturally sensitive and consistent in communicating with the home regarding expectations, progress, and/or concerns.</li> </ul>	

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator communicates with homes but does not gather information about the home environment.	The educator communicates with homes and gathers information about the home environment, and uses that knowledge to meet some students' educational needs.	The educator communicates with homes and gathers information about the home environment, and uses that knowledge to meet the majority of the students' educational needs.	The educator communicates with <b><i>all</i></b> home environments, and uses that information to meet the educational needs of <b><i>all</i></b> students.

## Alaska Cultural Standard E

### High-Unbiased Expectations

E. Culturally responsive educators recognize the full educational potential of each student and provide the challenges necessary for them to achieve that potential.

Description of the Standard:

Cultural Standard E addresses the belief by the educator that all children can learn. Educators support high expectations for all students by recognizing the cultural integrity and identity students bring with them into the classroom, and by reflecting on their own practices and beliefs. The educator engages students with respect, cultural sensitivity, and confidence in each student's ability to learn. Educators maintain high expectations for all students by: resisting making judgments based on stereotypes; using strategies that support all learners; and monitoring all students for achievement of the learning goals.

Focus Statement	Desired Outcome
The educator recognizes all students of all cultures can achieve and will provide rigorous academic challenges for them.	All students believe they can achieve and will strive to meet the challenges of academic rigor.

Indicator #	Cultural Indicator	Reflection Question
<b>CE1</b>	The educator plans for academic rigor that will challenge each student regardless of cultural background.	What will I do to better understand the full potential of each of my students in order to challenge their learning?
★ <b>CE2</b>	The educator provides rigorous learning opportunities for students that combines higher order thinking skills and student autonomy (from teacher-directed to student-directed).	How can I guide and support all students of all cultures to demonstrate higher order thinking skills and develop student autonomy?
★ <b>CE3</b>	The educator demonstrates value and respect for all students of all cultures and challenges them to strive for educational excellence.	How can I cultivate a classroom environment that encourages all students to strive for academic excellence and show pride in their culture?
<b>CE4</b>	The educator reflects on student performance based assessments, both formative and summative to identify areas for academic rigor.	How do I differentiate my instruction to support diverse student learning needs?

★*Denotes indicators that can be observed in the classroom*

Indicator #	
<b>CE1</b>	The educator plans for academic rigor that will challenge each student regardless of cultural background.
Desired Outcome	
The educator delivers instruction that is scaffolded and differentiated to challenge and meet the needs of all students.	
Example Evidences	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator's plans have differentiation strategies that reflect cultural sensitivity. (i.e. wait time, grouping, environment, learning styles)</li> <li><input type="checkbox"/> Educator's plans regularly include cultural connections to students in the classroom.</li> <li><input type="checkbox"/> Educator's plans include assessment strategies to measure student progress that accommodate cultural diversities.</li> <li><input type="checkbox"/> Educator's plans build on student background knowledge to address cognitive complexity.</li> <li><input type="checkbox"/> Educator designs strategies/activities that explicitly use the verbs associated with complexity. ie., Bloom's Taxonomy.</li> </ul>	

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator's plans do not reflect strategies and activities that are rigorous and/or culturally sensitive to challenge and meet the needs of all students.	The educator 's plans reflect strategies and activities that are culturally sensitive but lack rigor in order to challenge and meet the needs of students.	The educator 's plans reflect strategies and activities that are rigorous and culturally sensitive to challenge and meet the needs of the majority of students.	The educator 's plans reflect strategies and activities that are rigorous and culturally sensitive to challenge and meet the needs of <b>all</b> students.

Indicator #	
★ <b>CE2</b>	The educator provides rigorous learning opportunities for students that combines higher order thinking skills and student autonomy (from teacher-directed to student-directed).
Desired Outcome	
Students exhibit higher order thinking and increased student autonomy.	
Example Student Behaviors	Example Educator Behaviors
<ul style="list-style-type: none"> <li>❑ Students participate in large and small groups and in various roles within those groups.</li> <li>❑ Students are engaged in higher order activities (i.e. problem based learning or project based learning)</li> <li>❑ Students engage in critical thinking discussions that connect various cultural perspectives to the topic.</li> </ul>	<ul style="list-style-type: none"> <li>❑ Educator organizes students in various ways to interact with content.</li> <li>❑ Educator uses strategies that challenge students to apply their knowledge in creative ways, ie. problem solving, examining similarities and differences, etc.</li> <li>❑ Educator facilitates culturally responsive discussions allowing students to apply critical thinking skills.</li> </ul>

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator does not structure learning opportunities for students to demonstrate higher order thinking skills and/or student autonomy.	The educator structures learning opportunities for some students to demonstrate higher order thinking skills and develop student autonomy.	The educator structures learning opportunities for the majority students in order for them to demonstrate higher order thinking skills and develop student autonomy.	The educator structures unique and creative learning opportunities for <b>all</b> students in order for them to demonstrate higher order thinking skills and develop student autonomy.

Indicator #	
★ <b>CE3</b>	The educator demonstrates value and respect for all students of all cultures and challenges them to strive for educational excellence.
Desired Outcome	
All students feel capable, worthy, and accepted by the educator.	
Example Student Behaviors	Example Educator Behaviors
<ul style="list-style-type: none"> <li><input type="checkbox"/> Students take risks. (i.e. ask questions, participate in discussion, volunteer)</li> <li><input type="checkbox"/> Students state the teacher cares about them.</li> <li><input type="checkbox"/> Students exhibit a willingness to learn.</li> <li><input type="checkbox"/> Students avoid negative thinking about their abilities, attitudes, and actions.</li> <li><input type="checkbox"/> Students are willing to accept challenges.</li> <li><input type="checkbox"/> Students persevere with higher order learning activities.</li> <li><input type="checkbox"/> Students demonstrate respect toward others and property.</li> <li><input type="checkbox"/> Students display positive attitudes and actions in the classroom.</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator treats all students fairly.</li> <li><input type="checkbox"/> Educator interacts with students in culturally responsive ways, ie. smiles, makes appropriate physical contact, understands nonverbal signs, etc.</li> <li><input type="checkbox"/> Educator promotes inclusion of diverse cultures.</li> <li><input type="checkbox"/> Educator models respect for all students.</li> <li><input type="checkbox"/> Educator encourages students to achieve their full potential through scaffolding and/or differentiation.</li> <li><input type="checkbox"/> Educator addresses students in a manner they perceive as culturally respectful, i.e. using their Native name (if appropriate), not talking too loudly, not demanding eye contact, playful dialogue, etc.</li> <li><input type="checkbox"/> Educator maintains an environment that is safe.</li> <li><input type="checkbox"/> Educator does not allow negative comments about students' abilities and provides strategies for students to use to avoid negative thoughts and actions.</li> </ul>

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator encourages some of the students to persist in difficult and challenging learning experiences and interacts with them fairly and equitably.	The educator encourages the majority of the students of <b>all</b> cultures to persist in difficult and challenging learning experiences and interacts with them fairly and equitably.	The educator encourages <b>all</b> students of <b>all</b> cultures to persist in difficult and challenging learning experiences and interacts with them fairly and equitably.	The educator uses unique and creative ways to encourage <b>all</b> students of <b>all</b> cultures to develop leadership skills while collaborating with peers to solve real world problems.

Indicator #	
<b>CE4</b>	The educator reflects on student performance based assessments, both formative and summative to identify areas for academic rigor.
Desired Outcome	
Educator analyzes formative and summative assessments and differentiates instruction to challenge and meet the needs of all students.	
Example Evidences	
<ul style="list-style-type: none"> <li><input type="checkbox"/> Educator reflection journals.</li> <li><input type="checkbox"/> Educator pulls from multiple sources of data to create an Individual Learning Plan that includes the student's culture.</li> <li><input type="checkbox"/> Student growth goals.</li> <li><input type="checkbox"/> Educator tracks student progress toward specific goals.</li> <li><input type="checkbox"/> Educator engages in purposeful conversations about the students to identify areas of need and possible solutions/interventions. (i.e. former teachers, parents, paraprofessionals, cooks, janitors, other school staff as appropriate, RTI process.)</li> </ul>	

Rating Scale			
<i>Unsatisfactory</i>	<i>Basic</i>	<i>Proficient</i>	<i>Exemplary</i>
The educator reflects on students' assessments but lacks follow through to develop strategies that consider the student's culture when identifying strategies for increasing academic rigor and identifying areas of need.	The educator reflects on student's assessments to determine the effectiveness of instruction, but does not develop strategies that consider the student's culture when identifying strategies for increasing academic rigor and identifying areas of need.	The educator reflects on students' assessments and determines the effectiveness of specific strategies and considers the student's culture when identifying strategies for increasing academic rigor and identifying areas of need.	The educator is creative and innovating in developing an Individual Learning Plan for each student based upon assessments and the student's culture.

# Alaska English/ Language Arts Standards



**Adopted June 2012**

## Organization of English/Language Arts Standards

The Standards comprise two main sections: a comprehensive K- 5 section and content area- specific section for grades 6- 12.

Appendices and instructional tools accompany the main document and can be found on the state's website <http://www.eed.alaska.gov>.

Standards for each grade within K- 8 and for grade spans 9- 10 and 11- 12 follow the same anchor standards for each content area: reading, writing, listening and speaking, and language. Each grade- specific standard corresponds to the same- numbered anchor standard. Put another way, each anchor standard has an accompanying grade- specific standard translating the broader statement into grade- appropriate end- of- year expectations. Anchor standards “anchor” the document and define general, cross- disciplinary literacy expectations.

**Alaska Anchor Standards for Reading Grades K-12**

The K-12 standards on the following pages define what students should understand and be able to do by the end of each grade. They correspond to the anchor standards below by number. The grade-specific standards are necessary complements—the former providing broad standards, the latter providing additional specificity—that together define the skills and understandings that all students must demonstrate.

**Key Ideas and Details**

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, and ideas develop and interact over the course of a text.

**Craft and Structure**

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a scene or section in a story or drama) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

**Integration of Knowledge and Ideas**

7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in traditional print and digital formats.
8. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches to the subject.

**Range of Reading and Level of Text Complexity**

10. Read and comprehend a range of complex literary and informational texts independently and proficiently.

**Grade-Specific Standards**

**Reading Standards for Literature K-5**

The following standards offer a focus for instruction each year and help ensure that students gain adequate exposure to a range of texts and tasks. Rigor is also infused through the requirement that students read increasingly complex texts through the grades. Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.

Kindergarten:	Grade 1 students:	Grade 2 students:
<b>Key Ideas and Details</b> 1. With prompting and support, ask and answer questions about a literary text using key details from the text.	1. Ask and answer questions about a literary text using key details from the text.	1. Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of a literary text using key details.
<b>Craft and Structure</b> 2. With prompting and support, retell familiar stories, using key details.	2. Retell stories, using key details, and demonstrate understanding of a sequence (e.g., first, then, next, last) or a series of events (e.g., first, then, next, last).	
<b>Integration of Knowledge and Ideas</b> 3. With prompting and support, identify characters, settings, major events, and problem-solution in a story, play, or poem, using key details.	3. Describe characters, major events, and problem-solution in a story, play, settings, or poem, using key details.	
<b>Range of Reading and Level of Text Complexity</b> 4. Ask and answer questions about unknown words in a text.	4. Identify words and phrases in stories, plays, or poems that suggest feelings or appeal to the senses.	
	5. Explain major differences between books that tell stories and books that give information (fiction, non-fiction, and poetry), drawing on a wide reading of a range of text types.	
	6. With prompting and support, name the author and illustrator of a story and describe the role of each in telling the story.	6. Identify who is telling the story at various points in the text (e.g., a character in the text or a narrator/story teller).

**Reading Standards for Informational Text K-5**

The following standards offer a focus for instruction each year and help ensure that students gain adequate exposure to a range of texts and tasks. Rigor is also infused through the requirement that students read increasingly complex texts through the grades. Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.

Kindergarten:	Grade 1 students:	Grade 2 students:
<b>Key Ideas and Details</b> 1. With prompting and support, elicit background/prior knowledge and experience in order to ask and answer questions about an informational text using key details from the text.	1. With prompting and support, elicit background/prior knowledge and experience in order to ask and answer questions about an informational text using key details from the text.	1. Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of informational texts using key details from the text.
<b>Craft and Structure</b> 2. With prompting and support, identify the main topic and retell key details of a text.	2. With prompting and support, identify the main topic and retell key details of a text.	2. Identify the main topic of a multiparagraph text as well as the focus of specific paragraphs within the text.
<b>Integration of Knowledge and Ideas</b> 3. With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.	3. Describe the connection between two individuals, events, ideas, or pieces of information in a text.	3. Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.
<b>Range of Reading and Level of Text Complexity</b> 4. With prompting and support, ask and answer questions about unknown words in a text.	4. With prompting and support, ask and answer questions about unknown words in a text.	4. Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.
	5. Identify the front cover, back cover, and title page of a book.	5. Know and use various text features (e.g., title, labels with graphics, bold print, visual cues such as arrows, electronic menus, icons) to locate key facts or information in a text.
	6. Name the author and illustrator of a text and describe the role of each in presenting the ideas or information in a text.	6. Distinguish between information provided by photos or other graphics and information provided by the words in a text.
<b>Integration of Knowledge and Ideas</b> 7. With prompting and support, describe the relationship between illustrations and the text in which they appear (e.g., what person, place, thing, or idea in the text an illustration depicts).	7. Use the illustrations and details in a text to describe its key ideas.	7. Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text.
<b>Range of Reading and Level of Text Complexity</b> 8. With prompting and support, identify the opinions an author states in a text.	8. Identify the opinions an author states to support points in a text.	8. Describe how reasons given support specific opinions the author states in a text.
	9. With prompting and support, identify basic similarities in and differences between information presented in two texts on the same topic (e.g., compare two photos or diagrams, compare two animal babies).	9. Compare and contrast the most important points presented by two texts or related topics (e.g., a book about polar bears and a book about black bears).

Each anchor standard has an accompanying grade-specific standard translating the broader statement into grade- appropriate end-of-year expectations



The K- 12 grade- specific standards define end- of- year expectations and a cumulative progression designed to enable students to meet college and career readiness. Individual grade- specific standards can be identified by their content/focus, grade, strand, and number (or number and letter, where applicable), so that RI.4.3, for example, stands for Reading, Informational Text, grade 4, standard 3, and W.5.1a stands for Writing, grade 5, standard 1a.

Anchor standards are coded similarly. For example, R.CS.6 stands for Reading, Craft and Structure, standard 6.

**Alaska Anchor Standards for Reading Grades K-12**

The K-12 standards on the following pages define what students should understand and be able to do by the end of each grade. They correspond to the anchor standards below by number. The grade-specific standards are necessary complements—the former providing broad standards, the latter providing additional specificity—that together define the skills and understandings that all students must demonstrate.

**Key Ideas and Details**

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, and ideas develop and interact over the course of a text.

**Craft and Structure**

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

**Integration of Knowledge and Ideas**

7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

**Range of Reading and Level of Text Complexity**

10. Read and comprehend a range of complex literary and informational texts independently and proficiently.

Strand Key:

**KI - Key Ideas and  
Details CS - Craft and  
Structure**

**IK - Integration of Knowledge and Ideas**

**RR - Range of Reading and Level of Text Complexity**

## **Alaska Anchor Standards Reading Grades K- 12**

The K- 12 grade- specific standards on the following pages define what students should understand and be able to do by the end of each grade. They correspond to the anchor standards below by number. The grade- specific standards are necessary complements—the former providing broad standards, the latter providing additional specificity—that together define the skills and understandings that all students must demonstrate.

### **Key Ideas and Details**

1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, and ideas develop and interact over the course of a text.

### **Craft and Structure**

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

### **Integration of Knowledge and Ideas**

7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

### **Range of Reading and Level of Text Complexity**

10. Read and comprehend a range of complex literary and informational texts independently and proficiently.

## **Alaska Anchor Standards for Writing Grades K- 12**

The K- 12 grade- specific standards on the following pages define what students should understand and be able to do by the end of each grade. They correspond to the anchor standards below by number. The grade- specific standards are necessary complements—the former providing broad standards, the latter providing additional specificity—that together define the skills and understandings that all students must demonstrate.

### **Text Types and Purposes**

1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Use narrative writing to develop real or imagined experiences or events using effective technique, well- chosen details, and well- structured event sequences.

### **Production and Distribution of Writing**

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

### **Research to Build and Present Knowledge**

7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

### **Range of Writing**

10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

## **Alaska Anchor Standards for Speaking and Listening Grades K- 12**

The K- 12 grade- specific standards on the following pages define what students should understand and be able to do by the end of each grade. They correspond to the anchor standards below by number. The grade- specific standards are necessary complements—the former providing broad standards, the latter providing additional specificity—that together define the skills and understandings that all students must demonstrate.

### **Comprehension and Collaboration**

1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.

### **Presentation of Knowledge and Ideas**

4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and that the organization, development, and style are appropriate to task, purpose, and audience.
5. Make strategic use of digital media and visual displays of data to express information and enhance understanding of presentations.
6. Adapt speech to a variety of contexts and communicative tasks, demonstrating command of formal English when indicated or appropriate.

## **Alaska Anchor Standards for Language Grades K- 12**

The K- 12 grade- specific standards on the following pages define what students should understand and be able to do by the end of each grade. They correspond to the anchor standards below by number. The grade- specific standards are necessary complements—the former providing broad standards, the latter providing additional specificity—that together define the skills and understandings that all students must demonstrate.

### **Conventions of Standard English**

1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

### **Knowledge of Language**

3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

### **Vocabulary Acquisition and Use**

4. Determine or clarify the meaning of unknown and multiple- meaning words and phrases by using context clues, analyzing meaningful word parts, and consulting general and specialized reference materials, as appropriate.
5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
6. Acquire and use accurately a range of general academic and domain- specific words and phrases sufficient for reading, writing, speaking, and listening at the college- and career- readiness level; demonstrate independence in gathering vocabulary knowledge when encountering an unknown term important to comprehension or expression.

### Language Progressive Skills, by Grade

The following skills, marked with an asterisk (\*) in Language standards 1–3, are particularly likely to require continued attention in higher grades as they are applied to increasingly sophisticated writing and speaking.

Standards	Grades	
	9-10	11-12
<b>L.3.1f.</b> Ensure subject-verb and pronoun-antecedent agreement.		
<b>L.3.3a.</b> Choose words and phrases for effect.		
<b>L.4.1f.</b> Produce complete sentences, recognizing and correcting inappropriate fragments and run-ons.		
<b>L.4.1g.</b> Correctly use frequently confused words (e.g., <i>to/too/two</i> ; <i>there/their</i> ).		
<b>L.4.3a.</b> Choose words and phrases to convey ideas precisely.*		
<b>L.4.3b.</b> Choose punctuation for effect.		
<b>L.5.1d.</b> Recognize and correct inappropriate shifts in verb tense.		
<b>L.5.2a.</b> Use punctuation to separate items in a series.†		
<b>L.6.1c.</b> Recognize and correct inappropriate shifts in pronoun number and person.		
<b>L.6.1d.</b> Recognize and correct vague pronouns (i.e., ones with unclear or ambiguous antecedents).		
<b>L.6.1e.</b> Recognize variations from standard English in their own and others' writing and speaking, and identify and use strategies to improve expression in conventional language.		
<b>L.6.2a.</b> Use punctuation (commas, parentheses, dashes) to set off nonrestrictive/parenthetical elements.		
<b>L.6.3a.</b> Vary sentence patterns for meaning, reader/listener interest, and style.‡		
<b>L.6.3b.</b> Maintain consistency in style and tone.		
<b>L.7.1c.</b> Place phrases and clauses within a sentence, recognizing and correcting misplaced and dangling modifiers.		
<b>L.7.3a.</b> Choose language that expresses ideas precisely and concisely, recognizing and eliminating wordiness		

\*Subsumed by L.7.3a

†Subsumed by L.9–10.1a

‡Subsumed by L.11–12.3a

### **Measuring Text Complexity: Three Factors**

1. Quantitative measures – readability and other scores of text complexity, often best measured by computer software.
2. Qualitative measures – levels of meaning, structure, language conventionality and clarity, and knowledge demands, often best measured by an attentive human reader.
3. Reader and Task considerations – background knowledge of reader, motivation, interests, and complexity generated by tasks assigned, often best made by educators employing their professional judgment.

Text complexity described in Standard 10 is not limited to the quantitative measure, which deals exclusively with length and number of words. The more rigorous standard considers a qualitative measure, which addresses the levels of meaning, structure, language conventionality and clarity. Reader and task considerations look at the background knowledge of reader, motivation and interest. For instance, Steinbeck’s *Grapes of Wrath* may be considered at the second-grade level when looking only at the quantitative measure, but when the language conventions and background knowledge of the reader are considered, it is a ninth grade level.

### **Range of Text Types for 6-12**

Students in 6-12 apply the Reading standards to the following range of text types, with texts selected from a broad range of cultures and periods.

<b>Literature</b>			<b>Informational Text</b>
<b>Stories</b>	<b>Dramas</b>	<b>Poetry</b>	<b>Literary Nonfiction and Historical, Scientific, and Technical Texts</b>
Includes the subgenres of adventure stories, historical fiction, mysteries, myths, science fiction, realistic fiction, allegories, parodies, satire, and graphic novels.	Includes one-act and multi-act plays, both in written form and on film.	Includes the subgenres of narrative poems, lyrical poems, free verse poems, sonnets, odes, ballads, and epics.	Includes the subgenres of exposition, argument, and functional text in the form of personal essays, speeches, opinion pieces, essays about art or literature, biographies, memoirs, journalism, and historical, scientific, technical, or economic accounts (including digital sources) written for a broad audience.

## Reading Standards for Literature 9- 12

The following standards offer a focus for instruction each year and help ensure that students gain adequate exposure to a range of texts and tasks. Rigor is also infused through the requirement that students read increasingly complex texts through the grades. Students advancing through the grades are expected to meet each year's grade- specific standards and retain or further develop skills and understandings mastered in preceding grades. The anchor standards and high school grade- specific standards work in tandem to define expectations—the former providing broad standards, the latter providing additional specificity.

Grades 9-10 Students:	Grades 11-12 Students
<b>Key Ideas and Details</b>	
1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as implicit inferences drawn from the text.	1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain (ambiguity).
2. Determine a theme or central idea of a text and analyze in detail its development over the course of the text, including how it emerges and is shaped and refined by specific details; restate and summarize main ideas or events, in correct sequence, after reading a text.	2. Determine two or more themes or central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to produce a complex account; restate and summarize main ideas or events, in correct sequence, after reading a text.
3. Analyze how complex characters (e.g., those with multiple or conflicting motivations) develop over the course of a text, interact with other characters, and advance the plot or develop the theme.	3. Analyze the impact of the author's choices regarding how to develop and relate elements of a story or drama (e.g., where a story is set, how the action is ordered, how the characters are introduced and developed).
<b>Craft and Structure</b>	
4. Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place; how it sets a formal or informal tone).	4. Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including words with multiple meanings or language that is particularly fresh, engaging, or beautiful. (Include Shakespeare as well as other authors.)
5. Analyze how an author's choices concerning how to structure a text, use literary devices appropriate to genre (e.g., foreshadowing, imagery, allusion or symbolism), order events within it (e.g., parallel plots), and manipulate time (e.g., pacing, flashbacks) create such effects as mystery, tension, or surprise.	5. Analyze how an author's choices concerning how to structure specific parts of a text (e.g., the choice of where to begin or end a story, the choice to provide a comedic or tragic resolution) contribute to its overall structure and meaning as well as its aesthetic impact.
6. Analyze a particular point of view or cultural experience reflected in a work of literature (e.g., mythology, colonialism, local culture), drawing on a wide reading of world literature.	6. Analyze a case in which grasping point of view requires distinguishing what is directly stated in a text from what is really meant (e.g., satire, sarcasm, irony, understatement, or attitude).
<b>Integration of Knowledge and Ideas</b>	
7. Analyze the representation of a subject or a key scene in two different artistic media, including what is emphasized or absent in each treatment (e.g., Auden's "Musée des Beaux Arts" and Breughel's Landscape with the Fall of Icarus).	7. Analyze multiple interpretations of a story, drama, or poem (e.g., recorded or live production of a play or recorded novel or poetry), evaluating how each version interprets the source text. (Include at least one play by Shakespeare and one play by an American dramatist.)
8. (Not applicable to literature)	8. (Not applicable to literature)
9. Analyze how an author draws on and transforms source material in a specific work (e.g., how Shakespeare treats a theme or topic from Ovid or how a later author draws on a play by Shakespeare).	9. Demonstrate knowledge of eighteenth- , nineteenth- and early- twentieth century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics.



## Reading Standards for Literature 9- 12

Grades 9-10 Students:	Grades 11-12 Students
<b>Range of Reading and Level of Text Complexity</b>	
10. By the end of grade 9, read and comprehend a range of literature from a variety of cultures, within a complexity band appropriate to grade 9 (from upper grade 8 to grade 10), with scaffolding as needed at the high end of the range.	10. By the end of grade 11, read and comprehend a range of literature from a variety of cultures, within a complexity band appropriate to grade 11 (from upper grade 10 to grade 12), with scaffolding as needed at the high end of the range.
By the end of grade 10, read and comprehend a range of literature from a variety of cultures, within a complexity band appropriate to grade 10 (from upper grade 9 to grade 11), with scaffolding as needed at the high end of the range.	By the end of grade 12, read and comprehend a range of literature from a variety of cultures, at the high end of the grades 11–12 text complexity band independently and proficiently.

## Reading Standards for Informational Texts 9-12

Grades 9-10 Students:	Grades 11-12 Students
<b>Key Ideas and Details</b>	
1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.	1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.
2. Determine a central idea of a text and analyze its development over the course of the text, including how it emerges and is shaped and refined by specific details; restate and summarize main ideas or events, in correct sequence when necessary, after reading a text.	2. Determine two or more central ideas of a text and analyze their development over the course of the text, including how they interact and build on one another to provide a complex analysis; restate and summarize main ideas or events, in correct sequence when necessary, after reading a text.
3. Analyze how the author unfolds an analysis or series of ideas or events, including the order in which the points are made, how they are introduced and developed, and the connections that are drawn between them.	3. Analyze a complex set of ideas or sequence of events and explain how specific individuals, ideas, or events interact and develop over the course of the text.
<b>Craft and Structure</b>	
4. Determine the meaning of words and phrases as they are used in various genres, including figurative, connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language of a court opinion differs from that of a newspaper).	4. Determine the meaning of words and phrases as they are used in various genres, including figurative, connotative, and technical meanings; analyze how an author uses and refines the meaning of a key term or terms over the course of a text.
5. Analyze in detail how an author’s ideas or claims are developed and refined by particular sentences, paragraphs, or larger portions of a text (e.g., a section or chapter).	5. Analyze and evaluate the effectiveness of the structure an author uses in his or her exposition or argument, including whether the structure makes points clear, convincing, and engaging.
6. Determine an author’s point of view or purpose in a text and analyze how an author uses rhetoric to advance that point of view or purpose.	6. Discern an author’s point of view or purpose in a text in which the rhetoric is particularly effective, analyzing how style and content contribute to the power, persuasiveness, or aesthetic impact of the text.

## Reading Standards for Literature 9- 12

Grades 9-10 Students:	Grades 11-12 Students
<b>Integration of Knowledge and Ideas</b>	
7. Analyze various accounts of a subject told in different media (e.g., a person’s life story in both print and multimedia), determining which details are emphasized in each account.	7. Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
8. Delineate and evaluate the argument and specific claims in a text (e.g., bias and propaganda techniques, emotional effect of specific word choices and sentence structures, well- supported logical arguments), assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.	8. Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning (e.g., in U.S. Supreme Court majority opinions and dissents) and the premises, purposes, and arguments in works of public advocacy (e.g., The Federalist, presidential addresses).
9. Analyze seminal U.S. and world documents of historical and literary significance (e.g., Washington’s Farewell Address, the Gettysburg Address, Roosevelt’s Four Freedoms speech, King’s “Letter from Birmingham Jail”), including how they address related themes and concepts.	9. Analyze seventeenth- , eighteenth- , an nineteenth-century foundational U.S. and world documents of historical and literary significance (including The Declaration of Independence, the Preamble to the Constitution, the Bill of Rights, and Lincoln’s Second Inaugural Address) for their themes, purposes, and rhetorical features.
<b>Range of Reading and Level of Text Complexity</b>	
10. By the end of grade 9, read and comprehend literary nonfiction, within a complexity band appropriate to grade 9 (from upper grade 8 to grade 10), with scaffolding as needed at the high end of the range.	10. By the end of grade 11, read and comprehend literary nonfiction, within a complexity band appropriate to grade 11 (from upper grade 10 to grade 12), with scaffolding as needed at the high end of the range.
By the end of grade 10, read and comprehend literary nonfiction, within a complexity band appropriate to grade 10 (from upper grade 9 to grade 11), with scaffolding as needed at the high end of the range.	By the end of grade 12, read and comprehend literary nonfiction at the high end of the grades 11–12 text complexity band independently and proficiently.

## Writing Standards 9- 12

The following standards for 9 - 12 offer a focus for instruction each year to help ensure that students gain adequate mastery of a range of skills and applications. Each year in their writing, students should demonstrate increasing sophistication in all aspects of language use, from vocabulary and syntax to the development and organization of ideas, and they should address increasingly demanding content and sources. Students advancing through the grades are expected to meet each year's grade- specific standards and retain or further develop skills and understandings mastered in preceding grades. The anchor standards and high school grade- specific standards work in tandem to define expectations—the former providing broad standards, the latter providing additional specificity.

Grades 9-10 Students	Grades 11-12 Students
Text Types and Purposes	
<p>1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.</p> <p>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.</p> <p>b. Develop claim(s) and counterclaims fairly, supplying evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level and concerns.</p> <p>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</p> <p>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p>e. Provide a concluding statement or section that follows from and supports the argument presented.</p>	<p>1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.</p> <p>a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences claim(s), counterclaims, reasons, and evidence.</p> <p>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant evidence for each while pointing out the strengths and limitations of both in a manner that anticipates the audience's knowledge level, concerns, values, and possible biases.</p> <p>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.</p> <p>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p>e. Provide a concluding statement or section that follow from and supports the argument presented.</p>
<p>2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.</p> <p>a. Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</p> <p>b. Develop the topic with well- chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.</p> <p>c. Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.</p>	<p>2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.</p> <p>a. Introduce a topic; organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.</p> <p>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.</p>

## Writing Standards 9 – 12

Grades 9-10 Students	Grades 11-12 Students
<p>d. Use precise language and domain- specific vocabulary to manage the complexity of the topic.</p> <p>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).</p>	<p>c. Use appropriate and varied transitions and syntax to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.</p> <p>d. Use precise language, domain- specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic.</p> <p>e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p>f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).</p>
<p>3. Use narrative writing to develop real or imagined experiences or events using effective technique, well-chosen details, and well- structured event sequences.</p> <p>a. Engage and orient the reader by setting out a problem, situation, or observation, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events.</p> <p>b. Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters.</p> <p>c. Use a variety of techniques to sequence events so that they build on one another to create a coherent whole.</p> <p>d. Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.</p> <p>e. Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.</p>	<p>3. Use narrative writing to develop real or imagined experiences or events using effective technique, well-chosen details, and well- structured event sequences.</p> <p>a. Engage and orient the reader by setting out a problem, situation, or observation and its significance, establishing one or multiple point(s) of view, and introducing a narrator and/or characters; create a smooth progression of experiences or events.</p> <p>b. Use narrative techniques, such as dialogue, pacing, description, reflection, and multiple plot lines, to develop experiences, events, and/or characters.</p> <p>c. Use a variety of techniques to sequence events so that they build on one another to create a coherent whole and build toward a particular tone and outcome (e.g., a sense of mystery, suspense, growth, or resolution).</p> <p>d. Use precise words and phrases, telling details, and sensory language to convey a vivid picture of the experiences, events, setting, and/or characters.</p> <p>e. Provide a conclusion that follows from and reflects on what is experienced, observed, or resolved over the course of the narrative.</p>
<b>Production and Distribution of Writing</b>	
<p>4. Produce clear and coherent writing in which the development, organization, style, and features are appropriate to task, genre, purpose, and audience. (Grade- specific expectations for writing types are defined in standards 1–3 above.)</p>	<p>4. Produce clear and coherent writing in which the development, organization, style, and features are appropriate to task, genre, purpose, and audience. (Grade- specific expectations for writing types are defined in standards 1–3 above.)</p>
<p>5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 9–10.)</p>	<p>5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (Editing for conventions should demonstrate command of Language standards 1–3 up to and including grades 11–12.)</p>

<b>Writing Standards 9 – 12</b>	
<b>Grades 9-10 Students</b>	<b>Grades 11-12 Students</b>
6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.	6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
<b>Research to Build and Present Knowledge</b>	
7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.	8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research. a. Apply grades 9–10 Reading standards to literature (e.g., “Analyze how an author draws on and transforms source material in a specific work [e.g., how Shakespeare treats a theme or topic from Ovid or how a later author draws on a play by Shakespeare].”). b. Apply grades 9–10 Reading standards to literary nonfiction (e.g., “Delineate and evaluate the argument and specific claims in a text [e.g., bias and propaganda techniques, emotional effect of specific word choices and sentence structures, well-supported logical arguments], assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.”).	9. Draw evidence from literary or informational texts to support analysis, reflection, and research. a. Apply grades 11–12 Reading standards to literature (e.g., “Demonstrate knowledge of eighteenth - nineteenth- and early twentieth- century foundational works of American literature, including how two or more texts from the same period treat similar themes or topics.”). b. Apply grades 11–12 Reading standards to literary nonfiction (e.g., “Delineate and evaluate the reasoning in seminal U.S. texts, including the application of constitutional principles and use of legal reasoning [e.g., in U.S. Supreme Court Case majority opinions and dissents] and the premises, purposes, and arguments in works of public advocacy [e.g., The Federalist, presidential addresses].”).
<b>Range of Writing</b>	
10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.	10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.



## **Speaking and Listening Standards 9- 12**

The following standards for grades 9 - 12 offer a focus for instruction in each year to help ensure that students gain adequate mastery of a range of skills and applications. Students advancing through the grades are expected to meet each year's grade- specific standards and retain or further develop skills and understandings mastered in preceding grades. The anchor standards and high school grade- specific standards work in tandem to define expectations—the former providing broad standards, the latter providing additional specificity.

Grades 9-10 Students	Grades 11-12 Students
<b>Comprehension and Collaboration</b>	
<p>1. Initiate and participate effectively in a range of collaborative discussions (one- on- one, in groups, and teacher- led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.</p> <p>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.</p> <p>b. Work with peers to set rules for collegial discussions and decision- making (e.g., informal consensus, taking votes on key issues, presentation of alternate views), clear goals and deadlines, and individual roles as needed.</p> <p>c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.</p> <p>d. Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.</p>	<p>1. Initiate and participate effectively in a range of collaborative discussions (one- on- one, in groups, and teacher- led) with diverse partners on grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.</p> <p>a. Come to discussions prepared, having read and researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic or issue to stimulate a thoughtful, well reasoned exchange of ideas.</p> <p>b. Work with peers to promote civil, democratic discussions and decision making, set clear goals and deadlines, and establish individual roles as needed.</p> <p>c. Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.</p> <p>d. Respond thoughtfully to diverse perspectives or arguments; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the task.</p>
<p>2. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, orally) evaluating the credibility and accuracy of each source and noting any discrepancies among data or information.</p>	<p>2. Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data or information.</p>
<p>3. Identify and evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any fallacious reasoning or exaggerated or distorted evidence.</p>	<p>3. Identify and evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, assessing the stance, premises, links among ideas, word choice, points of emphasis, and tone used.</p>

## Speaking and Listening Standards 9 – 12

Grades 9-10 Students	Grades 11-12 Students
Presentation of Knowledge and Ideas	
4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.	4. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks.
5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.	5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
6. Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate and addressing intended audience needs and knowledge level. (See grades 9–10 Language standards 1 and 3 for specific expectations.)	6. Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate and addressing intended audience needs and knowledge level. (See grades 11–12 Language standards 1 and 3 for specific expectations.)

## **Language Standards 9- 12**

The following standards for grades 9- 12 offer a focus for instruction each year to help ensure that students gain adequate mastery of a range of skills and applications. Students advancing through the grades are expected to meet each year's grade- specific standards and retain or further develop skills and understandings mastered in preceding grades. Beginning in grade 3, skills and understandings that are particularly likely to require continued attention in higher grades as they are applied to increasingly sophisticated writing and speaking are marked with an asterisk (\*). For a complete list see the table in the Introduction. The anchor standards and high school grade- specific standards work in tandem to define readiness expectations—the former providing broad standards, the latter providing additional specificity.

<b>Grades 9-10 Students</b>	<b>Grades 11-12 Students</b>
<b>Conventions of Standard English</b>	
<p>1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.</p> <p>a. Use parallel structure.*</p> <p>b. Use various types of phrases (noun, verb, adjectival, adverbial, participial, prepositional, absolute) and clauses (independent, dependent; noun, relative, adverbial) to convey specific meanings and add variety and interest to writing or presentations.</p>	<p>1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.</p> <p>a. Apply the understanding that usage is a matter of convention, can change over time, and is sometimes contested.</p> <p>b. Resolve issues of complex or contested usage, consulting references (e.g., Merriam- Webster's Dictionary of English Usage, Garner's Modern American Usage) as needed.</p>
<p>2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.</p> <p>a. Use a semicolon (and perhaps a conjunctive adverb) to link two or more closely related independent clauses.</p> <p>b. Use a colon to introduce a list or quotation.</p> <p>c. Spell correctly.</p>	<p>2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.</p> <p>a. Observe hyphenation conventions.</p> <p>b. Spell correctly.</p>
<b>Knowledge of Language</b>	
<p>3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.</p> <p>a. Write and edit work so that it conforms to the guidelines in a style manual (e.g., MLA Handbook, Turabian's Manual for Writers) appropriate for the discipline and writing type.</p>	<p>3. Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.</p> <p>a. Vary syntax for effect, consulting references (e.g., Tufte's Artful Sentences) for guidance as needed; apply an understanding of syntax to the study of complex texts when reading.</p>
<b>Vocabulary Acquisition and Use</b>	
<p>4. Determine or clarify the meaning of unknown and multiple- meaning words and phrases based on grades 9- 10 reading and content, choosing flexibly from a range of strategies.</p>	<p>4. Determine or clarify the meaning of unknown and multiple- meaning words and phrases based on grades 11- 12 reading and content, choosing flexibly from a range of strategies.</p>



## Language Standards 9 – 12

Grades 9-10 Students	Grades 11-12 Students
<p>a. Determine meanings of unfamiliar words by using knowledge of derivational roots and affixes, including cultural derivations (e.g., the root of photography and photosynthesis; kayak), context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence), dialectical English (e.g., Huck Finn), idiomatic expressions (e.g., "it drives me up a wall") as clues to the meaning of a word or phrase.</p> <p>b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., analyze, analysis, analytical; advocate, advocacy).</p> <p>c. Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, or its etymology.</p> <p>d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).</p>	<p>a. Determine meanings of unfamiliar words by using knowledge of derivational roots and affixes, including cultural derivations (e.g., the root of photography and photosynthesis; kayak), context (e.g., the overall meaning of a sentence, paragraph, or text; a word's position or function in a sentence), dialectical English (e.g., Huck Finn), idiomatic expressions (e.g., "it drives me up a wall") as clues to the meaning of a word or phrase.</p> <p>b. Identify and correctly use patterns of word changes that indicate different meanings or parts of speech (e.g., conceive, conception, conceivable).</p> <p>c. Consult general and specialized reference materials (e.g., dictionaries, glossaries, thesauruses), both print and digital, to find the pronunciation of a word or determine or clarify its precise meaning, its part of speech, its etymology, or its standard usage.</p> <p>d. Verify the preliminary determination of the meaning of a word or phrase (e.g., by checking the inferred meaning in context or in a dictionary).</p>
<p>5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.</p> <p>a. Interpret figures of speech (e.g., euphemism, oxymoron) in context and analyze their role in the text.</p> <p>b. Analyze nuances in the meaning of words with similar denotation (definition) or determine the meaning of analogies.</p>	<p>5. Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.</p> <p>a. Interpret figures of speech (e.g., hyperbole, paradox) in context and analyze their role in the text.</p> <p>b. Analyze nuances in the meaning of words with similar denotations (definition) or determine the meaning of analogies.</p>
<p>6. Acquire and use accurately general academic and domain- specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression</p>	<p>6. Acquire and use accurately general academic and domain- specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.</p>

## **Standards for Literacy in History/Social Studies 9-12**

The Alaska Reading Anchor Standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

<b>Grades 9-10 Students</b>	<b>Grades 11-12 Students</b>
<b>Key Ideas and Details</b>	
1. Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.	1. Cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole.
2. Determine the central ideas or information of a primary or secondary source; provide accurate summary of how key events or ideas develop over the course of the text.	2. Determine the central ideas or information of a primary or secondary source; provide accurate summary that makes clear the relationships among the key details and ideas.
3. Analyze in detail a series of events described in a text; determine whether earlier events caused later ones or simply preceded them.	3. Evaluate various explanations for actions or events and determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.
<b>Craft and Structure</b>	
4. Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history/social studies.	4. Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
5. Analyze how a text uses structure to emphasize key points or advance an explanation or analysis.	5. Analyze in detail how a complex primary source is structured, including how key sentences, paragraphs, and larger portions of the text contribute to the whole.
6. Compare the point of view of two or more authors for how they treat the same or similar topics, including which details they include and emphasize in their respective accounts.	6. Evaluate authors' differing points of view on the same historical event or issue by assessing the authors' claims, reasoning, and evidence.
<b>Integration of Knowledge and Ideas</b>	
7. Integrate quantitative or technical analysis (e.g., charts, research data) with qualitative analysis in print or digital texts.	7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, as well as in words) in order to address a question or solve a problem.
8. Assess the extent to which the reasoning and evidence in a text support the author's claim.	8. Evaluate an author's premises, claims, and evidence by corroborating or challenging them with other information.
9. Compare and contrast treatments of the same topic in several primary and secondary sources.	9. Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.
<b>Range of Reading and level of Text Complexity</b>	
10. By the end of grade 10, read and comprehend history/social studies texts in the grades 9- 10 text complexity band independently and proficiently.	10. By the end of grade 12, read and comprehend history/social studies texts in the grades 11- 12 text complexity band independently and proficiently

<b>Reading Standards for Literacy in Science and Technical Subjects 9 -12</b>	
<b>Grades 9-10 Students</b>	<b>Grades 11-12 Students</b>
<b>Key Ideas and Details</b>	
1. Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.	1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
2. Determine the central ideas or conclusions of a text; trace the text’s explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.	2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.	3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
<b>Craft and Structure</b>	
4. Determine the meaning of symbols, key terms, and other domain- specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9- 10 texts and topics.	4. Determine the meaning of symbols, key terms, and other domain- specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11- 12 texts and topics.
5. Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).	5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
6. Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.	6. Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
<b>Integration of Knowledge and Ideas</b>	
7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.	7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
8. Assess the extent to which the reasoning and evidence in a text support the author’s claim or a recommendation for solving a scientific or technical problem.	8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.	9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon or concept, resolving conflicting information when possible.
<b>Range of Reading and Level of Text Complexity</b>	
10. By the end of grade 10, read and comprehend science/ technical texts in the grades 9- 10 text complexity band independently and proficiently.	10. By the end of grade 12, read and comprehend science/ technical texts in the grades 11- 12 text complexity band independently and proficiently.

## **Writing Standards for Literacy in History/Social Studies, Science and Technical Subjects 9-12**

The standards below begin in grade 6; standards for K- 5 writing in history/social studies, science, and technical subjects are integrated into the K- 5 writing standards. The Alaska Writing Anchor Standards and high school standards in literacy work in tandem to define college and career readiness expectations – the former providing broad standards, the latter providing additional specificity.

<b>Grades 9-10 Students</b>	<b>Grades 11-12 Students</b>
<b>Text Types and Purposes</b>	
<p>1. Write arguments focused on discipline- specific content.</p> <p>a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among the claim(s), counterclaims, reasons, and evidence.</p> <p>b. Develop claim(s) and counterclaims fairly, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline appropriate form and in a manner that anticipates the audience’s knowledge level and concerns.</p> <p>c. Use words, phrases, and clauses to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons between reasons and evidence, and between claim(s) and counterclaims.</p> <p>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p>e. Provide a concluding statement or section that follows from and supports the argument presented.</p>	<p>1. Write arguments focused on discipline- specific content.</p> <p>a. Introduce precise claim(s), knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.</p> <p>b. Develop claim(s) and counterclaims fairly and thoroughly, supplying the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience’s knowledge level, concerns, values, and possible biases.</p> <p>c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons between reasons and evidence, and between claim(s) and counterclaims.</p> <p>d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.</p> <p>e. Provide a concluding statement or section that follows from and supports the argument presented.</p>
<p>2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes</p> <p>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information, using strategies such as definition, classification, comparison/contrast, and cause/effect; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.</p> <p>b. Develop the topic with well- chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.</p> <p>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among ideas and concepts.</p>	<p>2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.</p> <p>a. Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.</p> <p>b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience’s knowledge of the topic.</p> <p>c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.</p>

<b>Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects</b>	
<b>Grades 9-10 Students</b>	<b>Grades 11-12 Students</b>
d. Use precise language and domain- specific vocabulary to manage the complexity of the topic and convey a style appropriate to the discipline and context as well as to the expertise of likely readers.	d. Use precise language and domain- specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
e. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.	e. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).
f. Provide a concluding statement or section that follows from and supports the information or explanation presented (e.g., articulating implications or the significance of the topic).	
3. Not applicable as a separate requirement.	3. Not applicable as a separate requirement.
Note: Students’ narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and information/explanatory texts. In history/social studies, students must be able to incorporate narrative accounts into their analyses of individuals or events of historical import. In science and technical subjects, students must be able to write precise enough descriptions of the step- by- step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results.	
<b>Production and Distribution of Writing</b>	
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.	5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on what is most significant for a specific purpose and audience.
6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology’s capacity to link to other information and to display information flexibly and dynamically.	6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
<b>Research to Build and Present Knowledge</b>	
7. Conduct short as well as more sustained research projects to answer a question (including a self- generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	7. Conduct short as well as more sustained research projects to answer a question (including a self- generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.	8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
9. Draw evidence from informational texts to support analysis, reflection, and research.	9. Draw evidence from informational texts to support analysis, reflection, and research.
<b>Range of Writing</b>	
10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline- specific tasks, purposes, and audiences.	10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline- specific tasks, purposes, and audiences.

## **Glossary for English/Language Arts Standards**

### **author's purpose**

Purpose is the goal or objective the author is trying to accomplish; the intention or reason for writing a text; for example: to persuade, to entertain, to describe, to explain.

### **collegial**

Marked by camaraderie among colleagues.

### **domain- specific words and phrases**

Vocabulary specific to a particular field of study: analogous to tier- three words.

### **expository text**

Nonfiction, factual prose written to explain or convey information.

### **fallacious**

Embodying a fallacy.

### **figurative language**

Language that moves beyond the literal in which a figure of speech is used to heighten the meaning; for example: hyperbole, metaphor, personification, or simile.

### **general academic words and phrases**

Vocabulary common to written texts but not commonly a part of speech.

### **informational text**

Explanatory writing that serves one or more closely related purposes: to increase readers' knowledge of a subject, to help readers better understand a procedure or process, or to provide readers with an enhanced comprehension of a concept. Informational/explanatory writing conveys information accurately.

### **literary text**

This category is used to classify literary works, usually by form, technique, or content: novel, essay, short story, comedy, epic.

### **narrative writing**

Writing that conveys experience, either real or imaginary, and uses time as its deep structure. It can be used for many purposes: inform, instruct, persuade, or entertain. Narratives take many forms: creative fictional stories, memoirs, anecdotes, and autobiographies.

**persuasive writing**

The purpose is to convince the reader of an idea, to change the reader's mind, or to move the reader to action: letters to the editor, political pamphlets.

**register**

A variety of language used for a specific purpose or in a particular social setting; appropriate register depends upon the audience, purpose, topic, and location; for example: a different type of language may be used for speaking to friends than to teachers.

**scaffolding**

Temporary guidance or assistance provided to a student by a teacher, another adult, or a more capable peer, enabling the student to perform a task he or she otherwise would not be able to do alone, with the goal of fostering the student's capacity to perform the task independently.

**technical text**

Practical, accurate, and precise communication of specialized information that imparts facts, persuades with facts, or analyzes data or problems. The format is clear and efficient, often including headings, itemized lists with bullets, diagrams, or tables: instruction manual, scientific article, sales letter, letter of recommendation, proposal, or memo

# Alaska Mathematical Standards





**Adopted June 2012**



## The Standards for Mathematical Practice

These eight standards bring the complexities of the world into focus and give schema for grappling with authentic and meaningful problems. The practice standards define experiences that build understanding of mathematics and ways of thinking through which students develop, apply, and assess their knowledge.

Algorithmic knowledge is no longer sufficient when preparing our students to become globally competitive. The knowledge of good practitioners goes beyond algorithmic learning and allows them to picture the problem and the many roads that may lead to a solution. They realize that mathematics is applicable outside of the classroom and are confident in their ability to apply mathematical concepts to all aspects of life. The Standards of Mathematical Practice allow students to deepen their understandings of mathematical concepts and cultivates their autonomy as mathematically literate and informed citizens. Employing mathematics as a means of synthesizing complex concepts and making informed decisions is paramount to success in all post-secondary endeavors.

 Standards for Mathematical Practice 									
1. Make sense of problems and persevere in solving them 2. Reason abstractly and quantitatively 3. Construct viable arguments and critique the reasoning of others 4. Model with mathematics					5. Use appropriate tools strategically 6. Attend to precision 7. Look for and make use of structure 8. Look for and express regularity in repeated reasoning				
Kindergarten	1	2	3	4	5	6	7	8	High School

Instruction around the Standards for Mathematical Practices is delivered across all grades K-12. For each Standard for Mathematical Practice, there are grade-span descriptors that are meant to help students, parents and educators determine how these might be demonstrated by students. Implementing the practices to meet the descriptors will involve strengthening current teaching practices.

## **The Standards for Mathematical Content**

Each grade level in the K-8 standards is prefaced with an explanation of instructional focus areas for that grade level. Each conceptual category in the high school standards is prefaced with an explanation of the implication of that category to a student's mastery of mathematics. Specific modeling standards appear throughout the high school standards as indicated by an asterisk (\*).

Additional mathematic standards that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics are indicated by a plus symbol (+). The plus symbol indicates that the standard is not required for all students.

<b>K-8 Mathematical Domains:</b> <ol style="list-style-type: none"><li>1. Counting and Cardinality – CC</li><li>2. Operations and Algebraic Thinking – OA</li><li>3. Number and Operations in Base Ten – NBT</li><li>4. Measurement and Data – MD</li><li>5. Number and Operations – Fractions – NF</li><li>6. Geometry – G</li><li>7. Ratios and Proportional Relationships – RP</li><li>8. The Number System – NS</li><li>9. Expressions and Equations – EE</li><li>10. Functions – F</li><li>11. Statistics and Probability – SP</li></ol>	<b>High School Conceptual Categories:</b> <ol style="list-style-type: none"><li>1. Number and Quantity – N</li><li>2. Algebra – A</li><li>3. Functions – F</li><li>4. Modeling – M</li><li>5. Geometry – G</li><li>6. Statistics and Probability – P</li></ol>
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The standards for mathematics stress both conceptual understanding and procedural skills to ensure students learn and can apply the critical information needed to succeed at each level. This creates a learning progression where the mathematics learned in elementary school provides the foundation for the study of statistics, probability, ratio and proportion, geometry, and algebra in middle school. This is, in turn, the base upon which the knowledge needed for success in colleges and careers can be developed in high school.

The standards organization is not intended to convey the order of instruction nor the length of time to devote to the topics. In the standards, the clusters have been arranged in the grade span to show the continuum between grades. The following table outlines the progression of the content from kindergarten through high school.

		Standards for Mathematical Content							
Kindergarten	1	2	3	4	5	6	7	8	High School
Counting and Cardinality									Number & Operations
Number and Operations in Base Ten					Ratios and Proportional Relationships				
			Number and Operations - Fractions		Number System				
Operations and Algebraic Thinking					Expressions and Equations		Algebra		
							Functions	Functions	Conceptual Categories
Geometr								Geometry	
Measurement and Data					Statistics and Probability			Statistics and Probability	

**Domains** are large groups of related standards. Each shaded row shows how domains at the earlier grades progress and lead to conceptual categories at the high school levels. The right side of the chart lists the five **conceptual categories** for high school. Selecting one conceptual category and moving left along the row shows the domains at the middle and elementary school levels from which this concept builds. Modeling, the sixth conceptual category, is incorporated throughout the other five high school categories.

Overall, the progressions of the standards begin and end in different grades, avoiding the re-teaching of concepts that should have been mastered. This allows for higher rigor overall, which is key to laying the foundation for high school mathematics standards and college/career preparedness.

For each of the grade-spans (K-2, 3-5, 6-8, and 9-12) an overview of the topics to be covered follows.

## Overview of High School Mathematical Content Standards

Modeling	Number and Quantity	Algebra
<p>Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions.</p> <p>Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Specific modeling standards appear throughout the high school standards indicated by an asterisk (*).</p> <p>If the asterisk appears on the heading for a group of standards, it should be understood to apply to all standards in that group. There are other individual standards under clusters, domains and conceptual categories that have connections to modeling.</p> <p>Additionally, model with mathematics is a Standard for Mathematical Practice. This practice will be started in kindergarten.</p>	<p><b>The Real Number System</b></p> <ul style="list-style-type: none"> <li>Extend the properties of exponents to rational exponents.</li> <li>Use properties of rational and irrational numbers.</li> </ul> <p><b>Quantities*</b></p> <ul style="list-style-type: none"> <li>Reason quantitatively and use units to solve problems.</li> </ul> <p><b>The Complex Number System</b></p> <ul style="list-style-type: none"> <li>Perform arithmetic operations with complex numbers.</li> <li>Represent complex numbers and their operations on the complex plane. +</li> <li>Use complex numbers in polynomial identities and equations.</li> </ul> <p><b>Vector and Matrix Quantities</b></p> <ul style="list-style-type: none"> <li>Represent and model with vector quantities. +</li> <li>Perform operations on vectors. +</li> <li>Perform operations on matrices and use matrices in applications. +</li> </ul>	<p><b>Seeing Structure in Expressions</b></p> <ul style="list-style-type: none"> <li>Interpret the structure of expressions.</li> <li>Write expressions in equivalent forms to solve problems.*</li> </ul> <p><b>Arithmetic with Polynomials and Rational Expressions</b></p> <ul style="list-style-type: none"> <li>Perform arithmetic operations on polynomials.</li> <li>Understand the relationship between zeros and factors of polynomials.</li> <li>Use polynomial identities to solve problems.</li> <li>Rewrite rational expressions.</li> </ul> <p><b>Creating Equations and Inequalities*</b></p> <ul style="list-style-type: none"> <li>Create equations and inequalities that describe numbers or relationships.</li> </ul> <p><b>Reasoning with Equations and Inequalities</b></p> <ul style="list-style-type: none"> <li>Understand solving equations as a process of reasoning and explain the reasoning.</li> <li>Solve equations and inequalities in one variable.</li> <li>Solve systems of equations.</li> <li>Represent and solve equations and inequalities graphically.</li> </ul>

\*Standards with connections to modeling. If asterisk appears on the category, domain, or cluster for a group of standards, it should be understood to apply to all standards in that group. There may be individual standards within clusters with connections to modeling.

+ Standards include additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics.

Functions	Geometry	Statistics and Probability*
<b>Interpreting Functions</b> <ul style="list-style-type: none"> <li>Understand the concept of a function and use function notation.</li> <li>Interpret functions that arise in applications in terms of the context.</li> <li>Analyze functions using different representations.</li> </ul> <b>Building Functions</b> <ul style="list-style-type: none"> <li>Build a function that models a relationship between two quantities.</li> <li>Build new functions from existing functions.</li> </ul> <b>Linear, Quadratic, and Exponential Models*</b> <ul style="list-style-type: none"> <li>Construct and compare linear, quadratic, and exponential models and solve problems.</li> <li>Interpret expressions for functions in terms of the situation they model.</li> </ul> <b>Trigonometric Functions</b> <ul style="list-style-type: none"> <li>Extend the domain of trigonometric functions using the unit circle.</li> <li>Model periodic phenomena with trigonometric functions.</li> <li>Prove and apply trigonometric identities.</li> </ul>	<b>Congruence</b> <ul style="list-style-type: none"> <li>Experiment with transformations in the plane.</li> <li>Understand congruence in terms of rigid motions.</li> <li>Prove geometric theorems.</li> <li>Make geometric constructions.</li> </ul> <b>Similarity, Right Triangles, and Trigonometry</b> <ul style="list-style-type: none"> <li>Understand similarity in terms of similarity transformations.</li> <li>Prove theorems involving similarity.</li> <li>Define trigonometric ratios and solve problems involving right triangles.</li> <li>Apply trigonometry to general triangles. +</li> </ul> <b>Circles</b> <ul style="list-style-type: none"> <li>Understand and apply theorems about circles.</li> <li>Find arc lengths and areas of sectors of circles.</li> </ul> <b>Expressing Geometric Properties with Equations</b> <ul style="list-style-type: none"> <li>Translate between the geometric description and the equation for a conic section.</li> <li>Use coordinates to prove simple geometric theorems algebraically.</li> </ul> <b>Geometric Measurement and Dimension</b> <ul style="list-style-type: none"> <li>Explain volume formulas and use them to solve problems.</li> <li>Visualize relationships between two-dimensional and three-dimensional objects.</li> </ul> <b>Modeling with Geometry</b> <ul style="list-style-type: none"> <li>Apply geometric concepts in modeling situations.*</li> </ul>	<b>Interpreting Categorical and Quantitative Data</b> <ul style="list-style-type: none"> <li>Summarize, represent, and interpret data on a single count or measurement variable.</li> <li>Summarize, represent, and interpret data on two categorical and quantitative variables.</li> <li>Interpret linear models.</li> </ul> <b>Making Inferences and Justifying Conclusions</b> <ul style="list-style-type: none"> <li>Understand and evaluate random processes underlying statistical experiments.</li> <li>Make inferences and justify conclusions from sample surveys, experiments, and observational studies.</li> </ul> <b>Conditional Probability and the Rules of Probability</b> <ul style="list-style-type: none"> <li>Understand independence and conditional probability and use them to interpret data.</li> <li>Use the rules of probability to compute probabilities of compound events in a uniform probability model.</li> </ul> <b>Using Probability to Make Decisions</b> <ul style="list-style-type: none"> <li>Calculate expected values and use them to solve problems. +</li> <li>Use probability to evaluate outcomes of decisions. +</li> </ul>

\*Standards with connections to modeling. If the asterisk appears on the category, domain, or cluster for a group of standards, it should be understood to apply to all standards in that group. There may be individual standards within clusters with connections to modeling.

+ Standards include additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics.

## Guide to Reading the Mathematical Content Standards

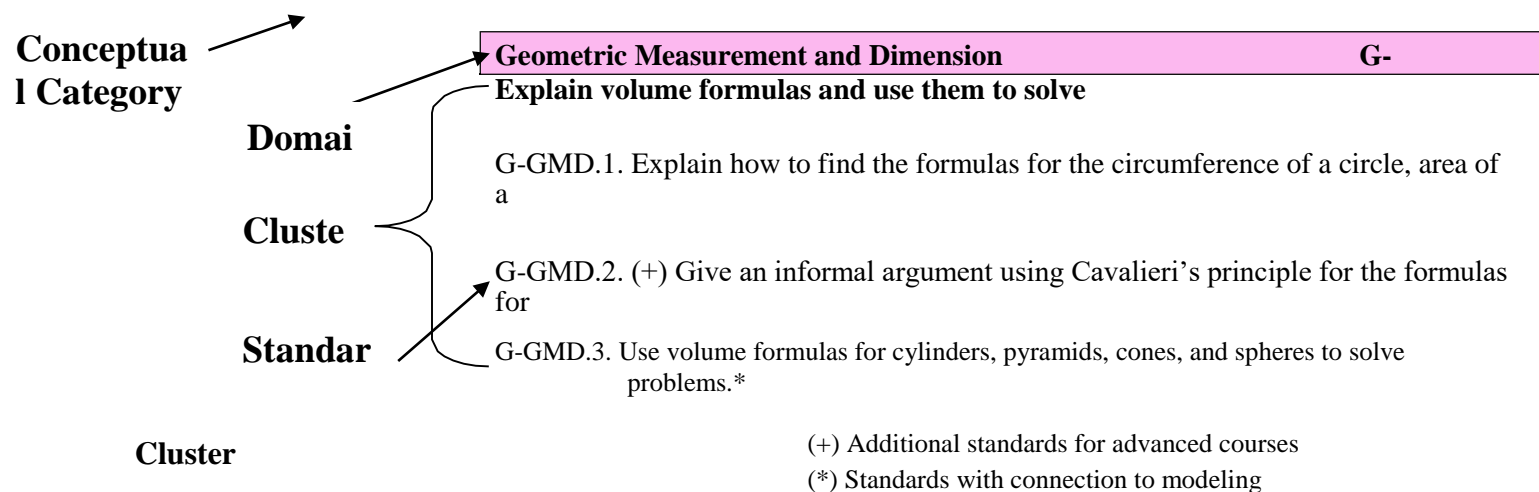
The high school standards specify the mathematics that all students should study in order to be career and college ready. They are organized into conceptual categories, which are intended to portray a coherent view of high school mathematics. A student's work with any set of standards crosses a number of traditional course boundaries. For example, the Functions Standards would apply to many courses such as Algebra I or Algebra II. It is a district decision how to design course offerings covering the mathematics standards. Districts can use the traditional approach of Algebra I, Geometry, and Algebra II or implement an integrated approach. There are various high school math pathways to be considered.

There are six conceptual categories for high school. Each conceptual category in the high school standards is prefaced with a narrative and an explanation of the implication of that category to a student's mastery of mathematics.

### High School Mathematical Conceptual Categories:

1. Number and Quantity - N
2. Algebra - A
3. Functions - F
4. Modeling - M
5. Geometry - G
6. Statistics and Probability - P

### Geometry Standards



## **Alaska Standards for Mathematical Practice**

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council’s report *Adding It Up*: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy).

- |  |  |
|--|--|
| 1. Make sense of problems and persevere in solving them            | 5. Use appropriate tools strategically                   |
| 2. Reason abstractly and quantitatively                            | 6. Attend to precision                                   |
| 3. Construct viable arguments and critique the reasoning of others | 7. Look for and make use of structure                    |
| 4. Model with mathematics  | 8. Look for and express regularity in repeated reasoning |

Each Standard for Mathematical Practice listed below is followed by a set of grade-span descriptors. These descriptors of the Standards of Mathematical Practice are meant to help students, parents and educators to picture how these practices might be demonstrated by students. Within the grade span, students should apply the practices using specific grade-level content. Additionally, students at higher grade spans may revisit earlier grade-span proficiencies as the rigor of the content increases.

### **Connecting the Standards for Mathematical Practice and Mathematical Content**

The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction. The Standards for Mathematical Content are a balanced combination of procedure and understanding. Expectations that begin with the word “understand” are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems, represent problems coherently, justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices. In this respect, those content standards which set an expectation of understanding are potential “points of intersection” between the Standards for Mathematical Content and the Standards for Mathematical Practice. These points of intersection are intended to be weighted toward central and generative concepts in the school mathematics curriculum that most merit the time, resources, innovative energies, and focus necessary to qualitatively improve the curriculum, instruction, assessment, professional development, and student achievement in mathematics.

## **1. Make sense of problems and persevere in solving them.**

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends.

Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

### **In grades 9-12 mathematically proficient students will:**

- make connections between a new problem and previous problems
- determine the question that needs to be answered
- choose a reasonable strategy
- identify the knowns and unknowns in a problem
- use previous knowledge and skills to simplify and solve problems
- break a problem into manageable parts or simpler problems
- represent algebraic expressions numerically, graphically, concretely/with manipulatives, verbally/written
- explain connections between the multiple representations
- solve a problem in more than one way
- explain the meaning of a problem and look for an entry point
- analyze a problem and make a plan for solving it
- explain correspondence between differing approaches to identify regularity and trends
- check answer using a different method
- identify correspondence between different approaches
- monitor and evaluate progress and change course if necessary
- check the answers to problems using a different method and continually ask, “Does this make sense?”



## **2. Reason abstractly and quantitatively.**

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to *decontextualize*—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to *contextualize*, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

### **In grades 9-12 mathematically proficient students will:**

- decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols.
- reflect during the manipulation process in order to probe into the meanings for the symbols involved
- create a coherent representation of the problem
- make sense of quantities and their relationships in problem situations
- attend to the meanings of quantities
- use flexibility with different properties of operations and objects
- translate an algebraic problem to a real-world context
- explain the relationship between the symbolic abstraction and the context of the problem
- compute using different properties
- consider the quantitative values, including units, for the numbers in a problem

### **3. Construct viable arguments and critique the reasoning of others.**

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

#### **In grades 9-12 mathematically proficient students will:**

- construct arguments using both concrete and abstract explanations
- justify conclusions in a variety of ways, communicate the methodology, and respond to the arguments
- reason inductively about data and make plausible arguments that take into account the context from which the data arose
- understand and use stated assumptions, definitions, and previously established results in constructing arguments
- make conjectures and build a logical progression of statements to explore the truth of the conjectures
- analyze situations by breaking them into cases and recognize and use counter-examples
- recognize general mathematical truths and statements to justify the conjectures
- identify special cases or counter-examples that don't follow the mathematical rules
- infer meaning from data and make arguments using its context
- compare effectiveness of two arguments by identifying and explaining both logical and/or flawed reasoning

## **4. Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

### **In grades 9-12 mathematically proficient students will:**

- apply mathematics to solve problems in everyday life, society, and workplace
- identify important quantities in a practical situation and map the relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- consistently interpret mathematical results in the context of the situation and reflect on whether the results make sense
- apply knowledge, making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later
- make assumptions and approximations to simplify a situation, realizing the final solution will need to be revised
- identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, and formulas
- analyze quantitative relationships to draw conclusions
- improve the model if it has not served its purpose

## **5. Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

### **In grades 9-12 mathematically proficient students will:**

- select and accurately use appropriate, available tools (such as pencil and paper, concrete or virtual manipulatives such as geoboards and algebra tiles, graphing and simpler calculators, a spreadsheet, and available technology) when solving a mathematical problem
- identify relevant external and digital mathematical resources and use the resources to pose or solve problems
- detect possible errors by strategically using estimation and other mathematical knowledge
- use technology to visualize the results of varying assumptions, exploring consequences, comparing predictions with data, and deepening understanding of concepts

## **6. Attend to precision.**

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

### **In grades 9-12 mathematically proficient students will:**

- communicate precisely to others
- use clear definitions in explanations
- use symbols consistently and appropriately
- specify units of measure, and label axes to clarify the correspondence with quantities in a problem

- calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context
- examine claims and make explicit use of definitions

## **7. Look for and make use of structure.**

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see  $7 \times 8$  equals the well remembered  $7 \times 5 + 7 \times 3$ , in preparation for learning about the distributive property. In the expression  $x^2 + 9x + 14$ , older students can see the 14 as  $2 \times 7$  and the 9 as  $2 + 7$ . They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see  $5 - 3(x - y)^2$  as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers  $x$  and  $y$ .

### **In all grade levels mathematically proficient students will:**

- discern a pattern or structure
- understand complex structures as single objects or as being composed of several objects
- check if the answer is reasonable

## **8. Look for and express regularity in repeated reasoning.**

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation  $(y - 2)/(x - 1) = 3$ . Noticing the regularity in the way terms cancel when expanding  $(x - 1)(x + 1)$ ,  $(x - 1)(x^2 + x + 1)$ , and  $(x - 1)(x^3 + x^2 + x + 1)$  might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

### **In all grade levels mathematically proficient students will:**

- identify if calculations or processes are repeated
- use alternative and traditional methods to solve problems
- evaluate the reasonableness of their intermediate results, while attending to the details



# **High School Mathematical Content Standards**

## **Courses and Transitions**

The high school standards specify the mathematics that all students should study in order to be career and college ready. They are organized into conceptual categories, which are intended to portray a coherent view of high school mathematics. A student's work with any set of standards crosses a number of traditional course boundaries. For example, the Functions Standards would apply to different courses such as Algebra I or Algebra II.

These standards do not mandate the sequence of high school courses. However, the organization of high school courses is a critical component to implementation of the standards. It is a district decision how to design course offerings covering the mathematics standards. Districts can use the traditional approach of Algebra I, Geometry, and Algebra II or implement an integrated approach. There are various high school math pathways to be considered and likely additional model pathways based on these standards will become available as well.

The standards themselves do not dictate curriculum, pedagogy, or delivery of content. In particular, districts may handle the transition to high school in different ways. For example, many students in the U.S. today take Algebra I in the 8th grade, and in some districts and states this is a requirement. By completing grade 7 standards successfully, students have met the prerequisites and are prepared for Algebra I by 8th grade. The standards are designed to permit districts and states to continue existing policies concerning Algebra I in 8th grade.

Another major transition is the transition from high school to post-secondary education for college and careers. The evidence concerning college and career readiness shows clearly that the knowledge, skills, and practices important for readiness include a great deal of mathematics prior to the boundary defined by (+) symbols in these standards. Indeed, some of the highest priority content for college and career readiness comes from grades 6-8. This body of material includes powerfully useful proficiencies such as applying ratio reasoning in real-world and mathematical problems, computing fluently with positive and negative fractions and decimals, and solving real-world and mathematical problems involving angle measure, area, surface area, and volume. Because important standards for college and career readiness are distributed across grades and courses, systems for evaluating college and career readiness should reach as far back in the standards as grades 6-8.

## Narrative of Standards – Modeling

Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.

A model can be very simple, such as writing total cost as a product of unit price and number bought, or using a geometric shape to describe a physical object like a coin. Even such simple models involve making choices. It is up to us whether to model a coin as a three-dimensional cylinder, or whether a two-dimensional disk works well enough for our purposes. Other situations—modeling a delivery route, a production schedule, or a comparison of loan amortizations—need more elaborate models that use other tools from the mathematical sciences. Real-world situations are not organized and labeled for analysis; formulating tractable models, representing such models, and analyzing them is appropriately a creative process. Like every such process, this depends on acquired expertise as well as creativity.

Some examples of such situations might include:

- Estimating how much water and food is needed for emergency relief in a devastated city of 3 million people, and how it might be distributed.
- Planning a table tennis tournament for 7 players at a club with 4 tables, where each player plays against each other player.
- Designing the layout of the stalls in a school fair so as to raise as much money as possible.
- Analyzing stopping distance for a car.
- Modeling savings account balance, bacterial colony growth, or investment growth.
- Engaging in critical path analysis, e.g., applied to turnaround of an aircraft at an airport.
- Analyzing risk in situations such as extreme sports, pandemics, and terrorism.
- Relating population statistics to individual predictions.



In situations like these, the models devised depend on a number of factors: How precise an answer do we want or need? What aspects of the situation do we most need to understand, control, or optimize? What resources of time and tools do we have? The range of models that we can create and analyze is also constrained by the limitations of our mathematical, statistical, and technical skills, and our ability to recognize significant variables and relationships among them. Diagrams of various kinds, spreadsheets and other technology, and algebra are powerful tools for understanding and solving problems drawn from different types of real-world situations.

One of the insights provided by mathematical modeling is that essentially the same mathematical or statistical structure can sometimes model seemingly different situations. Models can also shed light on the mathematical structures themselves, for example, as when a model of bacterial growth makes more vivid the explosive growth of the exponential function.

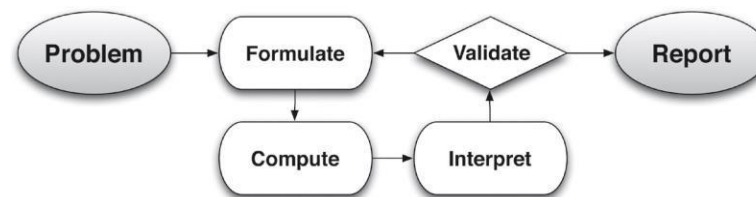
The basic modeling cycle is summarized in the diagram below. It involves (1) identifying variables in the situation and selecting those that represent essential features, (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables, (3) analyzing and performing operations on these relationships to draw conclusions, (4) interpreting the results of the mathematics in terms of the original situation, (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it is acceptable, (6) reporting on the conclusions and the reasoning behind them. Choices, assumptions, and approximations are present throughout this cycle.

In descriptive modeling, a model simply describes the phenomena or summarizes them in a compact form. Graphs of observations are a familiar descriptive model—for example, graphs of global temperature and atmospheric CO<sub>2</sub> over time.

Analytic modeling seeks to explain data on the basis of deeper theoretical ideas, albeit with parameters that are empirically based; for example, exponential growth of bacterial colonies (until cut-off mechanisms such as pollution or starvation intervene) follows from a constant reproduction rate. Functions are an important tool for analyzing such problems.

Graphing utilities, spreadsheets, computer algebra systems, and dynamic geometry software are powerful tools that can be used to model purely mathematical phenomena (e.g., the behavior of polynomials) as well as physical phenomena.

**Modeling Standards.** Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by an asterisk (\*).



## Narrative of Standards - Number and Quantity

**Numbers and Number Systems.** During the years from kindergarten to 8th grade, students must repeatedly extend their conception of number. At first, “number” means “counting number”: 1, 2, 3... . Soon after that, 0 is used to represent “none” and the whole numbers are formed by the counting numbers together with zero. The next extension is fractions. At first, fractions are barely numbers and tied strongly to pictorial representations. Yet by the time students understand division of fractions, they have a strong concept of fractions as numbers and have connected them, via their decimal representations, with the base-ten system used to represent the whole numbers. During middle school, fractions are augmented by negative fractions to form the rational numbers. In Grade 8, students extend this system once more, augmenting the rational numbers with the irrational numbers to form the real numbers. In high school, students will be exposed to yet another extension of number, when the real numbers are augmented by the imaginary numbers to form the complex numbers.

With each extension of number, the meanings of addition, subtraction, multiplication, and division are extended. In each new number system— integers, rational numbers, real numbers, and complex numbers—the four operations stay the same in two important ways: They have the commutative, associative, and distributive properties and their new meanings are consistent with their previous meanings.

Extending the properties of whole-number exponents leads to new and productive notation. For example, properties of whole-number exponents suggest that  $(5^{1/3})^3$  should be  $5^{(1/3)3} = 5^1 = 5$  and that  $5^{1/3}$  should be the cube root of 5.

Calculators, spreadsheets, and computer algebra systems can provide ways for students to become better acquainted with these new number systems and their notation. They can be used to generate data for numerical experiments, to help understand the workings of matrix, vector, and complex number algebra, and to experiment with non-integer exponents.

**Quantities.** In real-world problems, the answers are usually not numbers but quantities: numbers with units, which involves measurement. In their work in measurement up through grade 8, students primarily measure commonly used attributes such as length, area, and volume. In high school, students encounter a wider variety of units in modeling, e.g., acceleration, currency conversions, derived quantities such as person-hours and heating degree days, social science rates such as per-capita income, and rates in everyday life such as points scored per game or batting averages. They also encounter novel situations in which they themselves must conceive the attributes of interest. For example, to find a good measure of overall highway safety, they might propose measures such as fatalities per year, fatalities per year per driver, or fatalities per vehicle- mile traveled. Such a conceptual process is sometimes called quantification. Quantification is important for science, as when surface area suddenly “stands out” as an important variable in evaporation. Quantification is also important for companies, which must conceptualize relevant attributes and create or choose suitable measures for them.

## Number and Quantity Standards

### The Real Number System

N – RN

#### Extend the properties of exponents to rational exponents.

N-RN.1. Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define  $5^{1/3}$  to be the cube root of 5 because we want  $(5^{1/3})^3 = 5^{(1/3)^3}$  to hold, so  $(5^{1/3})^3$  must equal 5.*

N-RN.2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. *For example: Write equivalent representations that utilize both positive and negative exponents.*

#### Use properties of rational and irrational numbers.

N-RN.3. Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

### Quantities\*

N – Q

#### Reason quantitatively and use units to solve problems.

N-Q.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N-Q.2. Define appropriate quantities for the purpose of descriptive modeling.

N-Q.3. Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

## The Complex Number System

N - CN

### Perform arithmetic operations with complex numbers.

N-CN.1. Know there is a complex number  $i$  such that  $i^2 = -1$ , and every complex number has the form  $a + bi$  with  $a$  and  $b$  real.

N-CN.2. Use the relation  $i^2 = -1$  and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. N-CN.3. (+)

Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.

### Represent complex numbers and their operations on the complex plane.

N-CN.4. (+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.

N-CN.5. (+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. *For example,  $(1 - \sqrt{3}i)^3 = 8$  because  $(1 - \sqrt{3}i)$  has modulus 2 and argument  $120^\circ$ .*

N-CN.6. (+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.

### Use complex numbers in polynomial identities and equations.

N-CN.7. Solve quadratic equations with real coefficients that have complex solutions.

N-CN.8. (+) Extend polynomial identities to the complex numbers. *For example, rewrite  $x^2 + 4$  as  $(x + 2i)(x -$*

$2i)$ . N-CN.9. (+) Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

## Vector and Matrix Quantities

N – VM

### Represent and model with vector quantities.

N-VM.1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g.,  $\mathbf{v}$ ,  $|\mathbf{v}|$ ,  $\|\mathbf{v}\|$ ,  $v$ ).

N-VM.2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. N-VM.3. (+)

Solve problems involving velocity and other quantities that can be represented by vectors.

## Perform operations on vectors.

N-VM.4. (+) Add and subtract vectors.

- a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.
- b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.
- c. Understand vector subtraction  $\mathbf{v} - \mathbf{w}$  as  $\mathbf{v} + (-\mathbf{w})$ , where  $-\mathbf{w}$  is the additive inverse of  $\mathbf{w}$ , with the same magnitude as  $\mathbf{w}$  and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

N-VM.5. (+) Multiply a vector by a scalar.

- a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as  $c(v_x, v_y) = (cv_x, cv_y)$ .
- b. Compute the magnitude of a scalar multiple  $c\mathbf{v}$  using  $\|c\mathbf{v}\| = |c|\mathbf{v}$ . Compute the direction of  $c\mathbf{v}$  knowing that when  $|c|\mathbf{v} \neq 0$ , the direction of  $c\mathbf{v}$  is either along  $\mathbf{v}$  (for  $c > 0$ ) or against  $\mathbf{v}$  (for  $c < 0$ ).

## Perform operations on matrices and use matrices in applications.

N-VM.6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. N-VM.7. (+)

Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.

N-VM.8. (+) Add, subtract, and multiply matrices of appropriate dimensions.

N-VM.9. (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.

N-VM.10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

N-VM.11. (+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.

N-VM.12. (+) Work with  $2 \times 2$  matrices as a transformations of the plane, and interpret the absolute value of the determinant in terms of area.

## Narrative of Standards - Algebra

**Expressions.** An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances.

Reading an expression with comprehension involves analysis of its underlying structure. This may suggest a different but equivalent way of writing the expression that exhibits some different aspect of its meaning. For example,  $p + 0.05p$  can be interpreted as the addition of a 5% tax to a price  $p$ . Rewriting  $p + 0.05p$  as  $1.05p$  shows that adding a tax is the same as multiplying the price by a constant factor.

Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example,  $p + 0.05p$  is the sum of the simpler expressions  $p$  and  $0.05p$ . Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure.

A spreadsheet or a computer algebra system (CAS) can be used to experiment with algebraic expressions, perform complicated algebraic manipulations, and understand how algebraic manipulations behave.

**Equations and Inequalities.** An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form.

The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system.

An equation can often be solved by successively deducing from it one or more simpler equations. For example, one can add the same constant to both sides without changing the solutions, but squaring both sides might lead to extraneous solutions. Strategic competence in solving includes looking ahead for productive manipulations and anticipating the nature and number of solutions.

Some equations have no solutions in a given number system, but have a solution in a larger system. For example, the solution of  $x + 1 = 0$  is an integer, not a whole number; the solution of  $2x + 1 = 0$  is a rational number, not an integer; the solutions of  $x^2 - 2 = 0$  are real numbers, not rational numbers; and the solutions of  $x^2 + 2 = 0$  are complex numbers, not real numbers.

The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid,  $A = ((b_1 + b_2)/2)h$ , can be solved for  $h$  using the same deductive process.

Inequalities can be solved by reasoning about the properties of inequality. Many, but not all, of the properties of equality continue to hold for inequalities and can be useful in solving them.

**Connections to Functions and Modeling.** Expressions can define functions, and equivalent expressions define the same function. Asking when two functions have the same value for the same input leads to an equation; graphing the two functions allows for finding approximate solutions of the equation. Converting a verbal description to an equation, inequality, or system of these is an essential skill in modeling.

## Algebra Standards

### Seeing Structure in Expressions

A - SSE

#### Interpret the structure of expressions.

A-SSE.1. Interpret expressions that represent a quantity in terms of its context.\*

a. Interpret parts of an expression, such as terms, factors, and coefficients.

b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret  $P(1+r)^n$  as the product of  $P$  and a factor not depending on  $P$ .*

A-SSE.2. Use the structure of an expression to identify ways to rewrite it. *For example, see  $x^4 - y^4$  as  $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as  $(x^2 - y^2)(x^2 + y^2)$ .*

#### Write expressions in equivalent forms to solve problems.

A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.\*

a. Factor a quadratic expression to reveal the zeros of the function it defines. *For example,  $x^2 + 4x + 3 = (x + 3)(x + 1)$ .*

b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. *For example,  $x^2 + 4x + 3 = (x + 2)^2 - 1$ .*

- c. Use the properties of exponents to transform expressions for exponential functions. *For example the expression  $1.15^t$  can be rewritten as  $(1.15^{1/12})^{12t} \approx 1.012^{12t}$  to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.*

A-SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems.  
*For example, calculate mortgage payments.\**

## Arithmetic with Polynomials and Rational Expressions

A - APR

### Perform arithmetic operations on polynomials.

A-APR.1. Add, subtract, and multiply polynomials. Understand that polynomials form a system similar to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication.

### Understand the relationship between zeros and factors of polynomials.

A-APR.2. Know and apply the Remainder Theorem: For a polynomial  $p(x)$  and a number  $a$ , the remainder on division by  $x - a$  is  $p(a)$ , so  $p(a) = 0$  if and only if  $(x - a)$  is a factor of  $p(x)$ .

A-APR.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

### Use polynomial identities to solve problems.

A-APR.4. Prove polynomial identities and use them to describe numerical relationships.

*For example, the polynomial identity  $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$  can be used to generate Pythagorean triples.*

A-APR.5. (+) Know and apply the Binomial Theorem for the expansion of  $(x + y)^n$  in powers of  $x$  and  $y$  for a positive integer  $n$ , where  $x$  and  $y$  are any numbers, with coefficients determined for example by Pascal's Triangle.

### Rewrite rational expressions.

A-APR.6. Rewrite simple rational expressions in different forms; write  $a(x)/b(x)$  in the form  $q(x) + r(x)/b(x)$ , where  $a(x)$ ,  $b(x)$ ,  $q(x)$ , and  $r(x)$  are polynomials with the degree of  $r(x)$  less than the degree of  $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.

A-APR.7. (+) Add, subtract, multiply, and divide rational expressions. Understand that rational expressions form a system similar to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression.



**Creating Equations and Inequalities\*****A –****Create equations and inequalities that describe numbers or relationships.**

A-CED.1. Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*

A-CED.2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

A-CED.3. Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing cost constraints in various situations.*

A-CED.4. Rearrange formulas (literal equations) to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law  $V = IR$  to highlight resistance  $R$ .*

**Reasoning with Equations and Inequalities****A – REI****Understand solving equations as a process of reasoning and explain the reasoning.**

A-REI.1. Apply properties of mathematics to justify steps in solving equations in one variable.

A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

**Solve equations and inequalities in one variable.**

A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A-REI.4. Solve quadratic equations in one variable.

- Use the method of completing the square to transform any quadratic equation in  $x$  into an equation of the form  $(x - p)^2 = q$  that has the same solutions. Derive the quadratic formula from this form.
- Solve quadratic equations by inspection (e.g., for  $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as  $a \pm bi$  for real numbers  $a$  and  $b$ .

## **Solve systems of equations.**

A-REI.5. Show that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A-REI.6. Solve systems of linear equations exactly and approximately, e.g., with graphs or algebraically, focusing on pairs of linear equations in two variables.

A-REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

*For example, find the points of intersection between the line  $y = -3x$  and the circle  $x^2 + y^2 = 3$ .*

A-REI.8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.

A-REI.9. (+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension  $3 \times 3$  or greater).

## **Represent and solve equations and inequalities graphically.**

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A-REI.11. Explain why the  $x$ -coordinates of the points where the graphs of the equations  $y = f(x)$  and  $y = g(x)$  intersect are the solutions of the equation  $f(x) = g(x)$ ; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where  $f(x)$  and/or  $g(x)$  are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.\*

A-REI.12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

## **Narrative of Standards - Functions**

**Functions.** describe situations where one quantity determines another. For example, the return on \$10,000 invested at an annualized percentage rate of 4.25% is a function of the length of time the money is invested. Because we continually make theories about dependencies between quantities in nature and society, functions are important tools in the construction of mathematical models.

In school mathematics, functions usually have numerical inputs and outputs and are often defined by an algebraic expression. For example, the time in hours it takes for a car to drive 100 miles is a function of the car's speed in miles per hour,  $v$ ; the rule  $T(v) = 100/v$  expresses this relationship algebraically and defines a function whose name is  $T$ .

The set of inputs to a function is called its domain. We often infer the domain to be all inputs for which the expression defining a function has a value, or for which the function makes sense in a given context.

A function can be described in various ways, such as by a graph (e.g., the trace of a seismograph); by a verbal rule, as in, "I'll give you a state, you give me the capital city;" by an algebraic expression like  $f(x) = a + bx$ ; or by a recursive rule. The graph of a function is often a useful way of visualizing the relationship of the function models, and manipulating a mathematical expression for a function can throw light on the function's properties.

Functions presented as expressions can model many important phenomena. Two important families of functions characterized by laws of growth are linear functions, which grow at a constant rate, and exponential functions, which grow at a constant percent rate. Linear functions with a constant term of zero describe proportional relationships.

A graphing utility or a computer algebra system can be used to experiment with properties of these functions and their graphs and to build computational models of functions, including recursively defined functions.

**Connections to Expressions, Equations, Modeling, and Coordinates.** Determining an output value for a particular input involves evaluating an expression; finding inputs that yield a given output involves solving an equation. Questions about when two functions have the same value for the same input lead to equations, whose solutions can be visualized from the intersection of their graphs. Because functions describe relationships between quantities, they are frequently used in modeling. Sometimes functions are defined by a recursive process, which can be displayed effectively using a spreadsheet or other technology.

## Functions Standards

### Interpreting Functions

### F - IF

#### Understand the concept of a function and use function notation.

F-IF.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If  $f$  is a function and  $x$  is an element of its domain, then  $f(x)$  denotes the output of  $f$  corresponding to the input  $x$ . The graph of  $f$  is the graph of the equation  $y = f(x)$ .

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by  $f(0) = f(1) = 1$ ,  $f(n + 1) = f(n) + f(n - 1)$  for  $n \geq 1$ .*

#### Interpret functions that arise in applications in terms of the context.

F-IF.4. For a function that models a relationship between two quantities,

- interpret key features of graphs and tables in terms of the quantities, and
- sketch graphs showing key features given a verbal description of the relationship.

*Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.\**

F-IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then negative numbers would be an inappropriate domain for the function.\**

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.\*

#### Analyze functions using different representations.

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.\*

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

- b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
- c. Graph polynomial functions, identifying zeros (using technology) or algebraic methods when suitable factorizations are available, and showing end behavior.
- d.(+) Graph rational functions, identifying zeros and discontinuities (asymptotes/holes) using technology, and algebraic methods when suitable factorizations are available, and showing end behavior.
- e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

- a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
- b. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{12t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically, in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

## Building Functions

**F - BF**

### Build a function that models a relationship between two quantities.

F-BF.1. Write a function that describes a relationship between two quantities.\*

- a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
- b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- c. (+) Compose functions. *For example, if  $T(y)$  is the temperature in the atmosphere as a function of height, and  $h(t)$  is the height of a weather balloon as a function of time, then  $T(h(t))$  is the temperature at the location of the weather balloon as a function of time.*

F-BF.2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.\*

### Build new functions from existing functions.

F-BF.3. Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. *Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.*

F-BF.4. Find inverse functions.

a. Solve an equation of the form  $f(x) = c$  for a simple function  $f$  that has an inverse and write an expression for the inverse.  
*For example,  $f(x) = 2x^3$  for  $x > 0$  or  $f(x) = (x + 1)/(x - 1)$  for  $x \neq 1$ .*

b. (+) Verify by composition that one function is the inverse of another.

c. (+) Read values of an inverse function from a graph or a table, given that the function has an inverse.

d. (+) Produce an invertible function from a non-invertible function by restricting the domain.

F-BF.5. (+) Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

## Linear, Quadratic, and Exponential Models\*

F – LE

### Construct and compare linear, quadratic, and exponential models and solve problems.

F-LE.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

- a. Show that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
- b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
- c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F-LE.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or input-output table of values.

F-LE.3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

F-LE.4. For exponential models, express as a logarithm the solution to  $ab^{ct} = d$  where  $a$ ,  $c$ , and  $d$  are numbers and the base  $b$  is 2, 10, or  $e$ ; evaluate the logarithm using technology.

### **Interpret expressions for functions in terms of the situation they model.**

F-LE.5. Interpret the parameters in a linear or exponential function in terms of a context.

## **Trigonometric Functions**

**F - TF**

### **Extend the domain of trigonometric functions using the unit circle.**

F-TF.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

F-TF.2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

F-TF.3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for  $\pi/3$ ,  $\pi/4$  and  $\pi/6$ , and use the unit circle to express the values of sine, cosines, and tangent for  $\pi-x$ ,  $\pi+x$ , and  $2\pi-x$  in terms of their values for  $x$ , where  $x$  is any real number.

F-TF.4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

### **Model periodic phenomena with trigonometric functions.**

F-TF.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.\*

F-TF.6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

F-TF.7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.\*

### **Prove and apply trigonometric identities.**

F-TF.8. Prove the Pythagorean identity  $\sin^2(\theta) + \cos^2(\theta) = 1$  and use it to calculate trigonometric ratios.

F-TF.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

## **Narrative of Standards - Geometry**

An understanding of the attributes and relationships of geometric objects can be applied in diverse contexts—interpreting a schematic drawing, estimating the amount of wood needed to frame a sloping roof, rendering computer graphics, or designing a sewing pattern for the most efficient use of material.

Although there are many types of geometry, school mathematics is devoted primarily to plane Euclidean geometry, studied both synthetically (without coordinates) and analytically (with coordinates). Euclidean geometry is characterized most importantly by the Parallel Postulate, that through a point not on a given line there is exactly one parallel line. (Spherical geometry, in contrast, has no parallel lines.)

During high school, students begin to formalize their geometry experiences from elementary and middle school, using more precise definitions and developing careful proofs. Later in college some students develop Euclidean and other geometries carefully from a small set of axioms.

The concepts of congruence, similarity, and symmetry can be understood from the perspective of geometric transformation. Fundamental are the rigid motions: translations, rotations, reflections, and combinations of these, all of which are here assumed to preserve distance and angles (and therefore shapes generally). Reflections and rotations each explain a particular type of symmetry, and the symmetries of an object offer insight into its attributes—as when the reflective symmetry of an isosceles triangle assures that its base angles are congruent.

In the approach taken here, two geometric figures are defined to be congruent if there is a sequence of rigid motions that carries one onto the other. This is the principle of superposition. For triangles, congruence means the equality of all corresponding pairs of sides and all corresponding pairs of angles. During the middle grades, through experiences drawing triangles from given conditions, students notice ways to specify enough measures in a triangle to ensure that all triangles drawn with those measures are congruent. Once these triangle congruence criteria (ASA, SAS, and SSS) are established using rigid motions, they can be used to prove theorems about triangles, quadrilaterals, and other geometric figures.

Similarity transformations (rigid motions followed by dilations) define similarity in the same way that rigid motions define congruence, thereby formalizing the similarity ideas of "same shape" and "scale factor" developed in the middle grades. These transformations lead to the criterion for triangle similarity that two pairs of corresponding angles are congruent.

The definitions of sine, cosine, and tangent for acute angles are founded on right triangles and similarity, and, with the Pythagorean Theorem, are fundamental in many real-world and theoretical situations. The Pythagorean Theorem is generalized to nonright triangles by the Law of Cosines. Together, the Laws of Sines and Cosines embody the triangle congruence criteria for the cases where three pieces of information suffice to completely solve a triangle. Furthermore, these laws yield two possible solutions in the ambiguous case, illustrating that Side-Side-Angle is not a congruence criterion.



Analytic geometry connects algebra and geometry, resulting in powerful methods of analysis and problem solving. Just as the number line associates numbers with locations in one dimension, a pair of perpendicular axes associates pairs of numbers with locations in two dimensions. This correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof. Geometric transformations of the graphs of equations correspond to algebraic changes in their equations.

Dynamic geometry environments provide students with experimental and modeling tools that allow them to investigate geometric phenomena in much the same way as computer algebra systems allow them to experiment with algebraic phenomena.

**Connections to Equations.** The correspondence between numerical coordinates and geometric points allows methods from algebra to be applied to geometry and vice versa. The solution set of an equation becomes a geometric curve, making visualization a tool for doing and understanding algebra. Geometric shapes can be described by equations, making algebraic manipulation into a tool for geometric understanding, modeling, and proof.

## **Geometry Standards**

### **Congruence**

### **G - CO**

#### **Experiment with transformations in the plane.**

- G-CO.1. Demonstrates understanding of key geometrical definitions, including angle, circle, perpendicular line, parallel line, line segment, and transformations in Euclidian geometry. Understand undefined notions of point, line, distance along a line, and distance around a circular arc.
- G-CO.2. Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).
- G-CO.3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.
- G-CO.4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.
- G-CO.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.

#### **Understand congruence in terms of rigid motions.**

- G-CO.6. Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two

figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.

G-CO.7. Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.

G-CO.8. Explain how the criteria for triangle congruence (ASA, SAS, SSS, AAS, and HL) follow from the definition of congruence in terms of rigid motions.

### **Prove geometric theorems.**

G-CO.9. Using methods of proof including direct, indirect, and counter examples to prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.

G-CO.10. Using methods of proof including direct, indirect, and counter examples to prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to  $180^\circ$ ; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.

G-CO.11. Using methods of proof including direct, indirect, and counter examples to prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.

### **Make geometric constructions.**

G-CO.12. Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.

G-CO.13. Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

## **Similarity, Right Triangles, and Trigonometry**

**G - SRT**

### **Understand similarity in terms of similarity transformations.**

G-S RT.1. Verify experimentally the properties of dilations given by a center and a scale factor:

- a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.

b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.

G-SRT.2. Given two figures, use the definition of similarity in terms of transformations to explain whether or not they are similar. G-SRT.3.

Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.

### **Prove theorems involving similarity.**

G-SRT.4. Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely.*

G-SRT.5. Apply congruence and similarity properties and prove relationships involving triangles and other geometric figures.

### **Define trigonometric ratios and solve problems involving right triangles.**

G-SRT.6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

G-SRT.7. Explain and use the relationship between the sine and cosine of complementary angles.

G-SRT.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.\*

### **Apply trigonometry to general triangles.**

G-SRT.9. (+) Derive the formula  $A = 1/2 ab \sin(C)$  for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

G-SRT.10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.

G-SRT.11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

## **Circles**

**G - C**

### **Understand and apply theorems about circles.**

G-C.1. Prove that all circles are similar.

G-C.2. Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.*

G-C.3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle. G-C.4. (+)

Construct a tangent line from a point outside a given circle to the circle.

### **Find arc lengths and areas of sectors of circles.**

G-C.5. Use and apply the concepts of arc length and areas of sectors of circles. Determine or derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.

## **Expressing Geometric Properties with Equations**

**G -**

### **Translate between the geometric description and the equation for a conic section.**

G-GPE.1. Determine or derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.

G-GPE.2. Determine or derive the equation of a parabola given a focus and directrix. G-GPE.3.

(+) Derive the equations of ellipses and hyperbolas given foci and directrices.

### **Use coordinates to prove simple geometric theorems algebraically.**

G-GPE.4. Perform simple coordinate proofs. For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point  $(1, \sqrt{3})$  lies on the circle centered at the origin and containing the point  $(0, 2)$ .

G-GPE.5. Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point).

G-GPE.6. Find the point on a directed line segment between two given points that partitions the segment in a given ratio.

G-GPE.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.\*

## Geometric Measurement and Dimension

G - GMD

### Explain volume formulas and use them to solve problems.

G-GMD.1. Explain how to find the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.

G-GMD.2. (+) Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures.

G-GMD.3. Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems. *For example: Solve problems requiring determination of a dimension not given.\**

### Visualize relationships between two-dimensional and three-dimensional objects.

G-GMD.4. Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.

## Modeling with Geometry

G - MG

### Apply geometric concepts in modeling situations.

G-MG.1. Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).\*

G-MG.2. Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).\*

G-M G.3. Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).\*

## **Narrative of Standards - Statistics and Probability\***

Decisions or predictions are often based on data—numbers in context. These decisions or predictions would be easy if the data always sent a clear message, but the message is often obscured by variability. Statistics provides tools for describing variability in data and for making informed decisions that take it into account.

Data are gathered, displayed, summarized, examined, and interpreted to discover patterns and deviations from patterns. Quantitative data can be described in terms of key characteristics: measures of shape, center, and spread. The shape of a data distribution might be described as symmetric, skewed, flat, or bell shaped, and it might be summarized by a statistic measuring center (such as mean or median) and a statistic measuring spread (such as standard deviation or interquartile range). Different distributions can be compared numerically using these statistics or compared visually using plots. Knowledge of center and spread are not enough to describe a distribution. Which statistics to compare, which plots to use, and what the results of a comparison might mean, depend on the question to be investigated and the real-life actions to be taken.

Randomization has two important uses in drawing statistical conclusions. First, collecting data from a random sample of a population makes it possible to draw valid conclusions about the whole population, taking variability into account. Second, randomly assigning individuals to different treatments allows a fair comparison of the effectiveness of those treatments. A statistically significant outcome is one that is unlikely to be due to chance alone, and this can be evaluated only under the condition of randomness. The conditions under which data are collected are important in drawing conclusions from the data; in critically reviewing uses of statistics in public media and other reports, it is important to consider the study design, how the data were gathered, and the analyses employed as well as the data summaries and the conclusions drawn.

Random processes can be described mathematically by using a probability model: a list or description of the possible outcomes (the sample space), each of which is assigned a probability. In situations such as flipping a coin, rolling a number cube, or drawing a card, it might be reasonable to assume various outcomes are equally likely. In a probability model, sample points represent outcomes and combine to make up events; probabilities of events can be computed by applying the Addition and Multiplication Rules. Interpreting these probabilities relies on an understanding of independence and conditional probability, which can be approached through the analysis of two-way tables.

Technology plays an important role in statistics and probability by making it possible to generate plots, regression functions, and correlation coefficients, and to simulate many possible outcomes in a short amount of time.

**Connections to Functions and Modeling.** Functions may be used to describe data; if the data suggest a linear relationship, the relationship can be modeled with a regression line, and its strength and direction can be expressed through a correlation coefficient.

## **Statistics and Probability Standards\***

### **Interpreting Categorical and Quantitative Data**

**S - ID**

#### **Summarize, represent, and interpret data on a single count or measurement variable.**

S-ID.1. Represent data with plots on the real number line (dot plots, histograms, and box plots).

S-ID.2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

S-ID.3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).  
*For example: Justify why median price of homes or income is used instead of the mean.*

S-ID.4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.

#### **Summarize, represent, and interpret data on two categorical and quantitative variables.**

S-ID.5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

S-ID.6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

*a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models.*

*b. Informally assess the fit of a function by plotting and analyzing residuals. For example: Describe solutions to problems that require interpolation and extrapolation.*

*c. Fit a linear function for a scatter plot that suggests a linear association.*

#### **Interpret linear models.**

S-ID.7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. S-ID.8.

Compute (using technology) and interpret the correlation coefficient of a linear fit.

S-ID.9. Distinguish between correlation and causation.

## Making Inferences and Justifying Conclusions

S - IC

### Understand and evaluate random processes underlying statistical experiments.

- S-IC.1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
- S-IC.2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. *For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*

### Make inferences and justify conclusions from sample surveys, experiments, and observational studies.

- S-IC.3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
- S-IC.4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
- S-IC.5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.
- S-IC.6. Evaluate reports based on data.

## Conditional Probability and the Rules of Probability

S - CP

### Understand independence and conditional probability and use them to interpret data.

- S-CP.1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).
- S-CP.2. Understand that two events  $A$  and  $B$  are independent if the probability of  $A$  and  $B$  occurring together is the product of their probabilities, and use this characterization to determine if they are independent.
- S-CP.3. Understand the conditional probability of  $A$  given  $B$  as  $P(A \text{ and } B)/P(B)$ , and interpret independence of  $A$  and  $B$  as saying that the conditional probability of  $A$  given  $B$  is the same as the probability of  $A$ , and the conditional probability of  $B$  given  $A$  is the same as the probability of  $B$ .
- S-CP.4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect*



*data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in 10th grade. Do the same for other subjects and compare the results.*

- S-CP.5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.*

**Use the rules of probability to compute probabilities of compound events in a uniform probability model.**

- S-CP.6. Find the conditional probability of  $A$  given  $B$  as the fraction of  $B$ 's outcomes that also belong to  $A$ , and interpret the answer in terms of the model.
- S-CP.7. Apply the Addition Rule,  $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model.
- S-CP.8. (+) Apply the general Multiplication Rule in a uniform probability model,  $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$ , and interpret the answer in terms of the model.
- S-CP.9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems.

**Using Probability to Make Decisions**

**S - MD**

**Calculate expected values and use them to solve problems.**

- S-MD.1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.
- S-MD.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.
- S-MD.3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. *For example, find the theoretical probability distribution for the number of correct answers obtained by guessing on all five questions of a multiple-choice test where each question has four choices, and find the expected grade under various grading schemes.*
- S-MD.4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. *For example, find a current data distribution on the number of TV sets per household in the United States, and calculate the expected number of sets per household. How many TV sets would you expect to find in 100 randomly selected households?*

## Use probability to evaluate outcomes of decisions.

S-MD.5. (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values.

*a. Find the expected payoff for a game of chance. For example, find the expected winnings from a state lottery ticket or a game at a fast-food restaurant.*

*b. Evaluate and compare strategies on the basis of expected values. For example, compare a high-deductible versus a low-deductible automobile insurance policy using various, but reasonable, chances of having a minor or a major accident.*

S-MD.6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).

S-MD.7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).

# **Glossary for Alaska Mathematics Standards**

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## **addition and subtraction within 5, 10, 20, 100, or 1000**

Addition or subtraction of two whole numbers with whole number answers, and with sum or minuend in the range 0-5, 0-10, 0-20, or 0-100, respectively. Example:  $8 + 2 = 10$  is an addition within 10,  $14 - 5 = 9$  is a subtraction within 20, and  $55 - 18 = 37$  is a subtraction within 100.

## **additive inverses**

Two numbers whose sum is 0 are additive inverses of one another. Example:  $\frac{3}{4}$  and  $-\frac{3}{4}$  are additive inverses of one another because  $\frac{3}{4} + (-\frac{3}{4}) = (-\frac{3}{4}) + \frac{3}{4} = 0$ .

## **associative property of addition**

See Table 3 in this Glossary.

## **associative property of multiplication**

See Table 3 in this Glossary.

## **bivariate data**

Pairs of linked numerical observations. Example: a list of heights and weights for each player on a football team. Box plot. A method of visually displaying a distribution of data values by using the median, quartiles, and extremes of the data set. A box shows the middle 50% of the data.<sup>1</sup>

## **cardinality**

Cardinal numbers, known as the “counting numbers,” indicate quantity.

## **commutative property**

See Table 3 in this Glossary.

## **complex fraction**

A fraction  $A/B$  where  $A$  and/or  $B$  are fractions ( $B$  nonzero).

## **computation algorithm**

A set of predefined steps applicable to a class of problems that gives the correct result in every case when the steps are carried out correctly. *See also:* computation strategy.

## **computation strategy**

Purposeful manipulations that may be chosen for specific problems, may not have a fixed order, and may be aimed at converting one problem into another. *See also:* computation algorithm.

## **congruent**

Two plane or solid figures are congruent if one can be obtained from the other by rigid motion (a sequence of rotations, reflections, and translations).

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<sup>1</sup> Adapted from Wisconsin Department of Public Instruction, <http://dpi.wi.gov/standards/mathglos.html>, accessed Mar 2, 2010.

**counting on**

A strategy for finding the number of objects in a group without having to count every member of the group. For example, if a stack of books is known to have 8 books and 3 more books are added to the top, it is not necessary to count the stack all over again. One can find the total by counting on—pointing to the top book and saying “eight,” following this with “nine, ten, eleven. There are eleven books now.”

**dot plot**

*See:* line plot

**dilation**

A transformation that moves each point along the ray through the point emanating from a fixed center, and multiplies distances from the center by a common scale factor.

**expanded form**

A multi-digit number is expressed in expanded form when it is written as a sum of single-digit multiples of powers of ten. For example,  $643 = 600 + 40 + 3$ .

**expected value**

For a random variable, the weighted average of its possible values, with weights given by their respective probabilities.

**first quartile**

For a data set with median  $M$ , the first quartile is the median of the data values less than  $M$ . Example: For the data set {1, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the first quartile is 6.<sup>2</sup> *See also:* median, third quartile, interquartile range.

**fraction**

A number expressible in the form  $a/b$  where  $a$  is a whole number and  $b$  is a positive whole number. (The word fraction in these standards always refers to a non-negative number.) *See also:* rational number.

**identity property of 0**

*See* Table 3 in this Glossary.

**independently combined probability models**

Two probability models are said to be combined independently if the probability of each ordered pair in the combined model equals the product of the original probabilities of the two individual outcomes in the ordered pair.

**integer**

A number expressible in the form  $a$  or  $-a$  for some whole number  $a$ .

**interquartile range**

A measure of variation in a set of numerical data, the interquartile range is the distance between the first and third quartiles of the data set. Example: For the data set {1, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the interquartile range is  $15 - 6 = 9$ . *See also:* first quartile, third quartile.

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<sup>2</sup> Many different methods for computing quartiles are in use. The method defined here is sometimes called the More and McCabe method. *See* Langford, E., “Quartiles in Elementary Statistics,” *Journal of Statistics Education*, Volume 14, number 3 (2006).

## **line plot**

A method of visually displaying a distribution of data values where each data value is shown as a dot or mark above a number line. Also known as a dot plot.<sup>3</sup>

## **mean**

A measure of center in a set of numerical data, computed by adding the values in a list and then dividing by the number of values in the list.<sup>4</sup> Example: For the data set {1, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the mean is 21.

## **mean absolute deviation**

A measure of variation in a set of numerical data, computed by adding the distances between each data value and the mean, then dividing by the number of data values. Example: For the data set {2, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the mean absolute deviation is 20.

## **median**

A measure of center in a set of numerical data. The median of a list of values is the value appearing at the center of a sorted version of the list—or the mean of the two central values, if the list contains an even number of values. Example: For the data set {2, 3, 6, 7, 10, 12, 14, 15, 22, 90}, the median is 11.

## **midline**

In the graph of a trigonometric function, the horizontal line halfway between its maximum and minimum values. Multiplication and division within 100. Multiplication or division of two whole numbers with whole number answers, and with product or dividend in the range 0-100. Example:  $72 \div 8 = 9$ .

## **multiplicative inverses**

Two numbers whose product is 1 are multiplicative inverses of one another. Example:  $\frac{3}{4}$  and  $\frac{4}{3}$  are multiplicative inverses of one another because  $\frac{3}{4} \times \frac{4}{3} = \frac{4}{3} \times \frac{3}{4} = 1$ .

## **number line diagram**

A diagram of the number line used to represent numbers and support reasoning about them. In a number line diagram for measurement quantities, the interval from 0 to 1 on the diagram represents the unit of measure for the quantity.

## **ordinality**

Ordinal numbers indicate the order or rank of things in a set (e.g., sixth in line; fourth place).

## **percent rate of change**

A rate of change expressed as a percent. Example: if a population grows from 50 to 55 in a year, it grows by  $\frac{5}{50} = 10\%$  per year.

## **probability distribution**

The set of possible values of a random variable with a probability assigned to each.

## **probability**

A number between 0 and 1 used to quantify likelihood for processes that have uncertain outcomes (such as tossing a coin, selecting a person at random from a group of people, tossing a ball at a target, or testing for a medical condition).

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<sup>3</sup> Adapted from Wisconsin Department of Public Instruction, op. cit.

<sup>4</sup> To be more precise, this defines the *arithmetic mean*.

**probability model**

A probability model is used to assign probabilities to outcomes of a chance process by examining the nature of the process. The set of all outcomes is called the sample space, and their probabilities sum to 1. *See also:* uniform probability model.

**properties of equality**

See Table 4 in this Glossary.

**properties of inequality**

See Table 5 in this Glossary.

**properties of operation**

See Table 3 in this Glossary.

**random variable**

An assignment of a numerical value to each outcome in a sample space. Rational expression. A quotient of two polynomials with a non-zero denominator.

**rational expression**

A quotient of two polynomials with a non-zero denominator.

**rational number**

A number expressible in the form  $a/b$  or  $-a/b$  for some fraction  $a/b$ . The rational numbers include the integers.

**rectilinear figure**

A polygon all angles of which are right angles.

**rigid motion**

A transformation of points in space consisting of a sequence of one or more translations, reflections, and/or rotations. Rigid motions are here assumed to preserve distances and angle measures.

**repeating decimal**

The decimal form of a rational number. *See also:* terminating decimal.

**sample space**

In a probability model for a random process, a list of the individual outcomes that are to be considered.

**scatter plot**

A graph in the coordinate plane representing a set of bivariate data. For example, the heights and weights of a group of people could be displayed on a scatter plot.<sup>5</sup>

**similarity transformation**

A rigid motion followed by a dilation.

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<sup>5</sup> Adapted from Wisconsin Department of Public Instruction, op. cit.

**tape diagram**

A drawing that looks like a segment of tape, used to illustrate number relationships. Also known as a strip diagram, bar model, fraction strip, or length model.

**terminating decimal**

A decimal is called terminating if its repeating digit is 0.

**third quartile**

For a data set with median  $M$ , the third quartile is the median of the data values greater than  $M$ . *For example:* For the data set {2, 3, 6, 7, 10, 12, 14, 15, 22, 120}, the third quartile is 15. *See also:* median, first quartile, interquartile range.

**transitivity principle for indirect measurement**

If the length of object A is greater than the length of object B, and the length of object B is greater than the length of object C, then the length of object A is greater than the length of object C. This principle applies to measurement of other quantities as well.

**uniform probability model**

A probability model which assigns equal probability to all outcomes. *See also:* probability model.

**vector**

A quantity with magnitude and direction in the plane or in space, defined by an ordered pair or triple of real numbers.

**visual fraction model**

A tape diagram, number line diagram, or area model.

**whole numbers**

The numbers 0, 1, 2, 3,...

**Table 1: Common addition and subtraction situations<sup>1</sup>**

	Result Unknown	Change Unknown	Start Unknown
<b>Add To</b>	Two bunnies sat on the grass. Three more bunnies hopped there. How many bunnies are on the grass now? $2 + 3 = ?$	Two bunnies were sitting on the grass. Some more bunnies hopped there. Then there were five bunnies. How many bunnies hopped over to the first two? $2 + ? = 5$	Some bunnies were sitting on the grass. Three more bunnies hopped there. Then there were five bunnies. How many bunnies were on the grass before? $? + 3 = 5$
<b>Take from</b>	Five apples were on the table. I ate two apples. How many apples are on the table now? $5 - 2 = ?$	Five apples were on the table. I ate some apples. Then there were three apples. How many apples did I eat? $5 - ? = 3$	Some apples were on the table. I ate two apples. Then there were three apples. How many apples were on the table before? $? - 2 = 3$
	Total Unknown	Addend Unknown	Both Addends Unknown <sup>2</sup>
<b>Put Together/ Take Apart<sup>3</sup></b>	Three red apples and two green apples are on the table. How many apples are on the table? $3 + 2 = ?$	Five apples are on the table. Three are red and the rest are green. How many apples are green? $3 + ? = 5, 5 - 3 = ?$	Grandma has five flowers. How many can she put in her red vase and how many in her blue vase? $5 = 0 + 5, 5 = 5 + 0$ $5 = 1 + 4, 5 = 4 + 1$ $5 = 2 + 3, 5 = 3 + 2$
	Difference Unknown	Bigger Unknown	Smaller Unknown
<b>Compare<sup>4</sup></b>	("How many more?" version): Lucy has two apples. Julie has five apples. How many more apples does Julie have than Lucy?  ("How many fewer?" version): Lucy has two apples. Julie has five apples. How many fewer apples does Lucy have than Julie? $2 + ? = 5, 5 - 2 = ?$	(Version with "more"): Julie has three more apples than Lucy. Lucy has two apples. How many apples does Julie have?  (Version with "fewer"): Lucy has 3 fewer apples than Julie. Lucy has two apples. How many apples does Julie have? $2 + 3 = ?, 3 + 2 = ?$	(Version with "more"): Julie has three more apples than Lucy. Julie has five apples. How many apples does Lucy have?  (Version with "fewer"): Lucy has 3 fewer apples than Julie. Julie has five apples. How many apples does Lucy have? $5 - 3 = ?, ? + 3 = 5$

<sup>1</sup>Adapted from Box 2-4 of the National Research Council (2009, op. cit., pp. 32, 33).

<sup>2</sup>These take apart situations can be used to show all the decompositions of a given number. The associated equations, which have the total on the left of the equal sign, help children understand that the  $=$  sign does not always mean makes or results in but always does mean is the same number as.

<sup>3</sup>Either addend can be unknown, so there are three variations of these problem situations. Both Addends Unknown is a productive extension of this basic situation, especially for small numbers less than or equal to 10.

<sup>4</sup>For the Bigger Unknown or Smaller Unknown situations, one version directs the correct operation (the version using more for the bigger unknown and using less for the smaller unknown). The other versions are more difficult.



**Table 2: Common multiplication and division situations<sup>5</sup>**

	Unknown Product	Group Size Unknown ("How many in each group?" Division)	Number of Groups Unknown ("How many groups?" Division)
	$3 \times 6 = ?$	$3 \times ? = 18$ , and $18 \div 3 = ?$	$? \times 6 = 18$ , and $18 \div 6 = ?$
<b>Equal Groups</b>	<p>There are 3 bags with 6 plums in each bag. How many plums are there in all?</p> <p>Measurement example. You need 3 lengths of string, each 6 inches long. How much string will you need altogether?</p>	<p>If 18 plums are shared equally into 3 bags, then how many plums will be in each bag?</p> <p>Measurement example. You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?</p>	<p>If 18 plums are to be packed 6 to a bag, then how many bags are needed?</p> <p>Measurement example. You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?</p>
<b>Array<sup>6</sup>, Area<sup>7</sup></b>	<p>There are 3 rows of apples with 6 apples in each row. How many apples are there?</p> <p>Area example. What is the area of a 3 cm by 6 cm rectangle?</p>	<p>If 18 apples are arranged into 3 equal rows, how many apples will be in each row?</p> <p>Area example. A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?</p>	<p>If 18 apples are arranged into equal rows of 6 apples, how many rows will there be?</p> <p>Area example. A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?</p>
<b>Compare</b>	<p>A blue hat costs \$6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost?</p> <p>Measurement example. A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?</p>	<p>A red hat costs \$18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost?</p> <p>Measurement example. A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?</p>	<p>A red hat costs \$18 and a blue hat costs \$6. How many times as much does the red hat cost as the blue hat?</p> <p>Measurement example. A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?</p>
<b>General</b>	$a \times b = ?$	$a \times ? = p$ , and $p \div a = ?$	$? \times b = p$ , and $p \div b = ?$

<sup>5</sup>The first examples in each cell are examples of discrete things. These are easier for students and should be given before the measurement examples.

<sup>6</sup>The language in the array examples shows the easiest form of array problems. A harder form is to use the terms rows and columns: The apples in the grocery window are in 3 rows and 6 columns. How many apples are in there? Both forms are valuable.

<sup>7</sup>Area involves arrays of squares that have been pushed together so that there are no gaps or overlaps, so array problems include these especially important measurement situations.

### **Table 3. The properties of operations.**

Here  $a$ ,  $b$  and  $c$  stand for arbitrary numbers in a given number system. The properties of operations apply to the rational number system, the real number system, and the complex number system.

Associative property of addition	$(a + b) + c = a + (b + c)$
Commutative property of addition	$a + b = b + a$
Additive identity property of 0	$a + 0 = 0 + a = a$
Existence of additive inverses	For every $a$ there exists $-a$ so that $a + (-a) = (-a) + a = 0$ .
Associative property of multiplication	$(a \times b) \times c = a \times (b \times c)$
Commutative property of multiplication	$a \times b = b \times a$
Multiplicative identity property of 1	$a \times 1 = 1 \times a = a$
Existence of multiplicative inverses	For every $a \neq 0$ there exists $1/a$ so that $a \times 1/a = 1/a \times a = 1$ .
Distributive property of multiplication over addition	$a \times (b + c) = a \times b + a \times c$

### **Table 4. The properties of equality.**

Here  $a$ ,  $b$  and  $c$  stand for arbitrary numbers in the rational, real, or complex number systems.

Reflexive property of equality	$a = a$
Symmetric property of equality	If $a = b$ , then $b = a$ .
Transitive property of equality	If $a = b$ and $b = c$ , then $a = c$ .
Addition property of equality	If $a = b$ , then $a + c = b + c$ .
Subtraction property of equality	If $a = b$ , then $a - c = b - c$ .
Multiplication property of equality	If $a = b$ , then $a \times c = b \times c$ .
Division property of equality	If $a = b$ , then $b$ may be substituted for $a$ in any expression containing $a$ .
Substitution property of equality	If $a = b$ and $c \neq 0$ , then $a \div c = b \div c$ .

### **Table 5. The properties of inequality.**

Here  $a$ ,  $b$  and  $c$  stand for arbitrary numbers in the rational or real number systems.

Exactly one of the following is true: $a < b$ , $a = b$ , $a > b$ .
If $a > b$ and $b > c$ then $a > c$ .
If $a > b$ , then $b < a$ .
If $a > b$ , then $-a < -b$ .
If $a > b$ , then $a \pm c > b \pm c$ .
If $a > b$ and $c > 0$ , then $a \times c > b \times c$ .
If $a > b$ and $c < 0$ , then $a \times c < b \times c$ .
If $a > b$ and $c > 0$ , then $a \div c > b \div c$ .
If $a > b$ and $c < 0$ , then $a \div c < b \div c$ .

# **CTE Common Career Technical Core Standards**

# CTE Common Career Technical Core Standards



**CCTC**  
Common Career Technical Core

*Brought to you by the National Association of State Directors of Career Technical Education Consortium (NASDCTEC)*

## Introduction to The Common Career Technical Core

The Common Career Technical Core (CCTC) is an important step forward for the Career Technical Education (CTE) community. For the first time in the history of CTE, states throughout the nation have a common benchmark for what students should know and be able to do after completing a program of study.

The CCTC is a state-led initiative, with 42 states, the District of Columbia and Palau participating in the development stage. Business and industry representatives, educators and others helped guide the development of the CCTC from beginning to end to ensure CTE students will have the knowledge and skills to thrive in a global economy.

The resulting CCTC is a set of rigorous, high-quality standards for CTE that states can adopt voluntarily. The CCTC includes a set of standards for each of the 16 Career Clusters® and their corresponding Career Pathways that define what students should know and be able to do after completing instruction in a program of study (pages 4-21 of this document).

The CCTC also includes an overarching set of Career Ready Practices that apply to all programs of study. The Career Ready Practices include 12 statements that address the knowledge, skills and dispositions that are important to becoming career ready (pages 2-3 of this document).

To appropriately cite the Common Career Technical Core, including the Career Ready Practices, use the following:

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Career Ready Practices (CRP) describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study (PoS), discipline or level of education. CRP should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a PoS.

### 1. Act as a responsible and contributing citizen and employee.

Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

### 2. Apply appropriate academic and technical skills.

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

### 3. Attend to personal health and financial well-being.

Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

### 4. Communicate clearly, effectively and with reason.

Career-ready individuals communicate thoughts, ideas and action plans with clarity, whether using written, verbal and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice and organization and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

### 5. Consider the environmental, social and economic impacts of decisions.

Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organizations and the environment. They are aware of and utilize new technologies, understandings, procedures, materials and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and profitability of the organization.

### 6. Demonstrate creativity and innovation.

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

### 7. Employ valid and reliable research strategies.

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use a reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices. They use an informed process to test new ideas, information and practices in their workplace situation.

**8. Utilize critical thinking to make sense of problems and persevere in solving them.**

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem. They thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

**9. Model integrity, ethical leadership and effective management.**

Career-ready individuals consistently act in ways that align to personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they apply insights into human behavior to change others' actions, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morale and organizational culture.

**10. Plan education and career path aligned to personal goals.**

Career-ready individuals take personal ownership of their own educational and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the educational and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors and other experts to assist in the planning and execution of career and personal goals.

**11. Use technology to enhance productivity.**

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks -- personal and organizational -- of technology applications, and they take actions to prevent or mitigate these risks.

**12. Work productively in teams while using cultural/global competence.**

Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

## The Common Career Technical Core

### Agriculture, Food & Natural Resources Career Cluster® (AG)

1. Analyze how issues, trends, technologies and public policies impact systems in the Agriculture, Food & Natural Resources Career Cluster.
2. Evaluate the nature and scope of the Agriculture, Food & Natural Resources Career Cluster and the role of agriculture, food and natural resources (AFNR) in society and the economy.
3. Examine and summarize the importance of health, safety and environmental management systems in AFNR businesses.
4. Demonstrate stewardship of natural resources in AFNR activities.
5. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources Career Pathways.
6. Analyze the interaction among AFNR systems in the production, processing and management of food, fiber and fuel and the sustainable use of natural resources.

### Agribusiness Systems Career Pathway (AG-BIZ)

1. Apply management planning principles in AFNR businesses.
2. Use record keeping to accomplish AFNR business objectives, manage budgets, and comply with laws and regulations.
3. Manage cash budgets, credit budgets and credit for an AFNR business using generally accepted accounting principles.
4. Develop a business plan for an AFNR business.
5. Use sales and marketing principles to accomplish AFNR business objectives.

### Animal Systems Career Pathway (AG-ANI)

1. Analyze historic and current trends impacting the animal systems industry.
2. Utilize best-practice protocols based upon animal behaviors for animal husbandry and welfare.
3. Design and provide proper animal nutrition to achieve desired outcomes for performance, development, reproduction and/or economic production.
4. Apply principles of animal reproduction to achieve desired outcomes for performance, development and/or economic production.
5. Evaluate environmental factors affecting animal performance and implement procedures for enhancing performance and animal health.
6. Classify, evaluate and select animals based on anatomical and physiological characteristics.
7. Apply principles of effective animal health care.

### Environmental Service Systems Career Pathway (AG-ENV)

1. Use analytical procedures and instruments to manage environmental service systems.
2. Evaluate the impact of public policies and regulations on environmental service system operations.
3. Develop proposed solutions to environmental issues, problems and applications using scientific principles of meteorology, soil science, hydrology, microbiology, chemistry and ecology.
4. Demonstrate the operation of environmental service systems (e.g., pollution control, water treatment, wastewater treatment, solid waste management and energy conservation).
5. Use tools, equipment, machinery and technology common to tasks in environmental service systems.

### Food Products & Processing Systems Career Pathway (AG-FD)

1. Develop and implement procedures to ensure safety, sanitation and quality in food product and processing facilities.
2. Apply principles of nutrition, biology, microbiology, chemistry and human behavior to the development of food products.
3. Select and process food products for storage, distribution and consumption.
4. Explain the scope of the food industry and the historical and current developments of food products and processing.



#### **Natural Resources Systems Career Pathway (AG-NR)**

1. Plan and conduct natural resource management activities that apply logical, reasoned and scientifically based solutions to natural resource issues and goals.
2. Analyze the interrelationships between natural resources and humans.
3. Develop plans to ensure sustainable production and processing of natural resources.
4. Demonstrate responsible management procedures and techniques to protect or maintain natural resources.

#### **Plant Systems Career Pathway (AG-PL)**

1. Develop and implement a crop management plan for a given production goal that accounts for environmental factors.
2. Apply the principles of classification, plant anatomy and plant physiology to plant production and management.
3. Propagate, culture and harvest plants and plant products based on current industry standards.
4. Apply principles of design in plant systems to enhance an environment (e.g., floral, forest, landscape and farm).

#### **Power, Structural & Technical Systems Career Pathway (AG-PST)**

1. Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.
2. Operate and maintain AFNR mechanical equipment and power systems.
3. Service and repair AFNR mechanical equipment and power systems.
4. Plan, build and maintain AFNR structures.
5. Use control, monitoring, geospatial and other technologies in AFNR power, structural and technical systems.

#### **Architecture & Construction Career Cluster® (AC)**

1. Use vocabulary, symbols and formulas common to architecture and construction.
2. Use architecture and construction skills to create and manage a project.
3. Comply with regulations and applicable codes to establish and manage a legal and safe workplace.
4. Evaluate the nature and scope of the Architecture & Construction Career Cluster and the role of architecture and construction in society and the economy.
5. Describe the roles, responsibilities and relationships found in the architecture and construction trades and professions, including labor/management relationships.
6. Read, interpret and use technical drawings, documents and specifications to plan a project.
7. Describe career opportunities and means to achieve those opportunities in each of the Architecture & Construction Career Pathways.

#### **Construction Career Pathway (AC-CST)**

1. Describe contractual relationships between all parties involved in the building process.
2. Describe the approval procedures required for successful completion of a construction project.
3. Implement testing and inspection procedures to ensure successful completion of a construction project.
4. Apply scheduling practices to ensure the successful completion of a construction project.
5. Apply practices and procedures required to maintain jobsite safety.
6. Manage relationships with internal and external parties to successfully complete construction projects.
7. Compare and contrast the building systems and components required for a construction project.
8. Demonstrate the construction crafts required for each phase of a construction project.
9. Safely use and maintain appropriate tools, machinery, equipment and resources to accomplish construction project goals.

#### **Design/Pre-construction Career Pathway (AC-DES)**

1. Justify design solutions through the use of research documentation and analysis of data.
2. Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
3. Describe the requirements of the integral systems that impact the design of buildings.
4. Apply building codes, laws and rules in the project design.
5. Identify the diversity of needs, values and social patterns in project design, including accessibility standards.
6. Apply the techniques and skills of modern drafting, design, engineering and construction to projects.
7. Employ appropriate representational media to communicate concepts and project design.
8. Apply standards, applications and restrictions pertaining to the selection and use of construction materials, components and assemblies in the project design.



#### **Maintenance/Operations Career Pathway (AC-MO)**

1. Recognize and employ universal construction signs and symbols to function safely in the workplace.
2. Use troubleshooting procedures when solving a maintenance problem in buildings.
3. Apply construction skills when repairing, restoring or renovating existing buildings.
4. Determine work required to repair or renovate an existing building.
5. Plan and practice preventative maintenance activities to service existing buildings.
6. Maintain and inspect building systems to achieve safe and efficient operation of buildings.

#### **Arts, A/V Technology & Communications Career Cluster® (AR)**

1. Analyze the interdependence of the technical and artistic elements of various careers within the Arts, A/V Technology & Communications Career Cluster.
2. Analyze the importance of health, safety and environmental management systems, policies and procedures common in arts, audio/video technology and communications activities and facilities.
3. Analyze the lifestyle implications and physical demands required in the arts, audio/visual technology and communications workplace.
4. Analyze the legal and ethical responsibilities required in the arts, audio/visual technology and communications workplace.
5. Describe the career opportunities and means to achieve those opportunities in each of the Arts, A/V Technology & Communications Career Pathways.
6. Evaluate technological advancements and tools that are essential to occupations within the Arts, A/V Technology & Communications Career Cluster.

#### **A/V Technology & Film Career Pathway (AR-AV)**

1. Describe the history, terminology, occupations and value of audio, video and film technology.
2. Demonstrate the use of basic tools and equipment used in audio, video and film production.
3. Demonstrate technical support skills for audio, video and/or film productions.
4. Design an audio, video and/or film production.

#### **Journalism & Broadcasting Career Pathway (AR-JB)**

1. Describe the diversity of functions within the Journalism & Broadcasting Career Pathway.
2. Demonstrate writing processes used in journalism and broadcasting.
3. Plan and deliver a media production (e.g., broadcast, video, Internet, mobile).
4. Demonstrate technical support related to media production (e.g., broadcast, video, Internet, mobile).

#### **Performing Arts Career Pathway (AR-PRF)**

1. Describe the scope of the Performing Arts Career Pathway and the roles of various individuals in it.
2. Demonstrate the fundamental elements, techniques, principles and processes of various dance styles and traditions.
3. Perform a varied repertoire of vocal and/or instrumental music representing diverse styles, cultures and historical periods.
4. Demonstrate knowledge of music theory.
5. Explain key issues affecting the creation of characters, acting skills and roles.
6. Create stage, film, television or electronic media scripts in a variety of traditional and current formats.
7. Describe how technology and technical support enhance performing arts productions.
8. Analyze all facets of stage and performing arts production management.

#### **Printing Technology Career Pathway (AR-PRT)**

1. Manage the printing process, including customer service and sales, scheduling, production and quality control.
2. Demonstrate the production of various print, multimedia or digital media products.
3. Perform finishing and distribution operations related to the printing process.

#### **Telecommunications Career Pathway (AR-TEL)**

1. Demonstrate the use of telecommunications terminology, tools and test equipment.
2. Demonstrate telecommunication installation processes using appropriate tools, materials, schematics, diagrams, blueprints and industry specific codes and regulations.
3. Demonstrate decision making, problem-solving techniques and communication skills when providing services for customers.
4. Demonstrate the installation, repair and delivery of network systems.

**Visual Arts Career Pathway (AR-VIS)**

1. Describe the history and evolution of the visual arts and its role in and impact on society.
2. Analyze how the application of visual arts elements and principles of design communicate and express ideas.
3. Analyze and create two-and three-dimensional visual art forms using various media.

**Business Management & Administration Career Cluster® (BM)**

1. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision making in business.
2. Describe laws, rules and regulations as they apply to effective business operations.
3. Explore, develop and apply strategies for ensuring a successful business career.
4. Identify, demonstrate and implement solutions in managing effective business customer relationships.
5. Implement systems, strategies and techniques used to manage information in a business.
6. Implement, monitor and evaluate business processes to ensure efficiency and quality results.

**Administrative Support Career Pathway (BM-ADM)**

1. Plan, staff, lead and organize human resources to enhance employee productivity and satisfaction.
2. Access, evaluate and disseminate information for business decision making.
3. Plan, monitor and manage day-to-day business activities.

**Business Information Management Career Pathway (BM-BIM)**

1. Describe and follow laws and regulations affecting business operations and transactions.
2. Plan, monitor, manage and maintain the use of financial resources to ensure a business's financial well-being.
3. Access, evaluate and disseminate information for business decision making.
4. Plan, monitor and manage day-to-day business activities to sustain continued business functioning.
5. Plan, organize and manage an organization/department to achieve business goals.

**General Management Career Pathway (BM-MGT)**

1. Describe and follow laws and regulations affecting business operations and transactions.
2. Access, evaluate and disseminate information for business decision making.
3. Apply economic concepts fundamental to global business operations.
4. Employ and manage techniques, strategies and systems to enhance business relationships.
5. Plan, monitor, manage and maintain the use of financial resources to ensure a business's financial well-being.
6. Plan, monitor and manage day-to-day business activities to sustain continued business functioning.
7. Plan, organize and manage an organization/department to achieve business goals.
8. Create strategic plans used to manage business growth, profit and goals.

**Human Resources Management Career Pathway (BM-HR)**

1. Describe and follow laws and regulations affecting human resource operations.
2. Access, evaluate and disseminate information for human resources management decision making.
3. Motivate and supervise personnel to achieve completion of projects and business goals.
4. Plan, monitor and manage the use of financial and human resources to ensure a business's financial well-being.
5. Plan, staff, lead and organize human resources to enhance employee productivity and satisfaction.
6. Plan, monitor and manage day-to-day business activities to foster a healthy and safe work environment.
7. Plan, organize and implement compensation, benefits, health and safety programs.

**Operations Management Career Pathway (BM-OP)**

1. Describe and follow laws and regulations affecting business operations and transactions.
2. Develop and maintain positive customer relationships.
3. Apply inventory tracking systems to facilitate operational controls.
4. Plan, monitor and manage day-to-day business activities to maintain and improve operational functions.

### **Education & Training Career Cluster® (ED)**

1. Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning.
2. Demonstrate effective oral, written and multimedia communication in multiple formats and contexts.
3. Use critical thinking to process educational communications, perspectives, policies and/or procedures.
4. Evaluate and manage risks to safety, health and the environment in education and training settings.
5. Demonstrate group collaboration skills to enhance professional education and training practice.
6. Analyze ethical and legal policies of professional education and training practice.
7. Explain legal rights that apply to individuals and practitioners within education and training settings.
8. Demonstrate ethical and legal behavior within and outside of education and training settings.
9. Describe state-specific professional development requirements to maintain employment and to advance in an education and training career.
10. Apply organizational skills and logic to enhance professional education and training practice.
11. Demonstrate group management skills that enhance professional education and training practice.

### **Administration & Administration Support Career Pathway (ED-ADM)**

1. Use research-based practices to develop, communicate and enlist support for a vision of success for all learners.
2. Identify behaviors necessary for developing and sustaining a positive learning culture.
3. Create instructional programs to meet the learning organization's objectives.
4. Identify instructional practices that meet the learning organization's objectives.
5. Model leadership skills for personnel in order to improve the performance of the learning organization.
6. Identify operations to meet the learning organization's objectives.
7. Plan strategically to meet the learning organization's objectives.
8. Apply internal and external resources to meet the learning organization's objectives and learner needs.
9. Describe advocacy strategies to promote the learning organization's needs.

### **Professional Support Services Career Pathway (ED-PS)**

1. Identify strategies, techniques and tools used to determine the needs of diverse learners.
2. Implement methods to enhance learner success.
3. Identify resources and support services to meet learners' needs.
4. Identify resources and support services available in the learning organization to enhance the learning environment.

### **Teaching/Training Career Pathway (ED-TT)**

1. Use foundational knowledge of subject matter to plan and prepare effective instruction and design courses or programs.
2. Employ knowledge of learning and developmental theory to describe individual learners.
3. Use content knowledge and skills of instruction to develop standards-based goals and assessments.
4. Identify materials and resources needed to support instructional plans.
5. Establish a positive climate to promote learning.
6. Identify motivational, social and psychological practices that guide personal conduct.
7. Demonstrate organizational and relationship building skills used to manage instructional activities and related procedures.
8. Demonstrate flexibility and adaptability in instructional planning.
9. Utilize assessment and evaluation tools and data to advance learner achievement and adjust instructional plans.
10. Evaluate teaching and training performance indicators to determine and improve effectiveness of instructional practices and professional development.
11. Implement strategies to maintain relationships with others to increase support for the organization.



### **Finance Career Cluster® (FN)**

1. Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision making in the finance industry.
2. Utilize tools, strategies and systems to plan, monitor, manage and maintain the use of financial resources.
3. Plan, staff, lead and organize human resources in finance to enhance employee productivity and job satisfaction.
4. Determine effective tools, techniques and systems to communicate and deliver value to finance customers.
5. Create and maintain positive, ongoing relationships with finance customers.
6. Plan, monitor and manage day-to-day activities to ensure effective and efficient finance operations.
7. Implement safety, health and environmental controls to ensure a safe and productive finance work workplace.
8. Describe and follow laws, regulations and ethical standards that affect finance operations and transactions.
9. Plan, manage and maintain the use of financial resources to protect solvency.
10. Plan, organize and manage a finance organization/department.
11. Plan, monitor and manage day-to-day activities required to sustain continued business functioning.
12. Access, evaluate and disseminate financial information to enhance financial decision-making processes.
13. Manage a financial product or service mix in order to respond to market opportunities.
14. Employ financial risk management strategies and techniques used to minimize business loss.

### **Accounting Career Pathway (FN-ACT)**

1. Describe and follow laws and regulations to manage accounting operations and transactions.
2. Utilize accounting tools, strategies and systems to plan, monitor, manage and maintain the use of financial resources.
3. Process, evaluate and disseminate financial information to assist business decision making.
4. Utilize career-planning concepts, tools and strategies to explore, obtain and/or develop an accounting career.

### **Banking Services Career Pathway (FN-BNK)**

1. Describe and follow laws and regulations to manage business operations and transactions in the banking services industry.
2. Create and maintain positive, ongoing relationships with banking customers.
3. Manage the use of financial resources to enhance banking performance.
4. Demonstrate the use of banking technology and equipment.
5. Plan, monitor and manage the day-to-day activities within a banking organization to ensure secure operations.
6. Utilize career-planning concepts, tools and strategies to explore, obtain and/or develop a career in banking services.
7. Determine client needs and wants and respond through planned, personalized communication to guide purchase decisions and enhance future business opportunities in banking services.

### **Business Finance Career Pathway (FN-BFN)**

1. Describe and follow laws and regulations to manage business operations and transactions in corporate finance.
2. Manage the use of financial resources to ensure business stability.
3. Utilize career-planning concepts, tools and strategies to explore, obtain and/or develop in a corporate finance career.
4. Employ risk management strategies and techniques in corporate finance to minimize business loss.

### **Insurance Career Pathway (FN-INS)**

1. Describe and follow laws and regulations to manage business operations and transactions in the insurance industry.
2. Plan, monitor and manage day-to-day insurance organization activities.
3. Utilize career-planning concepts, tools and strategies to explore, obtain and/or develop a career in insurance.
4. Demonstrate underwriting techniques and strategies to evaluate the risk posed by potential insurance clients.
5. Determine client needs and wants and respond through planned, personalized communication to guide purchase decisions and enhance future insurance business opportunities.

### **Securities & Investments Career Pathway (FN-SEC)**

1. Describe and follow laws and regulations to manage business operations and transactions in the securities and investments industry.
2. Manage the use of financial resources to perform key duties in the securities and investments industry.
3. Plan, monitor and manage day-to-day securities and investments operations.
4. Utilize career-planning concepts, tools and strategies to explore, obtain and/or develop in a securities and investments career.
5. Determine client needs and wants and respond through planned, personalized communication to guide purchase decisions and enhance future securities and investments opportunities.

### **Government & Public Administration Career Cluster® (GV)**

1. Explain the purpose and functions of government and public administration and the application of democratic principles in the process of governmental and administrative policymaking.
2. Analyze the systemic relationships of government and public administration agencies.
3. Describe health, safety and environmental management systems, as well as policies and procedures, in government and public administration agencies.
4. Describe the implementation of plans and policies to respond to public health, safety and environmental needs in government and public administration agencies.
5. Describe career opportunities and the means to achieve those opportunities in each of the Government & Public Administration Career Pathways.
6. Explain the administration of human, financial, material and information resources in government and public administration agencies.

### **Foreign Service Career Pathway (GV-FOR)**

1. Apply the knowledge acquired from history, law, geography, science, language studies, social sciences (including economic and political science), business, foreign policy and culture to perform diplomatic functions.
2. Describe the laws, customs and current administrative practices of the United States and host countries used to manage administrative, social and policy matters.
3. Describe the application of United States and host country laws, regulations, policies and procedures used to manage consular administrative matters.
4. Describe the application of host country laws, customs and effective administrative practices used to manage the conduct of diplomatic operations.

### **Governance Career Pathway (GV-GOV)**

1. Employ research skills to gather and document factual information, analyze data and interpret statistics applicable to matters of public policy.
2. Develop and articulate reasoned, persuasive arguments to support public policy options or positions.
3. Select and apply appropriate political processes to gain consensus for the resolution of differing opinions and positions.
4. Advocate to gain support for new laws, regulations, ordinances, programs or procedures; alternatively, advocate to gain support to reform or revoke existing laws, regulations, ordinances, programs or procedures.

### **National Security Career Pathway (GV-SEC)**

1. Instruct persons who will perform tasks relating to national homeland security.
2. Describe the appropriate duties, responsibilities and authority of a national security agency's personnel at all levels.
3. Describe the leadership characteristics necessary to ensure compliance with rules of engagement and applicable ethical standards.
4. Collect and analyze information from within and outside the United States to assess threats and opportunities regarding national security.
5. Develop strategies to defend against and respond to the effects of chemical, biological, radiological, nuclear (CBRN) or other emergent events.

### **Planning Career Pathway (GV-PLN)**

1. Explain the planning process used to support the development and implementation of new and updated plans, programs and regulations for government and public administration agencies.
2. Develop a comprehensive and focused strategic planning process for government and public administration agencies to manage change.
3. Formulate plans and policies that meet the social, economic and physical needs of the public.

### **Public Management & Administration Career Pathway (GV-MGT)**

1. Describe the organization of a government or public administration department or agency.
2. Design strategies to maximize the potential of a government or public administration department or agency to meet its vision, mission and goals.
3. Utilize fiscal management skills to manage budgetary and allocation processes to ensure that resources are applied in a manner consistent with the department or agency's vision, mission and goals.
4. Facilitate the flow of ideas and information to keep the department or agency and its constituency informed of policies and operations.
5. Create plans that utilize department or agency expertise to help elected officials and others identify, implement and achieve common goals and objectives.
6. Use analysis, planning and fiscal services to fund department or agency priorities.
7. Describe ethical and fiscally responsible procurement systems and procedures used to meet department or agency needs.
8. Prepare procurement requirements, procedures and solicitations for bids or proposals.
9. Evaluate bids and proposals consistent with the requirements of the procurement process.
10. Describe the oversight of awarded contracts to ensure the ethical and optimal use of public funds.
11. Describe laws and policies that are used to protect or disclose information.
12. Develop strategies that encourage a creative and innovative environment in a government or public administration department or agency.

### **Regulation Career Pathway (GV-REG)**

1. Describe enforcement of compliance with legal requirements and regulatory standards.

### **Revenue & Taxation Career Pathway (GV-REV)**

1. Examine evidence and ensure revenue compliance by interpreting applicable laws, applying appropriate investigative principles and following relevant procedures.
2. Acquire, analyze and disseminate information to facilitate clear and accurate communication with revenue and taxation stakeholders.
3. Design, develop, operate and review data analysis systems and procedures to minimize and eliminate revenue-related financial problems.

### **Health Science Career Cluster® (HL)**

1. Determine academic subject matter, in addition to high school graduation requirements, necessary for pursuing a health science career.
2. Explain the healthcare worker's role within their department, their organization, and the overall healthcare system.
3. Identify existing and potential hazards to clients, coworkers, visitors and self in the healthcare workplace.
4. Evaluate the roles and responsibilities of individual members as part of the healthcare team and explain their role in promoting the delivery of quality health care.
5. Analyze the legal and ethical responsibilities, limitations and implications of actions within the healthcare workplace.
6. Evaluate accepted ethical practices with respect to cultural, social and ethnic differences within the healthcare workplace.

### **Biotechnology Research & Development Career Pathway (HL-BRD)**

1. Summarize the goals of biotechnology research and development within legal and ethical protocols.
2. Apply the fundamentals of biochemistry, cell biology, genetics, mathematical concepts, microbiology, molecular biology, organic chemistry and statistics to conduct effective biotechnology research and development of products.
3. Demonstrate basic knowledge of recombinant DNA, genetic engineering, bioprocessing, monoclonal antibody production, nanotechnology, bioinformatics, genomics, proteomics and transcriptomics to conduct biotechnology research and development.
4. Demonstrate the principles of solution preparation, sterile techniques, contamination control, and measurement and calibration of instruments used in biotechnology research.
5. Determine processes for product design and production and how that work contributes to an understanding of the biotechnology product development process.
6. Summarize and explain the larger ethical, moral and legal issues related to biotechnology research, product development and use in society.



#### **Diagnostic Services Career Pathway (HL-DIA)**

1. Communicate key diagnostic information to healthcare workers and patients in an accurate and timely manner.
2. Assess and report patient's/client's health status in order to monitor and document patient progress.
3. Demonstrate the principles of body mechanics for positioning, transferring and transporting of patients/clients, and perform them without injury to the patient/client or self.
4. Explain procedures and goals to the patient/client accurately and effectively, using strategies to respond to questions and concerns.
5. Select, demonstrate and interpret diagnostic procedures.

#### **Health Informatics Career Pathway (HL-HI)**

1. Communicate health information accurately and within legal and regulatory guidelines, upholding the strictest standards of confidentiality.
2. Describe the content and diverse uses of health information.
3. Demonstrate the use of systems used to capture, retrieve and maintain confidential health information from internal and external sources.

#### **Support Services Career Pathway (HL-SUP)**

1. Describe, differentiate and safely perform the responsibilities of healthcare support services roles.
2. Demonstrate work practices that maintain a clean and healthy healthcare facility to reduce or eliminate pathogenic organisms.
3. Follow established internal and external guidelines in order to provide high-quality, effective support services in the healthcare facility.
4. Maximize available resources for proper care and use of healthcare equipment and materials.
5. Implement healthcare facility standards in order to maintain high-quality healthcare facilities.

#### **Therapeutic Services Career Pathway (HL-THR)**

1. Utilize communication strategies to answer patient/client questions and concerns on planned procedures and goals.
2. Communicate patient/client information among healthcare team members to facilitate a team approach to patient care.
3. Utilize processes for assessing, monitoring and reporting patient's/clients' health status to the treatment team within protocol and scope of practice.
4. Evaluate patient/client needs, strengths and problems in order to determine if treatment goals are being met.

#### **Hospitality & Tourism Career Cluster® (HT)**

1. Describe the key components of marketing and promoting hospitality and tourism products and services.
2. Evaluate the nature and scope of the Hospitality & Tourism Career Cluster and the role of hospitality and tourism in society and the economy.
3. Demonstrate hospitality and tourism customer service skills that meet customers' needs.
4. Describe employee rights and responsibilities and employers' obligations concerning occupational health and safety in the hospitality and tourism workplace.
5. Identify potential, real and perceived hazards and emergency situations and determine the appropriate safety and security measures in the hospitality and tourism workplace.
6. Describe career opportunities and means to attain those opportunities in each of the Hospitality & Tourism Career Pathways.

#### **Lodging Career Pathway (HT-LOD)**

1. Use various communication technologies to accomplish work tasks in lodging facilities.
2. Explain the role and importance of housekeeping operations to lodging facility.
3. Allocate staff positions to meet the needs of various lodging departments.
4. Describe the role and responsibilities of lodging managers.
5. Compare the advantages and disadvantages of independently owned and chain-affiliated lodging facilities.
6. Analyze the departmental interrelationships of a lodging facility.
7. Explain various check-in and check-out procedures used in the lodging industry.
8. Understand reservation procedures used in the lodging industry.
9. Explain how room access policies and procedures ensure guest safety and minimize risks to the lodging facility.
10. Explain how cash control procedures are used in the lodging industry.
11. Explain how guests and property are protected to minimize losses or liabilities in the lodging facility.
12. Explain the basic legal issues in lodging management.

### **Recreation, Amusements & Attractions Career Pathway (HT-REC)**

1. Describe career opportunities in the Recreation, Amusements & Attractions Career Pathway.
2. Explain admission and traffic control procedures used to manage and control individuals, groups and vehicles in recreation, amusement and attraction venues.
3. Determine the maintenance and technology needs for various recreation, amusement and attraction venues.
4. Describe safety and security issues unique to the Recreation, Amusements & Attractions Career Pathway.
5. Compile a resource base to manage emergency situations in recreation, amusement and attraction venues.
6. Identify safety and security issues for recreation, amusement and attraction venues that might require customer education.
7. Compare different ticket sales options to maximize revenue for recreation, amusement and attraction venues.
8. Describe the types of information and directions a guest would need at a recreation, amusement and attraction entry point.
9. Develop marketing strategies for recreation, amusement and attractions venues.
10. Analyze the merchandising, program and product potential for different recreation, amusement and attraction venues.
11. Compare and contrast various types of recreation, amusement and attraction venues.

### **Restaurants & Food/ Beverage Services Career Pathway (HT-RFB)**

1. Describe ethical and legal responsibilities in food and beverage service facilities.
2. Demonstrate safety and sanitation procedures in food and beverage service facilities.
3. Use information from cultural and geographical studies to guide customer service decisions in food and beverage service facilities.
4. Demonstrate leadership qualities and collaboration with others.
5. Research costs, pricing, market demands and marketing strategies to manage profitability in food and beverage service facilities.
6. Explain the benefits of the use of computerized systems to manage food service operations and guest service.
7. Utilize technical resources for food services and beverage operations to update or enhance present practice.
8. Implement standard operating procedures related to food and beverage production and guest service.
9. Describe career opportunities and qualifications in the restaurant and food service industry.
10. Apply listening, reading, writing and speaking skills to enhance operations and customer service in food and beverage service facilities.

### **Travel & Tourism Career Pathway (HT-TT)**

1. Apply information about time zones, seasons and domestic and international maps to create or enhance travel.
2. Apply unit and time conversion skills to develop travel schedules and compute cost, distance and time (including travel time) factors.
3. Analyze cultural diversity factors to enhance travel planning.
4. Assess the potential (real and perceived) hazards related to multiple environments, and recommend appropriate safety, health and security measures for travelers.
5. Develop a safety and security plan containing proactive and reactive solutions to manage emergency situations for travelers and staff.
6. Use common travel and tourism terminology used to communicate within the industry.
7. Customize travel with diverse transportation, lodging, cruise and food options.
8. Compare and contrast services and products from related industries to understand and evaluate how they impact the delivery of travel and tourism products and services to customers.
9. Identify the community elements necessary to maintain cooperative tourism development efforts.
10. Develop a travel product that matches customer needs, wants and expectations.
11. Design promotional packages to effectively market travel and tourism.
12. Select the most effective communication technique and media venue to convey travel marketing information to a target audience.



### **Human Services Career Cluster® (HU)**

1. Evaluate principles of planning, development, implementation and evaluation to accomplish long-range goals in the human services.
2. Evaluate the role of the family, community and human services in society and the economy.
3. Use effective communication with human services clients and their families.
4. Demonstrate ethical and legal conduct in human services settings.
5. Evaluate career opportunities in each of the Human Services Career Pathways.
6. Explain how human development principles enhance the well-being of individuals and families.

### **Consumer Services Career Pathway (HU-CSM)**

1. Summarize necessary credentials, licensures or state-specific requirements to prepare for a career in consumer services.
2. Communicate product or equipment features that meet the needs of clients and consumers.
3. Make consumer services recommendations meeting the needs of clients or customers.
4. Analyze financial/economic situations when making recommendations about consumer services.
5. Use standard business processes or procedures to create consumer service information and facilitate client interactions.
6. Use a variety of methods to educate audiences about consumer services.
7. Demonstrate knowledge of ethical and legal responsibilities associated with providing consumer services.
8. Apply business procedures and utilize equipment and facilities to produce satisfying client outcomes.

### **Counseling & Mental Health Services Career Pathway (HU-CMH)**

1. Use clear written, spoken and nonverbal messages when communicating with clients about mental health services and the counseling process.
2. Utilize functional and specialized assessments to evaluate needs and solutions for counseling and mental health.
3. Evaluate client motivation, strengths and weaknesses to develop a client treatment program.
4. Demonstrate knowledge of an operational mental health or counseling program that meets organizational goals.
5. Demonstrate the ethical and legal responsibilities of counseling and mental health services.
6. Choose appropriate counseling and therapy techniques to serve identified needs.

### **Early Childhood Development & Services Career Pathway (HU-EC)**

1. Demonstrate communication techniques with children to facilitate ongoing development and enhance learning.
2. Communicate effectively with fellow staff members to facilitate child development activities.
3. Maintain working knowledge of child development licensing and certification organizations to keep abreast of current procedures and changes.
4. Create and maintain relationships between staff and parents/family members to encourage involvement and facilitate child development and learning.
5. Evaluate safety and sanitation procedures associated with the early childhood education environment to assure compliance and prevent potential hazards.
6. Adhere to ethical and legal responsibilities, laws and regulations to protect children and families.
7. Apply principles of child growth and development, including social, emotional, physical and cognitive milestones to provide comprehensive program offerings.
8. Evaluate curriculum for inclusiveness of children with special needs.

### **Family & Community Services Career Pathway (HU-FAM)**

1. Use formal and informal assessment practices to create and evaluate a prevention and/or treatment plan.
2. Identify community resources to provide family and community services.
3. Communicate effectively to gain support from the client's family and other support groups.
4. Comply with laws and procedures that govern abuse, neglect, confidentiality and other health and safety situations.
5. Evaluate crisis prevention, intervention and resolution techniques to formulate emergency plans.

### **Personal Care Services Career Pathway (HU-PC)**

1. Analyze basic principles of biology, chemistry and human anatomy for safe and effective utilization and selection of personal care products and services.
2. Evaluate an individualized personal care plan that reflects client preferences, needs and interests for a course of treatment/action.
3. Utilize data and information to maintain electronic records of client services and make recommendations for personal care services.
4. Demonstrate policies and procedures to achieve a safe and healthy environment for personal care services.
5. Develop organizational policies, procedures and regulations that establish personal care organization priorities, accomplish the mission, and provide high-quality service to a diverse set of clients and families.
6. Identify personal care business opportunities enhanced by community involvement, self-improvement and current trends.
7. Apply methods of obtaining feedback to understand expectations and promote high-quality personal care services standards.

### **Information Technology Career Cluster® (IT)**

1. Demonstrate effective professional communication skills and practices that enable positive customer relationships.
2. Use product or service design processes and guidelines to produce a quality information technology (IT) product or service.
3. Demonstrate the use of cross-functional teams in achieving IT project goals.
4. Demonstrate positive cyber citizenry by applying industry-accepted ethical practices and behaviors.
5. Explain the implications of IT on business development.
6. Describe trends in emerging and evolving computer technologies and their influence on IT practices.
7. Perform standard computer backup and restore procedures to protect IT information.
8. Recognize and analyze potential IT security threats to develop and maintain security requirements.
9. Describe quality assurance practices and methods employed in producing and providing quality IT products and services.
10. Describe the use of computer forensics to prevent and solve information technology crimes and security breaches.
11. Demonstrate knowledge of the hardware components associated with information systems.
12. Compare key functions and applications of software and determine maintenance strategies for computer systems.

### **Information Support & Services Career Pathway (IT-SUP)**

1. Provide technology support to maintain service.
2. Manage operating systems and software applications, including maintenance of upgrades, patches and service packs.
3. Apply appropriate troubleshooting techniques in resolving computer hardware, software and configuration problems.
4. Perform installation, configuration and maintenance of operating systems.
5. Demonstrate the use of networking concepts to develop a network.
6. Evaluate the effectiveness of an information system.
7. Employ system installation and maintenance skills to setup and maintain an information system.
8. Employ system administration and control skills to monitor the performance of an information system.
9. Employ technical writing and documentation skills in support of an information system.
10. Apply quality assurance processes to maximize information system operation.

### **Network Systems Career Pathway (IT-NET)**

1. Analyze customer or organizational network system needs and requirements.
2. Analyze wired and wireless network systems to determine if they meet specifications (e.g., IEEE, power, security).
3. Design a network system using technologies, tools and standards.
4. Perform network system installation and configuration.
5. Perform network administration, monitoring and support to maintain a network system.

### **Programming & Software Development Career Pathway (IT-PRG)**

1. Analyze customer software needs and requirements.
2. Demonstrate the use of industry-standard strategies and project planning to meet customer specifications.
3. Analyze system and software requirements to ensure maximum operating efficiency.
4. Demonstrate the effective use of software development tools to develop software applications.
5. Apply an appropriate software development process to design a software application.
6. Program a computer application using the appropriate programming language.
7. Demonstrate software testing procedures to ensure quality products.
8. Perform quality assurance tasks as part of the software development cycle.
9. Perform software maintenance and customer support functions.
10. Design, create and maintain a database.

### **Web & Digital Communications Career Pathway (IT-WD)**

1. Analyze customer requirements to design and develop a web or digital communication product.
2. Apply the design and development process to produce user-focused web and digital communications solutions.
3. Write product specifications that define the scope of work aligned to customer requirements.
4. Demonstrate the effective use of tools for digital communication production, development and project management.
5. Develop, administer and maintain web applications.
6. Design, create and publish a digital communication product based on customer needs.
7. Evaluate the functionality of a digital communication product using industry accepted techniques and metrics.
8. Implement quality assurance processes to deliver quality digital communication products and services.
9. Perform maintenance and customer support functions for digital communication products.
10. Comply with intellectual property laws, copyright laws and ethical practices when creating web/digital communications.

### **Law, Public Safety, Corrections & Security Career Cluster® (LW)**

1. Analyze the nature and scope of the Law, Public Safety, Corrections & Security Career Cluster and the role law, public safety, corrections and security play in society and the economy.
2. Formulate ideas, proposals and solutions to ensure effective and efficient delivery of law, public safety, corrections and/or security services.
3. Assess and implement measures to maintain safe and healthy working conditions in a law, public safety, corrections and/or security environment.
4. Conduct law, public safety, corrections and security work tasks in accordance with employee and employer rights, obligations and responsibilities, including occupational safety and health requirements.
5. Analyze the various laws, ordinances, regulations and organizational rules that apply to careers in law, public safety, corrections and security.
6. Describe various career opportunities and means to those opportunities in each of the Law, Public Safety, Corrections & Security Career Pathways.

### **Correction Services Career Pathway (LW-COR)**

1. Evaluate the correctional environment for signs of potential problems and/or danger.
2. Demonstrate leadership roles, responsibilities and collaboration in correctional environments.
3. Analyze the impact of federal, state and local laws on correctional facilities.
4. Describe the various roles and impacts of forensics and computer forensics in the resolution of crime in the correctional environment.
5. Describe the legal, regulatory and organizational guidelines governing the correction services.
6. Compare and contrast different career fields in the correction services.
7. Demonstrate effective communication skills (e.g., writing, speaking, active listening and nonverbal communication) in the correctional environment.
8. Analyze the techniques used to manage crisis situations and resolve conflicts in correctional environments.
9. Demonstrate the protocols regarding the reduction or elimination of sexual harassment or abuse in the correctional environment.
10. Analyze situations that require the use of force, including deadly force, to determine when varying degrees of force should be utilized in correctional facilities.
11. Analyze the impact of the Fourth, Fifth, Sixth and Fourteenth Amendments in the correction services environment.
12. Apply the ethical and legal responsibilities of correctional staff to various situations in the correction services environment.

13. Describe the knowledge and technical skills needed to carry out the day-to-day operations at a correctional facility.

#### **Emergency & Fire Management Services Career Pathway (LW-EFM)**

1. Demonstrate effective communication skills (e.g., writing, speaking, listening and nonverbal communication) while utilizing communications equipment and platforms common to emergency and fire management services.
2. Manage an incident scene as the first responder using emergency response skills.
3. Utilize up-to-date technology equipment and applications to facilitate the management of emergency and fire management situations.
4. Demonstrate an understanding of the objectives and a commitment to the mission of emergency and fire management services.
5. Execute safety procedures and protocols associated with local, state and federal regulations.
6. Develop an organizational professional growth plan including the development of team building and leadership skills within the emergency and fire management environment.
7. Describe the legal, regulatory and organizational guidelines governing emergency and fire management services.
8. Compare and contrast the different career fields in fire and emergency management services.
9. Execute protocols for handling emergency situations that range from minor medical and fire emergencies to area-wide incidents.
10. Demonstrate the use and various applications of the equipment commonly used in emergency and fire management services.
11. Implement an appropriate Incident Command System to effectively manage an incident scene.
12. Use common codes and icons to properly handle and transport potentially hazardous substances in fire and medical emergency scenes.
13. Implement public relations plans to enhance public awareness and safety in fire and emergency situations.
14. Describe the elements and issues involved in using the preparedness and response systems available to manage large-scale disasters.
15. Analyze the key functions and techniques of critical infrastructure protection in cases of terrorism and/or natural disasters.

#### **Law Enforcement Services Career Pathway (LW-ENF)**

1. Demonstrate effective communication skills (e.g., writing, speaking, listening and nonverbal communication) required in law enforcement.
2. Demonstrate proficiency in the operation of communications equipment used in an emergency telecommunications center.
3. Utilize anger and conflict management strategies to resolve problems in law enforcement settings.
4. Model behaviors that exhibit integrity and commitment to a code of conduct and ethics for law enforcement professionals.
5. Analyze the impact of federal, state and local laws on law enforcement procedures.
6. Execute established procedures to avoid the violation of the rights guaranteed by the Fourth, Fifth, Sixth and Fourteenth Amendments.
7. Manage crime and loss prevention programs in collaboration with the community.
8. Explain the appropriate techniques for managing crisis situations in order to maintain public safety.
9. Evaluate for the signs of domestic violence, child abuse and neglect.
10. Demonstrate the routine day-to-day tasks conducted by various law enforcement agencies.
11. Describe law enforcement protocols and procedures designed to handle incidents related to homeland security, terrorism and other disaster situations.
12. Demonstrate the procedures to properly protect, document and process the crime scene and all related evidence.
13. Demonstrate procedures to assist individuals requiring special assistance from law enforcement personnel.
14. Describe the behavioral symptoms of drug use and the inherent dangers associated with handling dangerous drugs.

#### **Legal Services Career Pathway (LW-LEG)**

1. Demonstrate effective communication skills (writing, speaking, listening and nonverbal communication) in the legal services environment.
2. Interpret nonverbal communication cues in order to discern facts from fabrication.
3. Produce written legal materials using writing strategies applicable to the legal services environment.
4. Apply information technology tools to perform daily tasks assigned to legal services professionals.
5. Analyze the role forensics plays in preventing and solving crimes.
6. Use legal terminology to communicate within the legal services community.
7. Compare and contrast different career fields in the legal services.
8. Analyze the influence of the three branches of the U.S. Government (judicial, legislative and executive) on the legal services.

17

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9. Analyze the impact of the Fourth, Fifth, Sixth and Fourteenth Amendments on the provision of legal services.

#### **Security & Protective Services Career Pathway (LW-SEC)**

1. Demonstrate effective communication skills (e.g., writing, speaking, listening and nonverbal communication) when communicating security-related directives, technical concepts and other information.
2. Utilize conflict resolution skills to resolve conflicts among individuals.
3. Compare and contrast the roles, responsibilities, tools and techniques of the criminal justice and security fields.
4. Describe the legal, regulatory and organizational guidelines governing the security and protective services.
5. Analyze the impact of federal, state and local laws on the security and protective services field.
6. Apply ethical and legal responsibilities of security and protective services personnel to various situations in the security and protective services field.
7. Analyze the impact of the Fourth, Fifth, Sixth and Fourteenth Amendments on the security and protective services.
8. Compare and contrast the different career fields in the security and protective services.
9. Evaluate the application and relevance of crime prevention concepts and security assessments to security and protective services functions.
10. Explain the application of risk management principles to the protection of assets in various settings.
11. Describe the importance of utilizing good public relations techniques and building relationships in security and crisis situations.
12. Describe the role of security systems in an overall security strategy.
13. Explain the duties of security and protective services personnel in terrorism, homeland security and disaster preparedness.
14. Apply basic management principles for the effective supervision and management of a security force or an organization's security program.
15. Perform the roles and responsibilities of a security officer, including basic incident response.
16. Compare types and techniques of security approaches within the public and private sectors.
17. Demonstrate the concepts and techniques used to ensure the security of information-based and intangible assets.
18. Summarize the importance and roles of intelligence analysis in crime prevention and homeland security.

#### **Manufacturing Career Cluster® (MN)**

1. Evaluate the nature and scope of the Manufacturing Career Cluster and the role of manufacturing in society and in the economy.
2. Analyze and summarize how manufacturing businesses improve performance.
3. Comply with federal, state and local regulations to ensure worker safety and health and environmental work practices.
4. Describe career opportunities and means to achieve those opportunities in each of the Manufacturing Career Pathways.
5. Describe government policies and industry standards that apply to manufacturing.
6. Demonstrate workplace knowledge and skills common to manufacturing.

#### **Health, Safety, & Environmental Assurance Career Pathway (MN-HSE)**

1. Demonstrate the safe use of manufacturing equipment.
2. Develop safety plans for production processes that meet health, safety and environmental standards.
3. Demonstrate a safety inspection process to assure a healthy and safe manufacturing environment.
4. Evaluate a system of health, safety and/or environmental programs, projects, policies or procedures to determine compliance.
5. Evaluate continuous improvement protocols and techniques in health, safety and/or environmental practices.
6. Conduct job safety and health analysis for manufacturing jobs, equipment and processes.
7. Develop the components of a training program based on environmental health and safety regulations.

#### **Logistics & Inventory Control Career Pathway (MN-LOG)**

1. Demonstrate positive customer service skills in regard to logistics and inventory control issues.
2. Demonstrate proper handling of products and materials in a manufacturing facility.
3. Develop a safety inspection process to assure a healthy and safe manufacturing facility.
4. Manage inventory using logistics and control processes and procedures.

### **Maintenance, Installation, & Repair Career Pathway (MN-MIR)**

1. Demonstrate maintenance skills and proficient operation of equipment to maximize manufacturing performance.
2. Demonstrate the safe use of manufacturing equipment to ensure a safe and healthy environment.
3. Diagnose equipment problems and effectively repair manufacturing equipment.
4. Investigate and employ techniques to maximize manufacturing equipment performance.
5. Implement a preventative maintenance schedule to maintain manufacturing equipment, tools and workstations.
6. Implement an effective, predictive and preventive manufacturing equipment maintenance program.

### **Manufacturing Production Process Development Career Pathway (MN-PPD)**

1. Produce quality products that meet manufacturing standards and exceed customer satisfaction.
2. Research, design and implement alternative manufacturing processes to manage production of new and/or improved products.
3. Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
4. Implement continuous improvement processes in order to maintain quality within manufacturing production.
5. Develop procedures to create products that meet customer needs.

### **Production Career Pathway (MN-PRO)**

1. Diagnose production process problems and take corrective action to meet production quality standards.
2. Manage safe and healthy production working conditions and environmental risks.
3. Make continuous improvement recommendations based on results of production process audits and inspections.
4. Coordinate work teams when producing products to enhance production process and performance.
5. Demonstrate the safe use of manufacturing equipment.

### **Quality Assurance Career Pathway (MN-QA)**

1. Evaluate production operations for product and process quality.
2. Recommend and implement continuous improvement in manufacturing processes.
3. Coordinate work teams to create a product that meets quality assurance standards.
4. Employ project management processes using data and tools to deliver quality, value-added products.
5. Perform safety inspections and training to ensure a safe and healthy workplace.
6. Implement continuous improvement processes to maintain quality products.
7. Identify inspection processes that ensure products meet quality specifications.

### **Marketing Career Cluster® (MK)**

1. Describe the impact of economics, economics systems and entrepreneurship on marketing.
2. Implement marketing research to obtain and evaluate information for the creation of a marketing plan.
3. Plan, monitor, manage and maintain the use of financial resources for marketing activities.
4. Plan, monitor and manage the day-to-day activities required for continued marketing business operations.
5. Describe career opportunities and the means to achieve those opportunities in each of the Marketing Career Pathways.
6. Select, monitor and manage sales and distribution channels.
7. Determine and adjust prices to maximize return while maintaining customer perception of value.
8. Obtain, develop, maintain and improve a product or service mix in response to market opportunities.
9. Communicate information about products, services, images and/or ideas to achieve a desired outcome.
10. Use marketing strategies and processes to determine and meet client needs and wants.

### **Marketing Communications Career Pathway (MK-COM)**

1. Apply techniques and strategies to convey ideas and information through marketing communications.
2. Plan, manage and monitor day-to-day activities of marketing communications operations.
3. Access, evaluate and disseminate information to enhance marketing decision-making processes.
4. Obtain, develop, maintain and improve a marketing communications product or service mix to respond to market opportunities.
5. Communicate information about products, services, images and/or ideas to achieve a desired outcome.

#### **Marketing Management Career Pathway (MK-MGT)**

1. Plan, organize and lead marketing staff to achieve business goals.
2. Plan, manage and monitor day-to-day marketing management operations.
3. Plan, manage and organize to meet the requirements of the marketing plan.
4. Access, evaluate and disseminate information to aid in making marketing management decisions.
5. Determine and adjust prices to maximize return and meet customers' perceptions of value.
6. Obtain, develop, maintain and improve a product or service mix in response to market opportunities.
7. Communicate information about products, services, images and/or ideas.

#### **Marketing Research Career Pathway (MK-RES)**

1. Plan, organize and manage day-to-day marketing research activities.
2. Design and conduct research activities to facilitate marketing business decisions.
3. Use information systems and tools to make marketing research decisions.

#### **Merchandising Career Pathway (MK-MER)**

1. Plan, organize and lead merchandising staff to enhance selling and merchandising skills.
2. Plan, manage and monitor day-to-day merchandising activities.
3. Move, store, locate and/or transfer ownership of retail goods and services.
4. Access, evaluate and disseminate marketing information to facilitate merchandising decisions and activities.
5. Determine and adjust prices to maximize return and meet customers' perceptions of value.
6. Obtain, develop, maintain and improve a product or service mix to respond to market opportunities.
7. Communicate information about retail products, services, images and/or ideas.
8. Create and manage merchandising activities that provide for client needs and wants.

#### **Professional Sales Career Pathway (MK-SAL)**

1. Access, evaluate and disseminate sales information.
2. Apply sales techniques to meet client needs and wants.
3. Plan, organize and lead sales staff to enhance sales goals.

#### **Science, Technology, Engineering & Mathematics Career Cluster® (ST)**

1. Apply engineering skills in a project that requires project management, process control and quality assurance.
2. Use technology to acquire, manipulate, analyze and report data.
3. Describe and follow safety, health and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.
4. Understand the nature and scope of the Science, Technology, Engineering & Mathematics Career Cluster and the role of STEM in society and the economy.
5. Demonstrate an understanding of the breadth of career opportunities and means to those opportunities in each of the Science, Technology, Engineering & Mathematics Career Pathways.
6. Demonstrate technical skills needed in a chosen STEM field.

#### **Engineering & Technology Career Pathway (ST-ET)**

1. Use STEM concepts and processes to solve problems involving design and/or production.
2. Display and communicate STEM information.
3. Apply processes and concepts for the use of technological tools in STEM.
4. Apply the elements of the design process.
5. Apply the knowledge learned in STEM to solve problems.
6. Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

#### **Science & Mathematics Career Pathway (ST-SM)**

1. Apply science and mathematics to provide results, answers and algorithms for engineering and technological activities.
2. Apply science and mathematics concepts to the development of plans, processes and projects that address real-world problems.
3. Analyze the impact that science and mathematics has on society.
4. Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.



### **Transportation, Distribution & Logistics Career Cluster® (TD)**

1. Describe the nature and scope of the Transportation, Distribution & Logistics Career Cluster and the role of transportation, distribution and logistics in society and the economy.
2. Describe the application and use of new and emerging advanced techniques to provide solutions for transportation, distribution and logistics problems.
3. Describe the key operational activities required of successful transportation, distribution and logistics facilities.
4. Identify governmental policies and procedures for transportation, distribution and logistics facilities.
5. Describe transportation, distribution and logistics employee rights and responsibilities and employers' obligations concerning occupational safety and health.
6. Describe career opportunities and means to achieve those opportunities in each of the Transportation, Distribution & Logistics Career Pathways.

#### **Facility & Mobile Equipment Maintenance Career Pathway (TD-MTN)**

1. Develop preventative maintenance plans and systems to keep facility and mobile equipment inventory in operation.
2. Design ways to improve facility and equipment system performance.

#### **Health, Safety, & Environmental Management Career Pathway (TD-HSE)**

1. Describe the health, safety and environmental rules and regulations in transportation, distribution and logistics workplaces.
2. Develop solutions to improve performance of health, safety and environmental management services.

#### **Logistics Planning & Management Services Career Pathway (TD-LOG)**

1. Develop solutions to provide and manage logistics services for the company and customers.
2. Analyze and improve performance of logistics systems to provide logistics planning and management services.

#### **Sales & Service Career Pathway (TD-SAL)**

1. Analyze the ongoing performance of transportation, logistics and distribution-related sales and service operations.
2. Demonstrate the use of sales and ongoing service of products and services that are transportation related to promote development of existing and future clients and customers.

#### **Transportation Operations Career Pathway (TD-OPS)**

1. Develop and evaluate transportation plans to move people and/or goods to meet customer requirements.
2. Analyze performance of transportation operations in order to improve quality and service levels and increase efficiency.
3. Comply with policies, laws and regulations in order to maintain safety, security and health and mitigate the economic and environmental risk of transportation operations.

#### **Transportation Systems / Infrastructure Planning, Management & Regulation Career Pathway (TD-SYS)**

1. Develop plans to maintain and/or improve the transportation infrastructure.
2. Assess, plan and manage the implementation of transportation services.
3. Describe ways to improve the system utilization, flow, safety and environmental performance of transportation systems.

#### **Warehousing & Distribution Center Operations Career Pathway (TD-WAR)**

1. Demonstrate efficient and effective warehouse and distribution center operations.
2. Describe ways to improve the performance of warehouse and distribution operations.
3. Analyze compliance with company policies and government laws and regulations in warehouse and distribution operations.

The CCTC is being coordinated by the National Association of State Directors of Career Technical Education Consortium (NASDCTEc), which represents the state and territory heads of secondary, postsecondary and adult CTE across the nation.

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# Textbooks

## **Advanced Automotive Technology**

Halderman, James D. *Automotive Technology: Principles, Diagnosis, and Service*. 6<sup>th</sup> edition, Pearson, 2019

Halderman, James D., and Darrell Deeter. *Introduction to Automotive Service*. Pearson, 2013

## **Basic Automotive Technology 1A/1B**

## **Diesel Operations and Technology 1A/1B**

Heard, Scott. *Heavy Duty Equipment Technology*. Pearson, 2015.

## **Introduction to Collision Repair**

Duffy, James E. *Auto Body Repair Technology*. 5<sup>th</sup> edition, Goodheart-Willcox, 2009

Duffy, James E. *Professional Automotive Collision Repair*. 2<sup>nd</sup> edition, Delmar, 2001.

## **Non-Structural Analysis and Damage Repair 1A/1B**

Duffy, James E. *Auto Body Repair Technology*. 5<sup>th</sup> edition, Goodheart-Willcox, 2009

## **Painting and Refinishing 1A/1B**

Duffy, James E. *Auto Body Repair Technology*. 5<sup>th</sup> edition, Goodheart-Willcox, 2009

## **Plastics and Refinishing 1A/1B**

Duffy, James E. *Auto Body Repair Technology*. 5<sup>th</sup> edition, Goodheart-Willcox, 2009

## **Small Engines 1A/1B and 2A/2B**

Roth, Alfred. *Small Gas Engines*. Goodheart-Wilcox.

Senn, Harry. *Two-Stroke Engines*. Goodheart-Willcox.

## **Structural Analysis and Damage Repair 1A/1B**

Duffy, James E. *Auto Body Repair Technology*. 5<sup>th</sup> edition, Goodheart-Willcox, 2009



# Tool Lists

# Automotive Technology Tool List

Suggested tools for the following courses:

*Small Engines 1A/1B*

*Small Engines 2A/2B*

*Basic Automotive Technology 1A/1B*

*Advanced Automotive Technology*

HAND TOOLS			
(Contained in individual sets or the tool crib in sufficient quantities to permit efficient instruction)			
	Air Blow Gun (meeting OSHA requirements)		Plastic Tip
	Allen (Wrench or Socket) Set - Standard (.050"-3/8")		Rubber Mallet
	Allen (Wrench or Socket) Set - Metric (2mm - 8mm, 10mm, 12mm)		Inspection Mirror
	Battery Post Cleaner		Magnetic Pickup Tool
	Battery Terminal Pliers		Pliers:
	Battery Terminal Puller		Combination 6"
	Chisels:		Hose Clamp
	Cape 5/16"		Locking Jaw
	Cold 3/8", 3/4"		Needle Nose 6"
	Chisel Holder		Side Cutting
	Claw Type Pickup Tool		Slip Joint (Water Pump)
	Combination Wrenches:		Pry Bars:
	Standard (1/4" – 1 1/4") (optional)		Rolling Head
	Metric (7mm - 24mm)		Straight
	Crowfoot Wrench Set - Metric		Punches:
	Crowfoot Wrench Set – Standard (optional)		Center
	Ear Protection		Brass Drift
	Feeler Gauge (Blade Type):		Pin 1/8", 3/16", 1/4", 5/16 "
	.002" - .040"		Taper 3/8", 1/2", 5/8"
	.006mm - .070mm		Safety Glasses (meeting OSHA requirements)
	Files:		Scraper:
	Coarse 6" and 12"		Plastic
	Fine 6" and 12"		Gasket 1"
	Half Round 12"		Screwdriver - Blade Type:
	Round 6" and 12"		Stubby
	Flare Nut (tubing) Wrenches:		6", 9", 12"
	3/8" - 3/4"		Offset
	10mm - 17mm		Screwdriver - Phillips:
	Flashlight		Stubby #1, #2

	Fuse Puller
	Fused Jumper Wire Set (with various adapters)
	Hack Saw
	Hammers:
	16 oz. Ball Peen
	Brass
	Dead Blow Plastic Mallet
	Socket Set - 1/4" Drive (continued)
	6mm - 12mm Standard Depth
	6mm - 12mm Deep
	Ratchet
	Socket Set - 3/8" Drive:
	5/16" - 3/4" Standard Depth (6 point)(optional)
	3/8" - 3/4" Deep (6 point)(optional)
	10mm - 19mm Standard Depth
	10mm - 19mm Deep
	3", 5", 10" Extensions
	Flexhead Ratchet
	Ratchet
	Spark Plug Sockets 5/8", 13/16", 9/16"
	Spark Plug Sockets 14mm
	Speed Handle
	Universal Joint
	Flexible Socket Set 3/8" - 3/4"
	Flexible Socket Set 10mm - 19mm

	6" #1, #2
	12" #3
	Offset #2
	Screwdriver - Impact Driver Set
	Socket Set - 1/4" Drive:
	1/4" - 1/2" Standard Depth (optional)
	1/4" - 1/2" Deep (optional)
	Socket Set - 1/2" Drive:
	7/16" - 1 1/8" Standard Depth (optional)
	7/16" - 1 1/8" Deep (optional)
	10mm - 24mm Standard Depth
	10mm - 24mm Deep
	3", 6", 12" Extensions
	Flex Handle (Breaker Bar)
	Ratchet
	Spark Plug Feeler Gauge (Gap Tool)
	Tape Measure – Standard and Metric
	Test Light (12V and self-powered)
	Tire Pressure Gauge
	Tire Tread Depth Gauge
	Torque Wrench:
	3/8" Drive (10 - 250 lb. in.)
	3/8" Drive (5 - 75 lb. ft.)
	1/2" Drive (50 - 250 lb. ft.)
	Torx® Set (screwdrivers and/or sockets):
	T-8 to T-60
	Wire Brush

## GENERAL LAB/SHOP EQUIPMENT

The tools and equipment on this list are used in general lab/shop work but are not generally considered to be individually owned hand tools. A well-equipped, accredited program should have all these general tools and equipment readily available and in sufficient quantity to provide quality instruction.

Air Chisel Set (various bits)	Hand Held Vacuum Pump
Air Compressor and Hoses	Hoist(s)
Air Pressure Regulator	Hood Prop
Air Ratchet (3/8" drive)	Hydraulic Press with adapters
Automotive Stethoscope (electronic recommended)	Impact Socket Sets - 3/8" Drive (Standard - optional)
Axle Stands (Jack Stands)	Impact Socket Sets – 3/8 Drive (8mm-19mm)
Axle Support Stands (Screw Jacks)	Impact Sockets - 1/2" Drive (7/16" - 1 1/8") (optional)
Battery Charger	Impact Sockets - 1/2" Drive (12mm – 24mm)
Battery/Starter/Charging System Tester	Impact Sockets – 1/2" Drive Deep (30 mm, 32 mm, 36mm)
Bearing Packer (hand operated)	Impact Wrench - 1/2" Drive
Belt Tension Gauge	Impact Wrench - 3/8" Drive
Bench or Pedestal Grinder	Jumper Cables
Coolant/Combustion Gas Detector (recommended)	Master Puller Set
Coolant Tester	Micrometer (Depth)
Cooling System Pressure Tester and Adapters	Micrometers - (Outside Type) 0-1", 1-2", 2-3", 3-4", 4-5"
Creeper	Oil Can - Pump Type
Cylinder Leakage Tester	Oil Filter Wrench and Sockets
Dial Indicator with Flex Arm and Clamp Base	Oxy-Acetylene Torch Set
Digital Multimeter (DMM) with various lead sets (sufficient quantities to meet instruction goals)	Parts Cleaning Tank and Gloves (non-solvent based cleanser suggested)
Drain Pans	Remote Starter Switch
Drill - 3/8" variable speed, reversible	Scan Tool OBDII w/CAN capability or Personal Computer (PC) with equivalent interface (appropriate capability to support tasks taught)
Drill - 1/2" variable speed, reversible	Screw Extractor Set
Electric Heat Gun	Seat Covers
Engine Coolant Recovery Equipment or Recycler or Coolant Disposal Contract Service	Serpentine Belt Tensioner Tools
Extension Cords	Snap Ring Pliers Set - external



## SPECIALTY TOOLS AND EQUIPMENT

### WITHIN EACH ACCREDITATION CATEGORY

This section covers the tools and equipment a lab/shop should have for training in any given specialty area. This equipment is specialized and it must be available in the lab/shop or to the program. No specific type or brand names are identified because they will vary in each local situation.

*For all tasks which are taught in the program, the training should be as thorough as possible with the tools and equipment necessary for those tasks. In other words, if a program does not teach a particular task, the tool from the tool list associated with that task is not required.*

## MAINTENANCE & LIGHT REPAIR

### SUSPENSION & STEERING

	Brake Pedal Depressor
	Hand Grease Gun
	Shock Absorber Tools
	Spring Compressor Tool
	Tire Mounting Machine (rim clamp type)
	Tire Pressure Monitoring System Tool (TPMS) as appropriate
	Tire Patching Tools and Supplies
	Wheel Balancer - Electronic Type
	Wheel Weight Pliers

### ENGINE PERFORMANCE

	Compression Tester
	Cylinder Power Balance Tester (scan tool/manual method)
	Infrared Thermometer (or appropriate substitute)
	Vacuum/Pressure Gauge

### ELECTRICAL/ELECTRONIC SYSTEMS

	Connector Pick Tool Set
	Molding and Trim Removal Tool(s)
	Headlight Aimer or Screen
	Heat Gun (or equivalent for heat shrinking operations)
	Wire and Terminal Repair Kit

### BRAKES

	Bearing Seal and Race Driver Set
	Brake Bleeder (Pressure or Vacuum)
	Brake Disc Micrometer
	Brake Drum Micrometer and Calibration Equipment
	Brake Fluid Test Strips or Kit
	Brake Lathe (bench with disc and drum service attachments)
	Brake Lathe (on car)
	Brake Shoe Adjusting Gauge
	Brake Spring Remover/Installer
	Brake Spring Pliers
	Brake Spoon
	Piston Retraction Set
	Wheel Stud Service Kit

### MANUAL DRIVE TRAIN AND AXLES

	Axle Nut Socket Set (or equivalent)
	Spindle Rethreader Die Set
	Universal Joint Tools

### ENGINE REPAIR

	Antifreeze/Coolant Tester

# AUTOMOBILE SERVICE TECHNOLOGY

SUSPENSION & STEERING		BRAKES	
	Ball Joint Press and other Special Tools		Bearing Seal and Race Driver Set
	Brake Pedal Depressor		Brake Bleeder (Pressure or Vacuum)
	Bushing Driver Set		Brake Disc Micrometer
	Coil Spring Compressor Tool		Brake Drum Micrometer and Calibration Equipment
	Chassis Ear (recommended)		Brake Fluid Test Strips or Kit
	Frame Angle Gauge or Portable Digital Protractor (appropriate for tasks being taught)		Brake Lathe (bench with disc and drum service attachments)
	Hand Grease Gun		Brake Lathe (on car)
	Inner Tie Rod End Tool		Brake Shoe Adjusting Gauge
	Pitman Arm Puller		Brake Spring Remover/Installer
	Power Steering Pump Pulley Special Tool Set (appropriate for tasks being taught)		Brake Spring Pliers
	Shock Absorber Tools		Brake Spoon
	Steering Angle Gauge or Portable Digital Protractor (appropriate for tasks being taught)		Caliper Piston Retraction Set
	Steering Column Special Tool Set (appropriate for teaching tasks being utilized)		Master Cylinder Bleeder Kit
	Strut Spring Compressor Tool		Wheel Stud Service Kit
	Tie Rod Puller		
	Tire Mounting Machine	<b>ELECTRICAL/ELECTRONIC SYSTEMS</b>	
	Tire Patching Tools and Supplies		Connector Pick Tool Set
	Tire Pressure Monitoring System (TPMS) Tool (appropriate for tasks being taught)		Molding and Trim Tool(s)
	Wheel Alignment Equipment-4 wheel (including alignment tools)		Headlight Aimer or Screen
	Wheel Balancer - Electronic Type		Heat Gun (or equivalent for heat shrinking operations)
	Wheel Weight Pliers		Terminal Tension (Pin Drag) Test Kit/Terminal Probe Kit (or equivalent)
			Wire and Terminal Repair Kit



<b>AUTOMATIC TRANSMISSION/TRANSAXLE</b>	
	Transmission Jack(s)
	Transmission/Transaxle Flushing Equipment (recommended)
	Transmission/Transaxle Holding Fixtures
	Transmission/Transaxle Removal and Installation Equipment
	Transmission/Transaxle Special Tool Sets (appropriate for units being utilized)


## AUTOMOBILE SERVICE TECHNOLOGY (cont.)

<b>HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)</b>	
	A/C Compressor Clutch Service Tools
	A/C Service Port Adapter Set
	Dye Injection Kit
	Hygrometer
	A/C Leak Detector (to meet current industry standard)
	A/C Manifold Gauge Set or equivalent (to meet current industry standard)
	A/C Refrigerant Recovery/Recycling/Recharging Station (to meet current industry standard)
	Thermometer(s) (digital)
	A/C Sealant Detector Kit
<b>MANUAL DRIVE TRAIN AND AXLES</b>	
	Axle Nut Socket Set (or equivalent)
	Clutch Alignment Set
	Clutch Pilot Bearing/Bushing Puller/Installer
	Constant Velocity Joint (CV) Service Tools:
	Boot Installation Tool
	Boot Clamp Pliers or Crimping Ring
	Engine Support Fixture
	Rotating Torque Wrench (beam-type or equivalent)
	Universal Joint Tools
	Spindle Rethreader Die Set

<b>ENGINE PERFORMANCE</b>	
	Cylinder Power Balance Tester (Scan Tool/Manual Method)
	Evaporative Emissions Control System (EVAP)
	Fuel Injection Pressure Gauge Sets with Adapters
	Infrared Thermometer (or appropriate substitute)
	Injector Pulse Tester
	Leak Detector (Smoke or Nitrogen)
	Logic Probe (suggested)
	Oxygen Sensor Socket
	Pinch-off Pliers
	Sending Unit Socket(s)
	Spark Plug Thread Tap
	Spark Tester
	Vacuum/Pressure Gauge
<b>ENGINE REPAIR</b>	
	Antifreeze/Coolant Tester
	Oil Pressure Gauge
	Straight Edge
	Torque Angle Gauge

# Collision Repair – Basic Tool List

For the following courses:

*Introduction to Collision Repair*

*Structural Analysis and Damage Repair 1A/1B*

*Non-Structural Analysis and Damage Repair 1A/1B*

*Painting and Refinishing 1A/1B*

*Plastics and Adhesives 1A/1B*

**C** = Suggested Tools for *Intro to Collision Repair, Structural Analysis and Damage Repair 1A/1B, and Non-Structural Analysis and Damage Repair 1A/1B*

**R** = Suggested Tools for *Painting and Refinishing 1A/1B and Plastics and Adhesives 1A/1B*

**O** = Optional Tools

- C/R 1. Rollaway toolbox large enough to hold tools
- C 2. Combination wrench set (metric 7mm-19mm)
- C 3. Hex wrench set (standard 1/16-3/8)
- C 4. Hex wrench set (metric 1.5mm-8mm)
- C 5. Adjustable 12' wrench (Crescent wrench)
- C 6. Socket set deep 1/4" drive (Metric 7mm-13mm)
- C 7. Socket set Deep 3/8" drive (Metric 10mm-19mm)
- C 8. Standard Socket set 3/8" drive (metric 10mm-19mm)
- C 9. Adapter 3/8" female to 1/4" male
- C 10. Torx Socket set 1/4" or 3/8" drive (10-50)
- C 11. Ratchet 1/4" drive
- C 12. Ratchet 3/8" drive
- C 13. Extensions 1/4" drive (2", 4", and 6")
- C 14. Extensions 3/8" drive (3", 4", and 8")
- C 15. Universal joint 3/8" drive
- C 16. Universal Joint 1/4" drive
- C 17. Screwdrivers, flat tip, 4 or 5 piece set
- C 18. Screwdrivers, Phillips (sizes #1, #2, #3 and #2 Stubby)
- O 19. Hacksaw, adjustable
- C 20. Pliers, needle nose
- C 21. Pliers, slip joint, 8"
- C 22. Pliers, locking (vice grips 4 piece set)
- C 23. Center punch
- C/R 24. Blowgun (OSHA Approved)
- C 25. Snips, tinnerns, straight cut
- C 26. Trouble Light
- C/R 27. Flashlight
- C/R 28. Extension cord 12 gauge (25 ft.)
- C 29. 7 piece body hammer & dolly set
- C 30. Hammer, ball pen 30-32 oz.
- C 31. Spoon, light dinging
- C 32. Tape measure inch/metric 12'
- C/R 33. Scraper with blade (razor blade single)
- C 34. Trim panel removal tool
- O 35. Release tool, manual window crank

- C 36. Wire Brush
- C/R 37. Putty knife, 1" wide
- C/R 38. Air hose 3/8 "x 50 ft.
- C 39. Drill bit set (1/8"-1/2") for steel
- C/R 40. Orbital palm sander (DA sander) with 6" pad
- C 41. Drill variable speed with 3/8" chuck
- O 42. 1/4" cordless impact driver
- O 43. 1/4" impact bits (screwdriver type)
- C/R 44. Magnetic pickup tool
- C 45. High-speed cut-off tool with guard
- C 46. 1/4" 90-degree grinder with roloc backing pad
- C 47. Welding gloves
- C 48. Mechanic gloves
- C/R 49. Coveralls
- C/R 50. Safety glasses
- C/R 51. Safety goggles
- C 52. Welding helmet (auto darkening)
- C/R 53. Hearing protectors
- R 54. Respirator, painting (NIOSH approved)
- C/R 55. Disposable dust masks
- C/R 56. Mixing palate (mud board)
- C/R 57. Plastic spreaders (for body filler)
- C/R 58. Sanding block set for sticky type pater 12", 6" and round (durablocks preferred)
- C/R 59. Coupler, Airline (type T)
- C/R 60. Nipples, Airline Female (NPT type T)-3 each
- C/R 61. Nipples, Airline Male (NPT type T) enough for personal air tools
- C 62. Seam Buster, straight (Steck)
- C 63. Seam Buster, 90-degree (Steck)
- R 64. Latex exam gloves (disposable)
- R 65. Paint Suit with hood
- O 66. Unispotter (Stud Gun)
- O 67. Hood Prop
- O 68. Antenna sockets
- O 69. Creeper
- R 70. Spray gun, Gravity feed, 1.3 tip HVLP or RP current model of Sata, Iwata, or DeVillbiss  
(If considering a spray gun other than listed please see instructor)
- R 71. Primer gun, HVLP 1.7 tip
- R 72. Spray gun air regulator
- R 73. Q-tips (Paper or wood shaft for solvent resistance)
- R 74. Spray gun cleaning kit
- C/R 75. Spray bottle for water
- C/R 76. Leather work boots
- C/R 77. Text Book
- C/R 78. Notebook
- C/R 79. Writing utensils (Pens, Pencils, etc.)

# Diesel Technology Tool List

Suggested Tools for the following courses:

*Diesel Operations & Technology 1A/1B*

1. On selection of tool box, it should be large enough to allow separation of tools to allow student to work efficiently without spending unnecessary time locating proper tool.
2. Tools should always be kept clean and in good proper condition.
3. All tools should be marked with a personal identification mark.
4. Extra tools may be suggested if need arises.

Insurance coverage of tools and other personal items is the responsibility of the student.

## **3 Drawer or Larger Top Chest with Bottom Box**

## **Flashlight**

## **Nitrile Disposable Gloves**

## **1/4" Drive Socket Set**

3/16" – 1/2" Standard Depth  
3/16" – 1/2" Deep  
4mm – 13mm Standard Depth  
4mm – 13mm Deep  
Extensions Short, Medium, Long  
Ratchet Handle  
Universal Joint

## **3/8" Drive Socket Set**

3/8" – 3/4" Standard Depth 12 Point  
3/8" – 3/4" Deep 6 Point  
10mm – 19mm Standard Depth  
10mm – 19mm Deep  
Extensions Short, Medium, Long  
Ratchet Handle  
Universal Joint  
3/8" – 3/4" Sq Dr Flexible Socket  
Torque Wrench 0-250 in-lb.

## **1/2" Drive Socket Set**

1/2" – 1 1/8" Shallow  
1/2" – 1 1/8" Deep  
13mm – 32mm Shallow  
13mm – 32mm Deep  
Sq Dr Stud Remover Tool  
Breaker Bar  
Extensions Short, Medium, Long  
Ratchet Handle  
Universal Joint  
Torque Wrench 0-250 ft-lb.

## **Combination Wrenches**

Standard 3/8" – 1 1/4"  
Metric 6mm – 26mm

## **Flare Nut Wrenches**

Standard 3/8" – 3/4"  
Metric 7mm – 19mm

## **Adjustable Wrenches**

1 – 8"  
1 – 12"

## **Allen Wrench Sets**

Standard .050" – 3/8"  
Metric 2mm – 12mm

## **Torx Wrench Set**

T – 15 to T – 55

## **Pipe Wrench 10" or 14"**

## **20" Reversing Chain Wrench**

## **Pliers**

Adjustable Joint  
Locking Pliers  
Needle Nose  
Side Cutters  
Slip-joint  
Snap Ring  
Small Reversible  
Large Reversible  
Flat w/ 1 3/4" min. opening  
Brake Spring  
Battery Nut

**Files**

12" Fine  
12" Coarse  
Round  
Half Round  
6" Triangle

**Screwdrivers****Blade Type**

1"  
6"  
9"  
12"  
Offset

**Phillips**

1" #2  
6" #1, #2  
12" #3

**Hammers****Ball Peen**

16 oz.  
24 oz.

**Plastic**

2 ½ lb h. d.

**Punches**

Pin 3/16" – 3/8"  
Center 5"  
Cold Chisel  
3/8" Blade – 5" Length  
5/8" Blade – 6" Length  
7/8" Blade – 7" Length  
Starter 3/16" – 3/8"  
Brass Punch

**Feeler Gauges**

.005" - .050"  
.005mm - .070mm

**Miscellaneous**

Rolling Head Pry Bar  
15" Aligning Bar  
Filter Wrench  
Gasket Scraper 1" Wide  
Hacksaw  
Battery Post Cleaner  
Battery Terminal Clamp Puller  
Digital Multimeter (Fluke 73 Series)  
Crimp/Stripper Tool  
Set Starter – Jumper Wires w/ Clips  
Valve Core Replacement Tool  
Pair Safety Glasses  
Pair Work Gloves  
Flashlight  
Tire Gauge (truck-type)  
Tire Air Chuck  
O-ring Pick Set  
Hearing protection  
Cotter Key Extractor  
Extractor Set (Broken Bolt)  
Drill Bits 1/16" – 1/2"  
Wire Brush  
Measuring Tape 12 Foot  
Knife  
Flexible Retrieving and Holding Tool  
Magnetic Pickup Tool (Telescoping)  
Inspection Mirror (Adjustable All Angle)  
Dial caliper

