

Transportation



Operations

Systems
Diagnostics,
Service, and
Repair

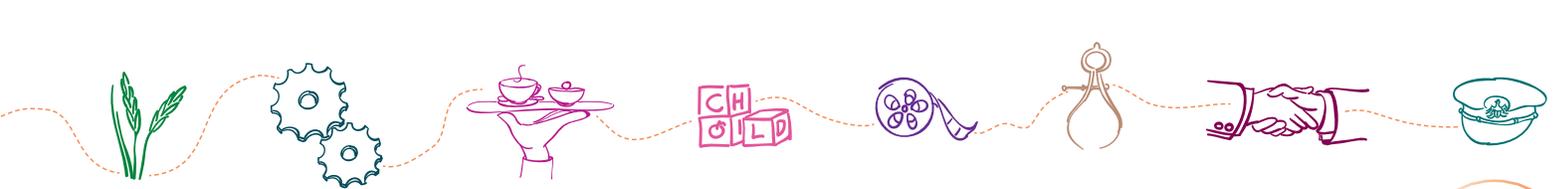
Structural Repair
and Refinishing





Table of Contents Transportation

Sector Description	1
Knowledge and Performance Anchor Standards	2
1.0 Academics.....	2
2.0 Communications.....	2
3.0 Career Planning and Management.....	2
4.0 Technology.....	3
5.0 Problem Solving and Critical Thinking.....	3
6.0 Health and Safety.....	3
7.0 Responsibility and Flexibility.....	4
8.0 Ethics and Legal Responsibilities.....	4
9.0 Leadership and Teamwork.....	5
10.0 Technical Knowledge and Skills.....	5
11.0 Demonstration and Application.....	5
Pathway Standards	7
A. Operations Pathway.....	7
B. Structural Repair and Refinishing Pathway.....	10
C. Systems Diagnostics, Service, and Repair Pathway.....	13
Academic Alignment Matrix	16
Appendix: CTE Model Curriculum Standards Contributors	35



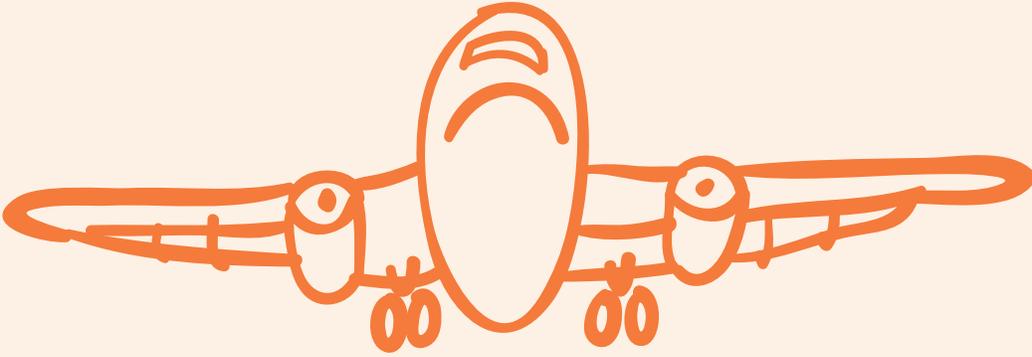
Transportation



Sector Description

This sector is designed to provide a foundation in transportation services for all industrial technology education students in California. There are eight focus areas that fall under the Transportation sector, each with different career opportunities. The focus areas are On-Road; Off-Road; Stationary; Rail; Water/Sea; Air; Space; and Small Engines and Specialty Equipment.

The pathways in the Transportation sector emphasize real-world, occupationally relevant experiences of significant scope and depth in three areas: Operations, Structural Repair and Refinishing, and Systems Diagnostics, Service, and Repair. The standards are designed to integrate academic and technical preparation and focus on career awareness, career exploration, and skill preparation in the three pathways. Integral components include classroom, laboratory, and hands-on contextual learning; project- and work-based instruction; and leadership development. The standards in this sector prepare students for continued training, postsecondary education, and entry to a career.





Transportation

Knowledge and Performance Anchor Standards

1.0 Academics

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Transportation academic alignment matrix for identification of standards.

2.0 Communications

Acquire and accurately use Transportation sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats. (Direct alignment with LS 9-10, 11-12.6)

- 2.1 Recognize the elements of communication using a sender–receiver model.
- 2.2 Identify barriers to accurate and appropriate communication.
- 2.3 Interpret verbal and nonverbal communications and respond appropriately.
- 2.4 Demonstrate elements of written and electronic communication such as accurate spelling, grammar, and format.
- 2.5 Communicate information and ideas effectively to multiple audiences using a variety of media and formats.
- 2.6 Advocate and practice safe, legal, and responsible use of digital media information and communications technologies.

3.0 Career Planning and Management

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans. (Direct alignment with SLS 11-12.2)

- 3.1 Identify personal interests, aptitudes, information, and skills necessary for informed career decision making.
- 3.2 Evaluate personal character traits such as trust, respect, and responsibility and understand the impact they can have on career success.
- 3.3 Explore how information and communication technologies are used in career planning and decision making.
- 3.4 Research the scope of career opportunities available and the requirements for education, training, certification, and licensure.
- 3.5 Integrate changing employment trends, societal needs, and economic conditions into career planning.
- 3.6 Recognize the role and function of professional organizations, industry associations, and organized labor in a productive society.
- 3.7 Recognize the importance of small business in the California and global economies.
- 3.8 Understand how digital media are used by potential employers and postsecondary agencies to evaluate candidates.
- 3.9 Develop a career plan that reflects career interests, pathways, and postsecondary options.



4.0 Technology

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Transportation sector workplace environment. (Direct alignment with WS 11-12.6)

- 4.1 Use electronic reference materials to gather information and produce products and services.
- 4.2 Employ Web-based communications responsibly and effectively to explore complex systems and issues.
- 4.3 Use information and communication technologies to synthesize, summarize, compare, and contrast information from multiple sources.
- 4.4 Discern the quality and value of information collected using digital technologies, and recognize bias and intent of the associated sources.
- 4.5 Research past, present, and projected technological advances as they impact a particular pathway.
- 4.6 Assess the value of various information and communication technologies to interact with constituent populations as part of a search of the current literature or in relation to the information task.

5.0 Problem Solving and Critical Thinking

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Transportation sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques. (Direct alignment with WS 11-12.7)

- 5.1 Identify and ask significant questions that clarify various points of view to solve problems.
- 5.2 Solve predictable and unpredictable work-related problems using various types of reasoning (inductive, deductive) as appropriate.
- 5.3 Use systems thinking to analyze how various components interact with each other to produce outcomes in a complex work environment.
- 5.4 Interpret information and draw conclusions, based on the best analysis, to make informed decisions.

6.0 Health and Safety

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Transportation sector workplace environment. (Direct alignment with RSTS 9-10, 11-12.4)

- 6.1 Locate, and adhere to, Material Safety Data Sheet (MSDS) instructions.
- 6.2 Interpret policies, procedures, and regulations for the workplace environment, including employer and employee responsibilities.
- 6.3 Use health and safety practices for storing, cleaning, and maintaining tools, equipment, and supplies.
- 6.4 Practice personal safety when lifting, bending, or moving equipment and supplies.



- 6.5 Demonstrate how to prevent and respond to work-related accidents or injuries; this includes demonstrating an understanding of ergonomics.
- 6.6 Maintain a safe and healthful working environment.
- 6.7 Be informed of laws/acts pertaining to the Occupational Safety and Health Administration (OSHA).

7.0 Responsibility and Flexibility

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Transportation sector workplace environment and community settings. (Direct alignment with SLS 9-10, 11-12.1)

- 7.1 Recognize how financial management impacts the economy, workforce, and community.
- 7.2 Explain the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
- 7.3 Understand the need to adapt to changing and varied roles and responsibilities.
- 7.4 Practice time management and efficiency to fulfill responsibilities.
- 7.5 Apply high-quality techniques to product or presentation design and development.
- 7.6 Demonstrate knowledge and practice of responsible financial management.
- 7.7 Demonstrate the qualities and behaviors that constitute a positive and professional work demeanor, including appropriate attire for the profession.
- 7.8 Explore issues of global significance and document the impact on the Transportation sector.

8.0 Ethics and Legal Responsibilities

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms. (Direct alignment with SLS 11-12.1d)

- 8.1 Access, analyze, and implement quality assurance standards of practice.
- 8.2 Identify local, district, state, and federal regulatory agencies, entities, laws, and regulations related to the Transportation industry sector.
- 8.3 Demonstrate ethical and legal practices consistent with Transportation sector workplace standards.
- 8.4 Explain the importance of personal integrity, confidentiality, and ethical behavior in the workplace.
- 8.5 Analyze organizational culture and practices within the workplace environment.
- 8.6 Adhere to copyright and intellectual property laws and regulations, and use and appropriately cite proprietary information.
- 8.7 Conform to rules and regulations regarding sharing of confidential information, as determined by Transportation sector laws and practices.



9.0 Leadership and Teamwork

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization (Direct alignment with SLS 11-12.1b)

- 9.1 Define leadership and identify the responsibilities, competencies, and behaviors of successful leaders.
- 9.2 Identify the characteristics of successful teams, including leadership, cooperation, collaboration, and effective decision-making skills as applied in groups, teams, and career technical student organization activities.
- 9.3 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
- 9.4 Explain how professional associations and organizations and associated leadership development and competitive career development activities enhance academic preparation, promote career choices, and contribute to employment opportunities.
- 9.5 Understand that the modern world is an international community and requires an expanded global view.
- 9.6 Respect individual and cultural differences and recognize the importance of diversity in the workplace.
- 9.7 Participate in interactive teamwork to solve real Transportation sector issues and problems.

10.0 Technical Knowledge and Skills

Apply essential technical knowledge and skills common to all pathways in the Transportation sector, following procedures when carrying out experiments or performing technical tasks. (Direct alignment with WS 11-12.6)

- 10.1 Interpret and explain terminology and practices specific to the Transportation sector.
- 10.2 Comply with the rules, regulations, and expectations of all aspects of the Transportation sector.
- 10.3 Construct projects and products specific to the Transportation sector requirements and expectations.
- 10.4 Collaborate with industry experts for specific technical knowledge and skills.

11.0 Demonstration and Application

Demonstrate and apply the knowledge and skills contained in the Transportation anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

- 11.1 Utilize work-based/workplace learning experiences to demonstrate and expand upon knowledge and skills gained during classroom instruction and laboratory practices specific to the Transportation sector program of study.



- 11.2 Demonstrate proficiency in a career technical pathway that leads to certification, licensure, and/or continued learning at the postsecondary level.
- 11.3 Demonstrate entrepreneurship skills and knowledge of self-employment options and innovative ventures.
- 11.4 Employ entrepreneurial practices and behaviors as appropriate to the Transportation sector opportunities.
- 11.5 Create a portfolio, or similar collection of work, that offers evidence through assessment and evaluation of skills and knowledge competency as contained in the anchor standards, pathway standards, and performance indicators.



A. Operations Pathway

The Operations pathway prepares students for postsecondary employment and education in a variety of career opportunities in the transportation industry, including but not limited to harbors, ports, warehousing, marine applications, airplanes, trains, vehicles, and specialty equipment.

Sample occupations associated with this pathway:

-  Warehouse Worker/Dispatcher
-  Production, Planning, and Expediting Clerk
-  Storage, Warehouse, and Distribution Manager
-  Container Crane Operator
-  Inspectors and Planners

- A1.0 Evaluate and assess all aspects of facilities and facility planning for efficient and effective processing/handling of people, goods, and services in the transportation industry (housing, storage, maintenance, parts).
 - A1.1 Recognize the importance of space and location of equipment.
 - A1.2 Define and understand highway, rail, harbor, port, and airport controls.
 - A1.3 Identify where to place equipment for effective and efficient processing.
 - A1.4 Explain the difference between office area and processing areas.
 - A1.5 Design a/an processing center/office/shop.
- A2.0 Describe and identify tools, techniques, and systems used to plan, staff, lead, and organize human resources as it relates to the transportation sector.
 - A2.1 Define the role of management and the responsibility and importance that are required to hold or maintain a position.
 - A2.2 Describe the production and use of industry-generated documents, records, and forms as well as related management skills used in the transportation industries.
 - A2.3 Understand work-related systems of the transportation industries.
 - A2.4 Maintain accurate records as applicable.
 - A2.5 Understand how guidelines, rules, regulations, and laws control transportation-industry practices and how they are overseen by local, state, federal, and international agencies.
 - A2.6 Explore career paths and opportunities within the transportation industry.
 - A2.7 Analyze asset acquisition and procurement needs.
 - A2.8 Research the various types of communication systems needed.
- A3.0 Demonstrate an understanding of the concepts and processes needed to move, store/house, locate, and/or transfer people, goods, and services.
 - A3.1 Identify and understand transportation options such as rail, air, road, and sea.



- A3.2 Define the different types of process controls available.
 - A3.3 Describe hazardous and nonhazardous materials handling.
 - A3.4 Understand process controls, from planning to completion.
 - A3.5 Determine the uses of information systems in the order fulfillment process.
 - A3.6 Determine the effects of government regulations on stock handling techniques and warehousing.
 - A3.7 Explore the functions of the shipping and receiving process in the success of the distribution function.
 - A3.8 Evaluate types of inventory controls.
- A4.0 Demonstrate an understanding of business fundamentals, uses and application of technologies, communications, and basic management functions.
- A4.1 Describe current business and marketing trends.
 - A4.2 Identify and analyze the risks associated with obtaining business credit.
 - A4.3 Identify considerations in planning and implementing marketing/business strategies.
 - A4.4 Identify target audience for specific marketing and sales needs.
 - A4.5 Identify the legal aspects of sales contracts and warranties.
 - A4.6 Explain the nature of sales forecasting and marketing needs.
 - A4.7 Understand the practices of acceptable customer relations services.
 - A4.8 Compare and contrast advantages and disadvantages of business ownership.
- A5.0 Analyze and evaluate the design advantages and disadvantages of transportation-industry systems and the effects of those systems on people and the environment.
- A5.1 Identify environmental conditions that would impact various aspects of the transportation industry.
 - A5.2 Identify steps necessary to design a specific mode of transportation using aerodynamics.
 - A5.3 Research the effects of ergonomics on the health and safety of workers and customers.
 - A5.4 Create a model of a vehicle (train, airplane, railroad, car) incorporating ergonomics and aerodynamics in the design.
- A6.0 Demonstrate safety practices pertaining to the transportation industry, including requirements of the Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), Air Quality Management Districts (AQMDs), and other regulatory agencies.
- A6.1 Extract information from Material Safety Data Sheets (MSDS) pertaining to chemicals used in the workplace.
 - A6.2 Locate regulatory information and manufacturer recalls.
 - A6.3 Conform to federal, state, and local regulations and manufacturers' specifications when handling, storing, and disposing of chemicals and equipment, including necessary certifications.



- A6.4 Adhere to ergonomic and environmental safety regulations in the workplace.
 - A6.5 Participate in compliance training activities and exercises.
 - A6.6 Determine the safe and correct application and use for chemicals used in the transportation industry.
- A7.0 Describe and identify the infrastructures required and used in the transportation industry.
- A7.1 Identify the infrastructure needed to move people, goods, and equipment from one location to another (highways, bridges, waterways, railways).
 - A7.2 Recognize the need for traffic signals, signs, and markings.
 - A7.3 Define fueling infrastructure needed to move vehicles, equipment, goods, and services from one location to another.
 - A7.4 Explain the importance of infrastructure in transporting vehicles, goods, and/or equipment in our everyday lives.
 - A7.5 Evaluate the need to safely move fluids from one location to another.



Transportation Pathway Standards

B. Structural Repair and Refinishing Pathway

The Structural Repair and Refinishing pathway prepares students for postsecondary education and employment in the transportation industry, including but not limited to body and frame straightening, estimating, painting, and refinishing (included but not limited to airplanes, trains, vehicles, and equipment).

Sample occupations associated with this pathway:



Estimator



Claims Adjuster



Technician



Insurance Company/Manufacturer's Representative



Investigator/Inspector

- B1.0 Students practice personal and occupational safety and understand the environmental effects of collision repair and refinishing practices.
 - B1.1 Describe industry environmental conservation practices and their applications.
 - B1.2 Practice the safe handling and storage of chemicals and hazardous wastes as required by the Occupational Safety and Health Administration (OSHA), Air Resources Board (ARB), Air Quality Management Districts (AQMDs), and other regulatory agencies.
 - B1.3 Understand the generation of waste products and other environmentally destructive substances.
 - B1.4 Use appropriate materials and repair technologies.
 - B1.5 Understand the environmental implications of using new and emerging materials, resources, and technologies.
 - B1.6 Demonstrate the safety practices applied when servicing vehicle-body electronics and other vehicle systems.
- B2.0 Practice the safe and appropriate use of tools, equipment, and work processes.
 - B2.1 Understand how certain tools and equipment are used to perform maintenance and repair operations.
 - B2.2 Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems (e.g., electrical and electronic circuits, alternating- and direct-current applications, fluid/hydraulic and air/pneumatic systems).
- B3.0 Apply measurement systems and the mathematical functions necessary to perform required fabrication, maintenance, and operation procedures.
 - B3.1 Use industry-standard measurement scales, devices, and systems to perform design, fabrication, diagnostic, maintenance, and repair procedures.
 - B3.2 Use technical vocabulary, technical reports and manuals, electronic systems, and related technical data resources, as appropriate, to determine repairs and estimates.



- B3.3 Demonstrate the different types of welding and heat processes used in repair processes and procedures.
- B3.4 Understand the mathematical functions associated with collision repair and refinishing.
- B4.0 Apply scientific principles in relation to chemical, mechanical, and physical functions and in relation to industry and manufacturer standards.
 - B4.1 Identify and understand the physical and chemical characteristics of metals, plastics, and other materials.
 - B4.2 Describe the basic terms, characteristics, and concepts of physical and chemical processes.
 - B4.3 Apply the principles of mechanical, electrical, hydraulic, and pneumatic power in relation to collision repair and refinishing.
 - B4.4 Practice the principles of electricity and electronics.
 - B4.5 Understand body and frame construction.
 - B4.6 Know the importance of calibration processes, systems, and techniques in using various measurement and testing devices.
- B5.0 Perform and document repair procedures in accordance with manufacturer recommendations and industry standards.
 - B5.1 Explain and practice the recommended procedures and practices of various manufacturers.
 - B5.2 Use reference books and materials, technical service bulletins, and other related documents to determine repairs and rate of pay.
 - B5.3 Document repair procedures accurately as required by the Bureau of Automotive Repair and other regulatory agencies.
- B6.0 Demonstrate basic business practices.
 - B6.1 Know the laws and regulations applicable to the recordkeeping and handling of hazardous materials.
 - B6.2 Use and understand work-related systems.
 - B6.3 Practice and understand the importance of, and procedures for, maintaining accurate records.
 - B6.4 Discuss and apply the concept and application of accepted ethical business practices.
 - B6.5 Use and understand the concept and application of acceptable customer relations services.
- B7.0 Understand structural and nonstructural analysis and damage repair.
 - B7.1 Perform frame inspection and repair.
 - B7.2 Demonstrate applications, installations, and removal of fixed and moveable glass and hardware.



- B7.3 Demonstrate the principles of metal welding and cutting.
- B7.4 Prepare and analyze vehicles for repair.
- B7.5 Perform outer body panel repairs, replacements, and adjustments.
- B7.6 Prepare vehicles for metal finishing and body filling.

- B8.0 Demonstrate an understanding of mechanical and electrical components in relation to industry and manufacturer standards.
 - B8.1 Identify and communicate the operation of drivetrain, fuel, intake, and exhaust systems.
 - B8.2 Perform steering and suspension analysis and repairs.
 - B8.3 Perform electrical repairs.
 - B8.4 Perform brake analysis and repairs.
 - B8.5 Perform heating, air-conditioning, and cooling system repairs.
 - B8.6 Explain and demonstrate the operation of restraint systems.

- B9.0 Demonstrate the concepts, principles, and practices of painting and refinishing.
 - B9.1 Identify, use, and repair plastics and adhesives.
 - B9.2 Prepare surfaces for painting and finishing.
 - B9.3 Practice operation of spray guns and related equipment.
 - B9.4 Practice mixing, matching, and applying paint.
 - B9.5 Prepare vehicles for final detail.
 - B9.6 Analyze the causes and cures of paint defects.



C. Systems Diagnostics, Service, and Repair Pathway

The Systems Diagnostics, Service, and Repair pathway prepares students for postsecondary education and employment in the transportation industry, which includes but is not limited to motor vehicles, rail systems, marine applications, and small-engine and specialty equipment.

Sample occupations associated with this pathway:

-  Service Technician/Maintenance Worker/Shop Foreman
-  Technical Writer
-  Dispatcher
-  Engineer
-  Investigator/Inspector

- C1.0 Demonstrate the practice of personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.
 - C1.1 Know and understand common environmental conservation practices and their applications.
 - C1.2 Practice the safe handling and storage of chemicals and hazardous wastes in accordance with Material Safety Data Sheets (MSDS) and the requirements of local, state, and federal regulatory agencies.
 - C1.3 Understand the way in which waste gasses, emissions, and other environmentally destructive substances are generated and the effects of these substances on the environment.
 - C1.4 Use appropriate personal protective equipment and safety practices.
 - C1.5 Evaluate the advantages and disadvantages of existing, new, and emerging systems and the effects of those systems on the environment.
- C2.0 Practice the safe and appropriate use of tools, equipment, and work processes.
 - C2.1 Recognize the importance of calibration processes, systems, and techniques using various measurement and testing devices.
 - C2.2 Demonstrate and use appropriate tools and equipment—such as wrenches, sockets, and pliers—to diagnose, service, repair, and maintain systems and components.
 - C2.3 Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems (e.g., electrical and electronic circuits, alternating- and direct-current applications, fluid/hydraulic and air/pneumatic systems).
 - C2.4 Select and use the appropriate measurement device(s) and use mathematical functions necessary to perform required fabrication, maintenance, and operation procedures.
 - C2.5 Use measurement scales, devices, and systems, such as dial indicators and micrometers, to design, fabricate, diagnose, maintain, and repair vehicles and components following recommended industry standards.



- C2.6 Demonstrate how to access technical reports, manuals, electronic retrieval systems, and related technical data resources.
- C2.7 Test and analyze the elements of precision measuring using standard and metric systems.
- C3.0 Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.
 - C3.1 Describe the operating principles of internal and/or external combustion engines.
 - C3.2 Describe the function and principles of air-conditioning and heating systems.
 - C3.3 Describe the basic principles of pneumatic and hydraulic power and their applications.
 - C3.4 Describe the applications of alternative power sources.
 - C3.5 Practice the basic principles of electricity, electronics and electrical power generation, and distribution systems.
 - C3.6 Explain the principles of converting energy from one form to another.
 - C3.7 Perform necessary procedures to maintain, diagnose, service, and repair vehicle systems and malfunctions.
- C4.0 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.
 - C4.1 Communicate the procedures and practices of various manufacturers regarding service, repair, and maintenance schedules.
 - C4.2 Demonstrate how to properly document maintenance and repair procedures in accordance with applicable rules, laws, and regulations (e.g., Bureau of Auto Repair [BAR], Occupational Safety and Health Administration [OSHA], and the California Air Resources Board [ARB]).
 - C4.3 Use reference books, technical service bulletins, and other documents and materials related to the service industry available in print and through electronic retrieval systems to accurately diagnose and repair systems, equipment, and vehicles.
 - C4.4 Complete a work order, including customer information, description of repairs, and billing information, in accordance with applicable rules, laws, and regulations.
- C5.0 Apply and understand appropriate business practices.
 - C5.1 Identify work-related systems common to the transportation service industry.
 - C5.2 Know the laws and regulations applicable to recordkeeping and the appropriate handling and disposal of hazardous materials.
 - C5.3 Explain the importance of and the procedures for maintaining accurate records (e.g., business licenses, repair orders, billing and tax records).
 - C5.4 Practice the concept and application of accepted ethical business practices.
 - C5.5 Practice the concept and application of acceptable customer relations practices.
 - C5.6 Recognize, analyze, and evaluate the need for maintenance of components and systems and the conditions under which service and maintenance are required.



- C6.0 Demonstrate the application, operation, maintenance, and diagnosis of engines, including but not limited to two- and four-stroke and supporting subsystems.
 - C6.1 Perform general engine maintenance, diagnosis, service, and repair in accordance with portable national industry standards, such as the National Automotive Technicians Education Foundation and the Equipment and Engine Training Council.
 - C6.2 Maintain, diagnose, service, and repair lubrication and cooling systems.
 - C6.3 Practice how to maintain, diagnose, and repair computerized engine control systems and other engine-related systems.
 - C6.4 Maintain, diagnose, service, and repair ignition, electronic, and computerized engine controls and fuel management systems.

- C7.0 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.
 - C7.1 Practice maintenance, diagnosis, and repair of electrical systems.
 - C7.2 Maintain, diagnose, repair, and service batteries.
 - C7.3 Demonstrate maintenance, diagnosis, service, and repair of starting and charging systems.
 - C7.4 Diagnose, service, and repair lighting systems.
 - C7.5 Diagnose, service, and repair heating and air-conditioning systems and components.
 - C7.6 Diagnose, service, and repair horns, wipers/washers, and other accessories.
 - C7.7 Perform necessary procedures to maintain, diagnose, service, and repair vehicle electrical and electronic systems and malfunctions.

- C8.0 Demonstrate the function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with national industry standards.
 - C8.1 Describe how to maintain, diagnose, service, and repair hydraulic and power assist systems.
 - C8.2 Describe the function and operation of automatic and manual transmissions and transaxles.
 - C8.3 Diagnose, service, and repair disc brakes, drum brakes, antilock brakes, and other brake systems as developed.
 - C8.4 Diagnose, service, and repair steering and suspension systems.
 - C8.5 Interpret tire and rim sizing to select appropriate wheels and tires for vehicles.
 - C8.6 Maintain, diagnose, service, and repair under-vehicle systems and malfunctions.



Academic Alignment Matrix

TRANSPORTATION	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
ENGLISH LANGUAGE ARTS			
Reading Standards for Literacy in Science and Technical Subjects – RLST (Standard Area, Grade Level, Standard #)			
11-12.3 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.	A6.0	B1.0, B2.0, B3.0, B4.0, B6.0, B7.0, B8.0, B9.0	C1.0, C2.0, C5.0
11-12.10 By the end of grade 12 read and comprehend science/technical texts in the grades 11-12 text complexity band independently and proficiently.	A1.0, A2.0, A3.0, A4.0, A5.0, A6.0, A7.0	B1.0, B2.0, B3.0, B4.0, B5.0, B6.0, B7.0, B8.0, B9.0	C1.0, C2.0, C3.0, C4.0, C5.0, C6.0, C7.0, C8.0
Writing Standards – WS (Standard Area, Grade Level, Standard #)			
11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.	A5.0	B5.0	C5.0
11-12.2 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.	A7.0	B5.0	C5.0
11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	A3.0, A4.0	B5.0	C4.0
11-12.6 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.	A1.0, A3.0, A4.0	B2.0, B3.0, B5.0, B6.0, B8.0, B9.0	C6.0, C7.0
11-12.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.	A1.0, A2.0		C8.0
11-12.10 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.	A1.0	B5.0	C4.0

Academic Alignment Matrix

TRANSPORTATION	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
MATHEMATICS			
Algebra – A-SSE – Seeing Structure in Expressions			
<i>Interpret the structure of expressions</i>			
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. <i>For example, interpret $P(1+r)^t$ as the product of P and a factor not depending on P.</i>		B3.0, B4.0, B9.0	
2. Use the structure of an expression to identify ways to rewrite it. <i>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 $(x^2 - y^2)(x^2 + y^2)$.</i> a. <i>Use the distributive property to express a sum of terms with a common factor as a multiple of a sum of terms with no common factor. For example, express $xy^2 + x^2y$ as $xy(y + x)$. (Common Core Standard A-SSE-2a)</i> b. <i>Use the properties of operations to express a product of a sum of terms as a sum of products. For example, use the properties of operations to express $(x + 5)(3 - x + c)$ as $-x^2 + cx - 2x + 5c + 15$. (Common Core Standard A-SSE-2b)</i>		B3.0, B9.0	
2.1 Apply basic factoring techniques to second- and simple third-degree polynomials. These techniques include finding a common factor for all terms in a polynomial, recognizing the difference of two squares, and recognizing perfect squares of binomials. (CA Standard Algebra I - 11.0)		B3.0, B9.0	





Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Algebra – A-SSE – Seeing Structure in Expressions <i>(continued)</i>			
<i>Write expressions in equivalent forms to solve problems</i>			
<p>3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.</p> <p>a. Factor a quadratic expression to reveal the zeros of the function it defines.</p> <p>b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.</p> <p>c. Use the properties of exponents to transform expressions for exponential functions. For example the expression 1.15^t can be rewritten as $(1.15^{1/12})^{12t} = 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.</p> <p>d. Prove simple laws of logarithms. (CA Standard Algebra II - 11.0)</p> <p>e. Use the definition of logarithms to translate between logarithms in any base. (CA Standard Algebra II - 13.0)</p> <p>f. Understand and use the properties of logarithms to simplify logarithmic numeric expressions and to identify their approximate values. (CA Standard Algebra 11- 14.0)</p>		B3.0, B9.0	
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.		B3.0, B9.0	
Algebra – A-CED – Creating Equations			
<i>Create equations that describe numbers or relationships</i>			
<p>1. Create equations and inequalities in one variable including ones with absolute value and use them to solve problems in and out of context, including equations arising from linear functions.</p> <p>1.1 Judge the validity of an argument according to whether the properties of real numbers, exponents, and logarithms have been applied correctly at each step. (CA Standard Algebra II - 11.2)</p>		B3.0, B4.0, B6.0	C2.0, C3.0, C5.0, C6.0, C7.0
2. Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.		B3.0, B4.0, B6.0	C2.0, C3.0, C5.0, C6.0, C7.0
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 nutritional and cost constraints on combinations of different foods.	A4.0	B3.0, B6.0	C5.0

Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Algebra – A-CED – Creating Equations <i>(continued)</i>			
4. Rearrange formulas 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 .		B3.0, B6.0	C2.0, C5.0, C7.0
Algebra – A-REI – Reasoning with Equations and Inequalities			
<i>Understand solving equations as a process of reasoning and explain the reasoning</i>			
1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.	A1.0		
2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	A1.0, A4.0	B4.0	C3.0, C4.0
<i>Solve equations and inequalities in one variable</i>			
3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. 3.1 Solve equations and inequalities involving absolute value. (CA Standard Algebra I - 3.0 and CA Standard Algebra II - 1.0)	A1.0, A5.0	B4.0, B5.0	
Functions – F-IF – Interpreting Functions			
<i>Understand the concept of a function and use function notation</i>			
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 $y = f(x)$.	A1.0, A2.0, A4.0	B6.0	C5.0
2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	A1.0, A2.0	B6.0	C5.0
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 $n \geq 1$.		B6.0	





Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Functions – F-IF – Interpreting Functions <i>(continued)</i>			
<i>Interpret functions that arise in applications in terms of the context</i>			
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.	A1.0, A2.0, A5.0, A4.0	B6.0	C5.0
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 the positive integers would be an appropriate domain for the function.	A1.0, A2.0, A5.0	B6.0	C5.0
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.	A1.0, A2.0, A4.0, A5.0	B6.0	C5.0, C6.0, C7.0
<i>Analyze functions using different representations</i>			
7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. <ul style="list-style-type: none"> 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 when suitable factorizations are available, and showing end behavior. d. (+) Graph rational functions, identifying zeros and asymptotes 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. 	A1.0, A2.0	B6.0	C5.0

Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Functions – F-IF – Interpreting Functions <i>(continued)</i>			
<p>8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p> <p>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.</p> <p>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.</p>		B6.0	
<p>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.</p>	A1.0, A2.0	B6.0	C5.0
<p>10. Demonstrate an understanding of functions and equations defined parametrically and graph them. (CA Standard Math Analysis – 7.0)</p>	A1.0, A2.0	B6.0	C5.0
Functions – F-BF – Building Functions			
<i>Build a function that models a relationship between two quantities</i>			
<p>1. Write a function that describes a relationship between two quantities.</p> <p>a. Determine an explicit expression, a recursive process, or steps for calculation from a context.</p> <p>b. Combine standard function types using arithmetic operations. <i>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.</i></p> <p>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.</p>	A1.0, A2.0	B6.0	C5.0
<p>2. Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.</p>	A1.0, A2.0	B6.0	C5.0





Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Functions – F-BF – Building Functions <i>(continued)</i>			
<i>Build new functions from existing functions</i>			
<p>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.</p> <p>3.1 Solve problems involving functional concepts, such as composition, defining the inverse function and performing arithmetic operations on functions. (CA Standard Algebra II - 24.0)</p>	A1.0, A2.0	B6.0	C5.0
Functions – F-LE – Linear, Quadratic, and Exponential Models			
<p>1. Distinguish between situations that can be modeled with linear functions and with exponential functions.</p> <p>a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.</p> <p>b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.</p> <p>c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</p>	A2.0	B5.0	C5.0
2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).	A2.0	B6.0	C5.0
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.	A2.0	B6.0	C5.0
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.		B6.0	C5.0
<i>Interpret expressions for functions in terms of the situation they model</i>			
5. Interpret the parameters in a linear or exponential function in terms of a context.	A2.0	B6.0	C5.0
6. Apply quadratic equations to physical problems, such as the motion of an object under the force of gravity. (CA Standard Algebra 1- 23.0)		B6.0	C5.0

Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Geometry – G–CO – Congruence			
<i>Experiment with transformations in the plane</i>			
1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	A1.0, A2.0	B6.0	C5.0
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).	A1.0, A2.0	B6.0	C5.0
3. Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	A1.0, A2.0	B6.0	C5.0
4. Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	A1.0, A2.0	B6.0	C5.0
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.	A1.0, A2.0	B6.0	C5.0
<i>Prove geometric theorems</i>			
9. 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.	A1.0, A2.0	B6.0	C5.0
10. Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; 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. 10.1 Know and use the triangle inequality theorem. (CA Standard Geometry - 6.0)	A1.0, A2.0	B6.0	C5.0
11. 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.	A1.0, A2.0	B6.0	C5.0





Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Geometry – G-CO – Congruence <i>(continued)</i>			
<i>Make geometric constructions</i>			
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.	A1.0, A2.0	B6.0	C5.0
Number and Quantity – N-VM – Vector and Matrix Quantities			
<i>Perform operations on matrices and use matrices in applications</i>			
6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.	A1.0, A2.0	B6.0	C5.0
7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.	A1.0, A2.0	B6.0	C5.0
8. (+) Add, subtract, and multiply matrices of appropriate dimensions.	A1.0, A2.0	B6.0	C5.0
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.	A1.0, A2.0	B6.0	C5.0
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.	A1.0, A2.0	B6.0	C5.0
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.	A1.0, A2.0	B6.0	C5.0
12. (+) Work with 2×2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.	A1.0, A2.0	B6.0	C5.0
Statistics and Probability – S-IC – Making Inferences and Justifying Conclusions			
<i>Understand and evaluate random processes underlying statistical experiments</i>			
1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	A1.0, A2.0, A4.0	B6.0	C5.0

Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Statistics and Probability – S-IC – Making Inferences and Justifying Conclusions <i>(continued)</i>			
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?	A1.0, A2.0	B6.0	C5.0
<i>Make inferences and justify conclusions from sample surveys, experiments, and observational studies</i>			
3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	A1.0, A2.0, A4.0	B6.0	C5.0
5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	A1.0, A2.0	B6.0	C5.0
6. Evaluate reports based on data.	A1.0, A2.0, A4.0, A5.0, A6.0	B6.0	C1.0, C5.0
Statistics and Probability – S-ID – Interpreting Categorical and Quantitative Data			
<i>Summarize, represent, and interpret data on a single count or measurement variable</i>			
1. Represent data with plots on the real number line (dot plots, histograms, and box plots).	A1.0, A2.0, A4.0	B6.0	C5.0
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.	A1.0, A2.0, A4.0	B6.0	C5.0
3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	A1.0, A2.0, A4.0	B6.0	C5.0
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.	A1.0, A2.0	B6.0	C5.0
<i>Summarize, represent, and interpret data on two categorical and quantitative variables</i>			
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.	A1.0, A2.0	B6.0	C5.0





Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Statistics and Probability – S-ID – Interpreting Categorical and Quantitative Data <i>(continued)</i>			
6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. <ul style="list-style-type: none"> 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. c. Fit a linear function for a scatter plot that suggests a linear association. 	A1.0, A2.0	B6.0	C5.0
<i>Interpret linear models</i>			
7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	A1.0, A2.0, A4.0, A5.0	B6.0	C5.0
8. Compute (using technology) and interpret the correlation coefficient of a linear fit.	A1.0, A2.0	B6.0	C5.0
9. Distinguish between correlation and causation.	A1.0, A2.0	B6.0	C5.0
Statistics and Probability – S-CP – Conditional Probability and the Rules of Probability			
<i>Understand independence and conditional probability and use them to interpret data</i>			
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").	A1.0, A2.0	B6.0	
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.		B6.0	
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.	A1.0, A2.0	B6.0	
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.	A1.0, A2.0	B6.0	

Academic Alignment Matrix

Transportation	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Statistics and Probability – S-CP – Conditional Probability and the Rules of Probability <i>(continued)</i>			
<i>Use the rules of probability to compute probabilities of compound events in a uniform probability model</i>			
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.	A1.0, A2.0	B6.0	
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.	A1.0, A2.0	B6.0	
Statistics and Probability – S-MD – Using Probability to Make Decisions			
<i>Calculate expected values and use them to solve problems</i>			
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.	A1.0, A2.0, A4.0	B6.0	C5.0
2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.	A1.0, A2.0, A4.0	B6.0	C5.0
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.	A1.0, A2.0, A4.0	B6.0	C5.0
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?	A1.0, A2.0, A4.0	B6.0	C5.0
<i>Use probability to evaluate outcomes of decisions</i>			
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.	A1.0, A2.0, A4.0, A5.0	B6.0	C5.0





Academic Alignment Matrix

TRANSPORTATION	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Statistics and Probability – S-MD – Using Probability to Make Decisions <i>(continued)</i>			
6. (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).	A1.0, A2.0	B6.0	C5.0
7. (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).	A1.0, A2.0, A4.0	B6.0	C5.0
SCIENCE			
Scientific and Engineering Practices – SEP			
1. Asking questions (for science) and defining problems (for engineering) 2. Developing and using models 3. Planning and carrying out investigations 4. Analyzing and interpreting data 5. Using mathematics and computational thinking 6. Constructing explanations (for science) and designing solutions (for engineering) 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information	A1.0, A2.0, A3.0, A4.0, A5.0, A6.0, A7.0	B1.0, B2.0, B3.0, B4.0, B5.0, B6.0, B7.0, B8.0, B9.0	C1.0, C2.0, C3.0, C4.0, C5.0, C7.0
Crosscutting Concept – CC			
1. Patterns 2. Cause and effect: Mechanism and explanation 3. Scale, proportion, and quantity 4. Systems and system models 5. Energy and matter: Flows, cycles, and conservation 6. Structure and function 7. Stability and change	A1.0, A2.0, A3.0, A4.0, A5.0, A6.0, A7.0	B1.0, B2.0, B4.0, B5.0, B6.0, B7.0, B8.0, B9.0	C1.0, C2.0, C3.0, C4.0, C5.0

Academic Alignment Matrix

TRANSPORTATION	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Physical Sciences – PS			
PS1: Matter and Its Interactions PS1.A: Structure and Properties of Matter PS1.B: Chemical Reactions PS1.C: Nuclear Processes	A5.0, A6.0, A7.0	B1.0, B4.0, B7.0, B8.0	C1.0, C2.0, C3.0, C4.0, C5.0
PS2: Motion and Stability: Forces and Interactions PS2.A: Forces and Motion PS2.B: Types of Interactions PS2.C: Stability and Instability in Physical Systems	A2.0, A3.0, A6.0	B1.0, B4.0, B7.0, B8.0	C1.0, C2.0, C3.0, C4.0
PS3: Energy PS3.A: Definitions of Energy PS3.B: Conservation of Energy and Energy Transfer PS3.C: Relationship Between Energy and Forces PS3.D: Energy in Chemical Processes and Everyday Life	A2.0, A3.0, A5.0, A6.0, A7.0	B1.0, B4.0, B8.0	C2.0, C3.0, C4.0, C5.0, C7.0
PS4: Waves and Their Applications in Technologies for Information Transfer PS4.A: Wave Properties PS4.B: Electromagnetic Radiation PS4.C: Information Technologies and Instrumentation		B4.0, B8.0	C2.0, C3.0, C4.0, C7.0
Life Sciences – LS			
LS1: From Molecules to Organisms: Structures and Processes LS1.A: Structure and Function LS1.B: Growth and Development of Organisms LS1.C: Organization for Matter and Energy Flow in Organisms LS1.D: Information Processing	A5.0, A6.0	B4.0	C3.0, C4.0





Academic Alignment Matrix

TRANSPORTATION	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Life Sciences – LS <i>(continued)</i>			
LS2: Ecosystems: Interactions, Energy, and Dynamics LS2.A: Interdependent Relationships in Ecosystems LS2.B: Cycles of Matter and Energy Transfer in Ecosystems LS2.C: Ecosystems Dynamics, Functioning, and Resilience LS2.D: Social Interactions and Group Behavior		B1.0	C1.0
LS3: Heredity: Inheritance and Variation of Traits LS3.A: Inheritance of Traits LS3.B: Variation of Traits	A6.0	B1.0	
LS4: Biological Evolution: Unity and Diversity LS4.A: Evidence of Common Ancestry and Diversity LS4.B: Natural Selection LS4.C: Adaptation LS4.D: Biodiversity and Humans	A4.0	B1.0	
Earth and Space Sciences – ESS			
ESS2: Earth's Systems ESS2.A: Earth Materials and Systems ESS2.B: Plate Tectonics and Large-Scale System Interactions ESS2.C: The Roles of Water in Earth's Surface Processes ESS2.D: Weather and Climate ESS2.E: Biogeology		B1.0	C1.0
ESS3: Earth and Human Activity ESS3.A: Natural Resources ESS3.B: Natural Hazards ESS3.C: Human Impacts on Earth Systems ESS3.D: Global Climate Change	A5.0	B1.0, B4.0, B8.0, B9.0	C1.0, C2.0, C4.0, C5.0

Academic Alignment Matrix

TRANSPORTATION	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Engineering, Technology, and the Applications of Science – ETS			
ETS1: Engineering Design ETS1.A: Defining and Delimiting an Engineering Problem ETS1.B: Developing Possible Solutions ETS1.E: Optimizing the Design Solution	A1.0, A2.0, A4.0, A5.0, A6.0, A7.0	B1.0, B2.0, B3.0, B4.0, B7.0, B8.0, B9.0	C1.0, C2.0, C3.0, C4.0, C5.0
ETS2: Links Among Engineering, Technology, Science, and Society ETS2.A: Interdependence of Science, Engineering, and Technology ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World	A1.0, A2.0, A4.0, A5.0, A6.0, A7.0	B1.0, B2.0, B3.0, B4.0, B5.0, B7.0, B8.0, B9.0	C1.0, C2.0, C3.0, C4.0, C5.0, C7.0
HISTORY/SOCIAL SCIENCE			
Principles of American Democracy and Economics – AD			
12.7 Students analyze and compare the powers and procedures of the national, state, tribal, and local governments.			
12.7.2. Identify the major responsibilities and sources of revenue for state and local governments.		B1.0, B2.0	C1.0, C2.0
12.7.5. Explain how public policy is formed, including the setting of the public agenda and implementation of it through regulations and executive orders.	A6.0, A7.0	B1.0, B2.0, B9.0	C1.0, C2.0
12.7.7. Identify the organization and jurisdiction of federal, state, and local (e.g., California) courts and the interrelationships among them.	A6.0, A7.0	B1.0, B9.0	
Principles of Economics – PE			
12.1 Students understand common economic terms and concepts and economic reasoning.			
12.1.1. Examine the causal relationship between scarcity and the need for choices.	A4.0	B6.0	C1.0, C2.0, C5.0, C7.0, C8.0
12.1.2. Explain opportunity cost and marginal benefit and marginal cost.	A4.0	B1.0, B2.0, B6.0	C1.0, C2.0, C5.0, C7.0, C8.0
12.1.3. Identify the difference between monetary and non-monetary incentives and how changes in incentives cause changes in behavior.		B1.0, B2.0, B6.0	C5.0, C7.0, C8.0





Academic Alignment Matrix

TRANSPORTATION	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Principles of Economics – PE <i>(continued)</i>			
12.1.4. Evaluate the role of private property as an incentive in conserving and improving scarce resources, including renewable and nonrenewable natural resources.		B1.0, B2.0, B6.0	C5.0, C7.0, C8.0
12.2 Students analyze the elements of America's market economy in a global setting.			
12.2.5. Understand the process by which competition among buyers and sellers determines a market price.		B6.0	C5.0, C7.0, C8.0
12.2.6. Describe the effect of price controls on buyers and sellers.		B6.0	C5.0, C7.0, C8.0
12.2.9. Describe the functions of the financial markets.	A6.0	B6.0	C5.0, C7.0, C8.0
12.2.10. Discuss the economic principles that guide the location of agricultural production and industry and the spatial distribution of transportation and retail facilities.	A1.0, A6.0	B6.0	C5.0, C7.0, C8.0
12.3 Students analyze the influence of the federal government on the American economy.		B6.0	
12.3.1. Understand how the role of government in a market economy often includes providing for national defense, addressing environmental concerns, defining and enforcing property rights, attempting to make markets more competitive, and protecting consumers' rights.	A4.0	B1.0, B2.0, B6.0	C1.0, C2.0, C5.0, C7.0, C8.0
12.3.2. Identify the factors that may cause the costs of government actions to outweigh the benefits.	A7.0	B1.0, B2.0 B6.0	C1.0, C2.0, C5.0, C7.0, C8.0
12.3.3. Describe the aims of government fiscal policies (taxation, borrowing, spending) and their influence on production, employment, and price levels.		B6.0	C5.0, C7.0, C8.0
12.3.4. Understand the aims and tools of monetary policy and their influence on economic activity (e.g., the Federal Reserve).		B6.0	C5.0, C7.0, C8.0
12.4 Students analyze the elements of the U.S. labor market in a global setting.			
12.4.2. Describe the current economy and labor market, including the types of goods and services produced, the types of skills workers need, the effects of rapid technological change, and the impact of international competition.	A4.0		
12.4.4. Explain the effects of international mobility of capital and labor on the U.S. economy.		B6.0	C5.0, C7.0, C8.0
12.5 Students analyze the aggregate economic behavior of the U.S. economy.		B6.0	C5.0, C7.0, C8.0
12.6 Students analyze issues of international trade and explain how the U.S. economy affects, and is affected by, economic forces beyond the United States' borders.			

Academic Alignment Matrix

TRANSPORTATION	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
Principles of Economics – PE <i>(continued)</i>			
12.6.1. Identify the gains in consumption and production efficiency from trade, with emphasis on the main products and changing geographic patterns of twentieth-century trade among countries in the Western Hemisphere.	A2.0, A3.0, A4.0 A7.0	B6.0	C5.0, C7.0, C8.0
12.6.2. Compare the reasons for and the effects of trade restrictions during the Great Depression compared with present-day arguments among labor, business, and political leaders over the effects of free trade on the economic and social interests of various groups of Americans.	A4.0		
12.6.3. Understand the changing role of international political borders and territorial sovereignty in a global economy.	A4.0		
U.S. History and Geography – US			
11.2 Students analyze the relationship among the rise of industrialization, large-scale rural-to-urban migration, and massive immigration from Southern and Eastern Europe.			
11.2.1. Know the effects of industrialization on living and working conditions, including the portrayal of working conditions and food safety in Upton Sinclair's <i>The Jungle</i> .	A6.0	B1.0, B2.0	
11.2.2. Describe the changing landscape, including the growth of cities linked by industry and trade, and the development of cities divided according to race, ethnicity, and class.	A3.0, A4.0		
11.2.9. Understand the effect of political programs and activities of the Progressives (e.g., federal regulation of railroad transport, Children's Bureau, the Sixteenth Amendment, Theodore Roosevelt, Hiram Johnson).	A1.0, A6.0, A7.0		
11.4 Students trace the rise of the United States to its role as a world power in the twentieth century.			
11.4.4. Explain Theodore Roosevelt's Big Stick diplomacy, William Taft's Dollar Diplomacy, and Woodrow Wilson's Moral Diplomacy, drawing on relevant speeches.			C1.0
11.5 Students analyze the major political, social, economic, technological, and cultural developments of the 1920s.			
11.5.7. Discuss the rise of mass production techniques, the growth of cities, the impact of new technologies (e.g., the automobile, electricity), and the resulting prosperity and effect on the American landscape.	A1.0, A3.0, A5.0, A6.0, A7.0		C2.0, C3.0, C7.0, C8.0





Academic Alignment Matrix

TRANSPORTATION	PATHWAYS		
	A. Operations	B. Structural Repair and Refinishing	C. Systems Diagnostics, Service, and Repair
U.S. History and Geography – US <i>(continued)</i>			
11.6 Students analyze the different explanations for the Great Depression and how the New Deal fundamentally changed the role of the federal government.			
11.6.4. Analyze the effects of and the controversies arising from New Deal economic policies and the expanded role of the federal government in society and the economy since the 1930s (e.g., Works Progress Administration, Social Security, National Labor Relations Board, farm programs, regional development policies, and energy development projects such as the Tennessee Valley Authority, California Central Valley Project, and Bonneville Dam).	A7.0		
11.11 Students analyze the major social problems and domestic policy issues in contemporary American society.			
11.11.5. Trace the impact of, need for, and controversies associated with environmental conservation, expansion of the national park system, and the development of environmental protection laws, with particular attention to the interaction between environmental protection advocates and property rights advocates.	A5.0, A6.0	B1.0	
11.11.7. Explain how the federal, state, and local governments have responded to demographic and social changes such as population shifts to the suburbs, racial concentrations in the cities, Frostbelt-to-Sunbelt migration, international migration, decline of family farms, increases in out-of-wedlock births, and drug abuse.	A4.0, A5.0, A6.0		
World History, Culture, and Geography – WH			
10.3 Students analyze the effects of the Industrial Revolution in England, France, Germany, Japan, and the United States.			
10.3.2. Examine how scientific and technological changes and new forms of energy brought about massive social, economic, and cultural change (e.g., the inventions and discoveries of James Watt, Eli Whitney, Henry Bessemer, Louis Pasteur, Thomas Edison).	A4.0	B4.0, B5.0	
10.3.3. Describe the growth of population, rural to urban migration, and growth of cities associated with the Industrial Revolution.	A2.0, A3.0, A4.0		
10.3.4. Trace the evolution of work and labor, including the demise of the slave trade and the effects of immigration, mining and manufacturing, division of labor, and the union movement.	A1.0, A3.0, A4.0	B1.0, B3.0, B4.0	
10.11 Students analyze the integration of countries into the world economy and the information, technological, and communications revolutions (e.g., television, satellites, computers).	A1.0, A4.0		



Appendix: CTE Model Curriculum Standards Contributors



Transportation

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