



MASSACHUSETTS
DEPARTMENT of
EDUCATION

**Vocational Technical Education
Framework**

**Information Technology Services
Cluster**

Programming and Web Development

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Strand 1: Safety and Health Knowledge and Skills

1.A Define health and safety regulations.

- 1.A.01a Identify and apply OSHA and other health and safety regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.02a Identify and apply EPA and other environmental protection regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.03a Identify and apply Right-To-Know (Hazard Communication Policy) and other communicative regulations that apply to specific tasks and jobs in the occupational area.
- 1.A.04a Explain procedures for documenting and reporting hazards to appropriate authorities.
- 1.A.05a List penalties for non-compliance with appropriate health and safety regulations.
- 1.A.06a Identify contact information for appropriate health and safety agencies and resources.

1.B Demonstrate health and safety practices.

- 1.B.01a Identify, describe and demonstrate the effective use of Material Safety Data Sheets (MSDS).
- 1.B.02a Read chemical, product, and equipment labels to determine appropriate health and safety considerations.
- 1.B.03a Identify, describe and demonstrate personal, shop and job site safety practices and procedures.
- 1.B.04a Demonstrate safe dress and use of relevant safety gear and personal protective equipment (PPE), including wrist rests, adjustable workspaces and equipment, gloves, boots, earplugs, eye protection, and breathing apparatus.
- 1.B.05a Illustrate appropriate safe body mechanics, including proper lifting techniques and ergonomics.
- 1.B.06a Locate emergency equipment in your lab, shop, and classroom, including (where appropriate) eyewash stations, shower facilities, sinks, fire extinguishers, fire blankets, telephone, master power switches, and emergency exits.
- 1.B.07a Demonstrate the safe use, storage, and maintenance of every piece of equipment in the lab, shop, and classroom.
- 1.B.08a Describe safety practices and procedures to be followed when working with and around electricity.
- 1.B.09a Properly handle, store, dispose of, and recycle hazardous, flammable, and combustible materials.
- 1.B.10a Demonstrate proper workspace cleaning procedures.

1.C Demonstrate responses to situations that threaten health and safety.

- 1.C.01a Illustrate First Aid procedures for potential injuries and other health concerns in the occupational area.
- 1.C.02a Describe the importance of emergency preparedness and an emergency action plan.
- 1.C.03a Illustrate procedures used to handle emergency situations and accidents, including identification, reporting, response, evacuation plans, and follow-up procedures.

- 1.C.04a Identify practices used to avoid accidents.
- 1.C.05a Identify and describe fire protection, precautions and response procedures.
- 1.C.06a Discuss the role of the individual and the company/organization in ensuring workplace safety.
- 1.C.07a Discuss ways to identify and prevent workplace/school violence.

Strand 2: Technical Knowledge and Skills

2.A Apply Problem Solving and Troubleshooting Basics.

- 2.A.01c Define and document a problem.
- 2.A.02c Define possible causes of a problem.
- 2.A.03c Determine and discuss possible solutions to a problem.
- 2.A.04c Explain and perform basic troubleshooting and maintenance tasks.

Performance Example:

1. Interview a customer with a computer problem, document and research issue, and propose solution or direct them to appropriate resources.

2.B Explain basic network technologies.

- 2.B.01c Describe the function of the internet and intranets.
- 2.B.02c Define network terms.
- 2.B.03c Differentiate between LANs, MANs and WANs.
- 2.B.04c Describe the purposes of a network.
- 2.B.05c Trace the evolution of networks.
- 2.B.06c Analyze the current trends and developments in LANs.
- 2.B.07c Identify OSI Layer 1 through Layer 7.
- 2.B.08c Explain passwords and log ins as they relate to network structures.
- 2.B.09c Demonstrate the basic design and components of LAN and WAN systems.
- 2.B.10c Describe network topologies (ring, star, bus).
- 2.B.11c Identify voice communication, data communications, and telecommunications systems.
- 2.B.12c Compare and contrast wireless networking to wired networking.

Performance Example:

1. Explain the different network classifications and terms.
2. Explain why an organization would implement a network system. Describe the historical and future evolution of network technologies.
3. In a given network environment, describe the components and topology used.
4. Explain the different types of communication systems.

2.C Describe and use network system hardware and software components.

- 2.C.01c Construct networks using different types of cables.
- 2.C.02c Describe how terminals are connected in a network configuration.
- 2.C.03c Identify and utilize modems used for dial-up access.
- 2.C.04c Identify network applications (fax, voice mail, online services, email).
- 2.C.05c Summarize the characteristics and uses of TCP/IP protocol.
- 2.C.06c Differentiate between local computer operating systems and network operating systems.
- 2.C.07c Open, and communicate over, an internet connection.
- 2.C.08c Demonstrate basic diagnostic skills.
- 2.C.09c Configure a simple peer-to-peer network.
- 2.C.10c Share a resource in a peer-to-peer networked environment.
- 2.C.11c Access a shared resource in a peer-to-peer networked environment.
- 2.C.12c Demonstrate how bandwidths affect data transfer.

Performance Example:

1. Use a variety of hardware and software to connect and establish communications on a network.
2. Create a simple peer to peer network including creating and accessing shared resources.

2.D Explain programming concepts.

- 2.D.01c Define what a computer program is.
- 2.D.02c Define how a computer program runs.
- 2.D.03c Identify the applications appropriate for each programming language.
- 2.D.04c Define functions/methods/procedures.
- 2.D.05c Define programming structures.
- 2.D.06c Differentiate between procedural and object oriented programming.
- 2.D.07c Define purpose and use of flowcharting.

2.E Utilize multimedia and graphic tools.

- 2.E.01c Describe various interactive media tools.
- 2.E.02c Create and manipulate illustrations using a drawing or painting program.
- 2.E.03c Import and export graphics using external peripherals.
- 2.E.04c Identify and define different graphic file formats.
- 2.E.05c Open and run video clips.
- 2.E.06c Create a simple video clip.
- 2.E.07c Play and record sound clips.

Performance Example:

1. Design and publish a web page incorporating multimedia and graphic components.

2.F Create HTML documents.

- 2.F.01c Work with multiple applications (ASCII editor and browser).
- 2.F.02c Create an HTML document using simple HTML tags.
- 2.F.03c Launch HTML document in a browser.
- 2.F.04c Apply basic debugging techniques.

2.G Classify and install computer hardware.

- 2.G.01c Identify main classification of computers.
- 2.G.02c Identify major hardware components, their functions and relationships.
- 2.G.03c Identify types of computer storage devices.
- 2.G.04c Practice proper handling procedures for components.
- 2.G.05c Install and configure hardware in a computer system.

Performance Example:

1. Given a set of specifications, select, install and configure hardware, operating system and applications.

- 2.H Use and support computer operating systems.**
- 2.H.01c Identify major operating system fundamentals and components, and hardware compatibility.
 - 2.H.02c Perform basic operations within an operating system.
 - 2.H.03c Troubleshoot basic problems within an operating system.
 - 2.H.04c Customize the operating system environment.
 - 2.H.05c Return an operating system back to original configuration.

- 2.I Install and configure software.**
- 2.I.01c Install software programs.
 - 2.I.02c Perform basic configuration operations.
 - 2.I.03c Describe basic compatibility issues.
 - 2.I.04c Uninstall applications.

- 2.J Explain information technology's role in the workplace and society.**
- 2.J.01c Illustrate the IT timeline (evolution).
 - 2.J.02c Identify professional certifications.
 - 2.J.03c Define impact of technologies on society.
 - 2.J.04c Identify technologies and describe their uses in the workplace and society.
 - 2.J.05c Illustrate uses of interactive media in society/industry.

Performance Example:

1. Create a time line following one area of IT from inception to current day including careers and major changes caused by the technology.

- 2.K Explain security and risk awareness issues.**
- 2.K.01c Discuss security principles, vulnerability and threats.
 - 2.K.02c Explain principles of secure passwording strategies.
 - 2.K.03c Illustrate what fundamental legal issues involved with security management.
- 2.L Demonstrate project management skills.**
- 2.L.01c Define scope of work to achieve individual and group goals.
 - 2.L.02c Identify stakeholders and decision makers.
 - 2.L.03c Identify escalation procedures.
 - 2.L.04c Develop work breakdown structures.
 - 2.L.05c Evaluate project requirements.
 - 2.L.06c Identify required resources and budget.
 - 2.L.07c Estimate time requirements.
 - 2.L.08c Develop initial project management flow chart.
 - 2.L.09c Identify interdependencies within a project management plan.
 - 2.L.10c Identify and track critical milestones.
 - 2.L.11c Evaluate risks and prepare contingency plan.
 - 2.L.12c Participate in project phase review and report project status.
 - 2.L.13c Identify project management software.
 - 2.L.14c Develop method of evaluation.
 - 2.L.15c Formulate a task strategy.
 - 2.L.16c Prioritize tasks according to customer needs.
 - 2.L.17c Devise plan of action.
 - 2.L.18c Identify means of managing change.

Performance Examples:

1. Using appropriate project management software complete an assigned project within the given time limit and submit documentation for each phase including plan of action, individuals responsibilities, flowchart, and time requirements.
2. Describe how the project will be evaluated.
3. Perform an assessment of a suggested change in a particular process in regards to technology, cost, and feasibility.

2.M Prepare and present documentation.

- 2.M.01c Prepare a technical documentation report that is clear, concise, accurate, complete, appropriate, and grammatically correct.
- 2.M.02c Describe the contents, characteristics and the purpose of network documentation, user documentation, troubleshooting logs, and maintenance logs.

2.N Explain fundamental programming theory.

- 2.N.01 Describe the relationship between hardware and software.
- 2.N.02 Analyze programming languages for uses, structure, and environment.
- 2.N.03 Classify the various programming languages by communication level.
- 2.N.04 Summarize the function and operation of compilers and interpreters.
- 2.N.05 List the stages of program development.
- 2.N.06 Analyze a problem identifying desired outputs for given inputs.
- 2.N.07 Describe the fundamental data types and their operations (including arrays).
- 2.N.08 Design program logic using graphical techniques (flow charts).
- 2.N.09 Design program logic using pseudocode techniques.
- 2.N.10 Identify the use of program design tools.
- 2.N.11 Explain structured/modular programming.
- 2.N.12 Describe the information system (IS) life cycle.
- 2.N.13 List the characteristics and uses of batch processing.
- 2.N.14 List the characteristics and uses of interactive processing.
- 2.N.15 List the characteristics and uses of event-driven, object-oriented processing.
- 2.N.16 Illustrate characteristics of technical documentation associated with software development.

Performance Example:

1. In the proper environment describe the various types of programs, operating systems, how the computer works, the binary number system, and how data is stored in memory.

2.O Plan programs.

- 2.O.01 Develop a problem statement.
- 2.O.02 Define the assumptions that define the scope of the problem.
- 2.O.03 List strategies used to gather known information.
- 2.O.04 Apply known information to the problem statement.
- 2.O.05 Hypothesize expected output.

Performance Example:

1. Given a project, work on planning a computer program, devising a problem statement, scope of the problem to be solved, gather the known information and expected output.

2.P Develop programs.

- 2.P.01 Develop programs using desired language.
- 2.P.02 Develop programs that use arithmetic operations.
- 2.P.03 Develop programs that use relational operators.
- 2.P.04 Explain and apply the use of logical operators.
- 2.P.05 Explain and apply compound conditions.
- 2.P.06 Explain and apply control breaks.
- 2.P.07 Explain and apply methods of calculating subtotals and final totals.
- 2.P.08 Explain and apply iterative and conditional loops.
- 2.P.09 Describe common development environments.
- 2.P.10 Explain and apply the use of sort routines.
- 2.P.11 Explain and apply the use of files in programming.
- 2.P.12 Create sequential files.
- 2.P.13 Create random files.
- 2.P.14 Create, update, and delete records.
- 2.P.15 Explain and apply methods used to incorporate menus.
- 2.P.16 Develop interactive programs.
- 2.P.17 Explain and apply the use of an array.
- 2.P.18 Design and develop structures.
- 2.P.19 Design and develop classes, subclasses.
- 2.P.20 Instantiate objects.
- 2.P.21 Explain and apply methods of incorporating error handling routines.
- 2.P.22 Define and apply built in functions.
- 2.P.23 Create user defined functions.
- 2.P.24 Apply language specific programming techniques.
- 2.P.25 Test and run a program for desired output.
- 2.P.26 Explain and apply methods used to debug a program.
- 2.P.27 Utilize reference materials for problem solving.
- 2.P.28 Generate executable code.
- 2.P.29 Provide internal documentation.
- 2.P.30 Explain the importance of versioning and source code control.
- 2.P.31 Compare and contrast revision control and version control.
- 2.P.32 Annotate program and design and revision.
- 2.P.33 Explain release management.
- 2.P.34 Explain and apply methods used to maintain application/program.

Performance Examples:

1. Given many types of assignments, create programs using good programming style guidelines, compile, link, and run the programs.
2. Correct syntax errors and warnings.

2.Q Implement and manage software.

- 2.Q.01 Demonstrate ability to work on a software development team.
- 2.Q.02 Identify sources and techniques used to gather information needed for implementation.

- 2.Q.03 Explain and demonstrate a program's use/function.
- 2.Q.04 Plan and write end user documentation.
- 2.Q.05 List and apply methods used to troubleshoot compatibility issues of hardware and software.
- 2.Q.06 Disable/uninstall software that may interfere with installation of a program.
- 2.Q.07 Document installation and configuration procedures.
- 2.Q.08 Explain and demonstrate methods to verify software/program installation and operation.
- 2.Q.09 Identify the issues of security in programming and software implementation.

Performance Example:

1. Given group projects, work on creating a program in which the group creates programs using good programming style, principles of design, and testing is utilized.

2.R Test and follow a Quality Assurance Process.

- 2.R.01 Create a testing plan.
- 2.R.02 Implement a testing plan.
- 2.R.03 Demonstrate ability to provide feedback to the development process.

Performance Example:

1. Choose a program that has many errors, write a test procedure for the program, implement the test program, and document what the errors are and how to correct the errors.

2.S Use Hypertext Markup Language (HTML).

- 2.S.01 Identify HTML tags and syntax in accordance with W3C standards.
- 2.S.02 Describe using tables for page layout and tabular data.
- 2.S.03 Create anchors, absolute, and relative hypertext links.
- 2.S.04 Evaluate the use of frames and I-frames in web design and identify and offer alternatives.
- 2.S.05 Implement interactivity using a form.
- 2.S.06 Employ appropriate tags to incorporate multimedia components.
- 2.S.07 List the industry standard web authoring tools available.
- 2.S.08 Identify various browsers and their associated operating systems.
- 2.S.09 Apply design debugging techniques.

Performance Examples:

1. Create a web page utilizing standard HTML tags in contemporary use.
2. Test and debug page.

2.T Use Cascading Style Sheets in the creation of a website.

- 2.T.01 Define CSS in accordance with W3C standards.
- 2.T.02 Explain the use of selectors, declarations, properties and values.
- 2.T.03 Demonstrate CSS syntax.
- 2.T.04 Differentiate between in-line, internal, and external style sheets.
- 2.T.05 Explain the importance of class, id, div, span attributes.
- 2.T.06 Differentiate between relative and absolute positioning.

Performance Example:

1. Create web pages utilizing standard HTML tags with internal and external cascading style sheets.

2.U Use JavaScript in the creation of a website.

- 2.U.01 Summarize JavaScript syntax and the placement of code.
- 2.U.02 Define objects, properties and methods.
- 2.U.03 Employ interactive events with event handlers.
- 2.U.04 Define and invoke functions.
- 2.U.05 Implement common JavaScript (pop-up windows, rollovers, slideshow arrays, form verifications).
- 2.U.06 Create and link external JavaScript page to website.
- 2.U.07 Explain basic DHTML techniques (time/date, moving objects, etc).
- 2.U.08 Apply JavaScript debugging techniques.

Performance Example:

1. Create a web page utilizing basic JavaScript functions and techniques such as pop-up windows, rollovers, slideshows, time/date, and form verification.

2.V Define interactive/server-side technologies.

- 2.V.01 Compare and contrast server-side concept and a flat system.
- 2.V.02 Discuss various server-side technologies including their strengths and vulnerabilities.
- 2.V.03 Demonstrate methods of managing form data with server-side technology.

Performance Example:

1. Define server-side technologies.
2. Distinguish between CGI/Perl, HyperText PreProcessor (PHP), and Active Server Pages (ASP) technologies.

2.W Use Extensible Markup Language (XML).

- 2.W.01 Define XML syntax in accordance with W3C standards.
- 2.W.02 Describe XML and its application.
- 2.W.03 Summarize XML's relationship to database integration and E-commerce.

Performance Example:

1. Create a web page utilizing standard HTML tags and XML tags.
2. Test and debug page.

2.X Identify security issues.

- 2.X.01 Discuss site security issues.
- 2.X.02 Explain basic security issues regarding servers, hardware, and infrastructure including conditions that lead to vulnerability and potential solutions.

Performance Example:

1. Identify web site security issues, protection of hardware, and anti-virus software protection.

2.Y Design and create a web page.

- 2.Y.01 Analyze the historical evolution of web page design.
- 2.Y.02 Develop a competitive analysis to identify current trends.
- 2.Y.03 Plan and design site in accordance with the purpose and function of interactive media.

- 2.Y.04 Create an organizational structure, site map, and logical navigation scheme (including written schematic with customer approval before development begins).
- 2.Y.05 Design a basic template page.
- 2.Y.06 Employ aesthetic/design theory for page layout.
- 2.Y.07 Develop content in accordance with search engine optimization standards.
- 2.Y.08 Identify and test site for browser compatibility issues and user accessibility standards.
- 2.Y.09 Edit and incorporate an audio clip into a web page.
- 2.Y.10 Edit and incorporate a video clip into a web page.
- 2.Y.11 Create and incorporate an animation into a web page.
- 2.Y.12 Scan and incorporate a digital image into a web page.
- 2.Y.13 Create and incorporate a graphic into a web page.

Performance Examples:

1. Plan a basic web page template.
2. Create structure, page layout, site map, and navigational scheme.
3. Develop content with search engine keywords.
4. Create the basic web page template and test site.

2.Z Publish and Maintain a website.

- 2.Z.01 Illustrate the responsibilities of website hosting.
- 2.Z.02 Identify various media server types.
- 2.Z.03 Identify various publishing procedures.
- 2.Z.04 Publish/upload website.
- 2.Z.05 Explain the importance of versioning and source code control.
- 2.Z.06 Describe ways to maintain content on an on-going basis.
- 2.Z.07 Identify various strategies to promote a web site.
- 2.Z.08 Describe methods used to submit a site to various directories and search engines.
- 2.Z.09 Describe methods used to collect and evaluate site traffic using server log data and other feedback.

Performance Example:

1. List steps necessary to register a domain name, publish a web site, secure hosting services, and provide on-going web site maintenance.
2. Identify web site marketing strategies and collection of site statistics.
3. List procedure of web site URL submission to search engines.

Strand 3: Embedded Academic Knowledge and Skills

3.A English Language Arts

VTE #	Acad #	Standard	Grade	Topic
3.A.01c	19.21	For informational/expository writing: Write reports based on research that includes quotations, footnotes or endnotes, and a bibliography.	Pre-9	Composition
3.A.02c	24.4	Apply steps for obtaining information from a variety of sources, organizing information, documenting sources, and presenting research in individual projects:	Pre-9	Composition
3.A.03c	2.4	Integrate relevant information gathered from group discussions and interviews for reports.	Pre-9	Language
3.A.04c	13.19	Identify and use knowledge of common graphic features (charts, maps, diagrams).	Pre-9	Reading
3.A.05c	24.5	Formulate open-ended research questions and apply steps for obtaining and evaluating information from a variety of sources, organizing information, documenting sources in a consistent and standard format, and presenting research.	9/10	Composition
3.A.06c	26.5	Analyze visual or aural techniques used in a media message for a particular audience and evaluate their effectiveness.	9/10	Media
3.A.07c	19.27	For informational/expository writing: Write well-organized research papers that prove a thesis statement using logical organization, effective supporting evidence, and variety in sentence structure.	11/12	Composition
3.A.08c	24.6	Formulate original, open-ended questions to explore a topic of interest, design and carry out research, and evaluate the quality of the research paper in terms of the adequacy of its questions, materials, approach, and documentation of sources.	11/12	Composition
3.A.09c	3.17	Deliver formal presentations for particular audiences using clear enunciation and appropriate organization, gestures, tone, and vocabulary.	11/12	Language

3.A.10c	4.27	Use general dictionaries, specialized dictionaries, thesauruses, histories of language, books of quotations, and other related references as needed.	11/12	Language
3.A.11c		Explain purpose and format of specific technical documents (logs, reports, training manuals).		Voc
3.A.12c		Read technical manuals, guides, resource books and technical literature to gain information and solve problems.		Voc
3.A.13c		Write and communicate using appropriate technical language and methods (logs, reports, etc).		Voc
3.A.14	26.4	Analyze the effect on the reader's or viewer's emotions of text and image in print journalism, and images, sound, and text in electronic journalism, distinguishing techniques used in each to achieve these effects.	Pre-9	Media
3.A.15	26.5	Analyze visual or aural techniques used in a media message for a particular audience and evaluate their effectiveness.	9/10	Media
3.A.16	27.7	Develop and apply criteria for assessing the effectiveness of the presentation, style, and content of films and other forms of electronic communication.	9/10	Media
3.A.17	26.6	Identify the aesthetic effects of a media presentation and identify and evaluate the techniques used to create them.	11/12	Media
3.A.18	27.8	Create coherent media productions that synthesize information from several sources.	11/12	Media

3.B Mathematics

VTE #	Acad #	Standard	Grade	Topic
3.B.01	7.G.5	Use a ruler, protractor, and compass to draw polygons and circles.	Pre-9	Geometry
3.B.02c	7.M.2	Given the formulas, convert from one system of measurement to another. Use technology as appropriate.	Pre-9	Measurement

3.B.03c	8.M.2	Given the formulas, convert from one system of measurement to another. Use technology as appropriate.	Pre-9	Measurement
3.B.04c	8.N.1	Compare, order, estimate, and translate among integers, fractions and mixed numbers (i.e., rational numbers), decimals, and percents.	Pre-9	Numbers
3.B.05c	7.P.4	Solve linear equations using tables, graphs, models, and algebraic methods.	Pre-9	Patterns, relations, algebra
3.B.06c	7.P.6	Use linear equations to model and analyze problems involving proportional relationships. Use technology as appropriate.	Pre-9	Patterns, relations, algebra
3.B.07c	10.D.1	Select, create, and interpret an appropriate graphical representation (e.g., scatterplot, table, stem-and-leaf plots, box-and-whisker plots, circle graph, line graph, and line plot) for a set of data and use appropriate statistics (e.g., mean, median, range, and mode) to communicate information about the data. Use these notions to compare different sets of data.	9/10	Data Analysis, Statistics
3.B.08c	10.D.3	Describe and explain how the relative sizes of a sample and the population affect the validity of predictions from a set of data.	9/10	Data Analysis, Statistics
3.B.09c	10.G.3	Recognize and solve problems involving angles formed by transversals of coplanar lines. Identify and determine the measure of central and inscribed angles and their associated minor and major arcs. Recognize and solve problems associated with radii, chords, and arcs within or on the same circle.	9/10	Geometry
3.B.10c	10.G.4	Apply congruence and similarity correspondences (e.g., $\triangle ABC \cong \triangle XYZ$) and properties of the figures to find missing parts of geometric figures, and provide logical justification.	9/10	Geometry
3.B.11c	10.G.6	Use the properties of special triangles (e.g., isosceles, equilateral, 30° - 60° - 90° , 45° - 45° - 90°) to solve problems.	9/10	Geometry

3.B.12c	10.G.7	Using rectangular coordinates, calculate midpoints of segments, slopes of lines and segments, and distances between two points, and apply the results to the solutions of problems.	9/10	Geometry
3.B.13c	10.G.8	Find linear equations that represent lines either perpendicular or parallel to a given line and through a point, e.g., by using the "point-slope" form of the equation.	9/10	Geometry
3.B.14c	10.G.9	Draw the results, and interpret transformations on figures in the coordinate plane, e.g., translations, reflections, rotations, scale factors, and the results of successive transformations. Apply transformations to the solutions of problems.	9/10	Geometry
3.B.15c	10.M.2	Given the formula, find the lateral area, surface area, and volume of prisms, pyramids, spheres, cylinders, and cones, e.g., find the volume of a sphere with a specified surface area.	9/10	Measurement
3.B.16c	10.M.4	Describe the effects of approximate error in measurement and rounding on measurements and on computed values from measurements.	9/10	Measurement
3.B.17c	10.P.8	Solve everyday problems that can be modeled using systems of linear equations or inequalities. Apply algebraic and graphical methods to the solution. Use technology when appropriate. Include mixture, rate, and work problems.	9/10	Patterns, relations, algebra
3.B.18c	12.D.1	Design surveys and apply random sampling techniques to avoid bias in the data collection.	11/12	Data Analysis, Statistics
3.B.19c	12.D.2	Select an appropriate graphical representation for a set of data and use appropriate statistics (e.g., quartile or percentile distribution) to communicate information about the data.	11/12	Data Analysis, Statistics
3.B.20c	12.D.3	Apply regression results and curve fitting to make predictions from data.	11/12	Data Analysis, Statistics
3.B.21c	12.D.4	Apply uniform, normal, and binomial distributions to the solutions of problems.	11/12	Data Analysis, Statistics

3.B.22c	12.D.6	Use combinatorics (e.g., "fundamental counting principle," permutations, and combinations) to solve problems, in particular, to compute probabilities of compound events. Use technology as appropriate.	11/12	Data Analysis, Statistics
3.B.23c	12.D.7	Compare the results of simulations (e.g., random number tables, random functions, and area models) with predicted probabilities.	11/12	Data Analysis, Statistics
3.B.24c	12.D.7	Compare the results of simulations (e.g., random number tables, random functions, and area models) with predicted probabilities.	11/12	Data Analysis, Statistics
3.B.25c	12.M.2	Use dimensional analysis for unit conversion and to confirm that expressions and equations make sense.	11/12	Measurement
3.B.26c	12.P.7	Find solutions to quadratic equations (with real coefficients and real or complex roots) and apply to the solutions of problems.	11/12	Patterns, relations, algebra
3.B.27c	12.P.8	Solve a variety of equations and inequalities using algebraic, graphical, and numerical methods, including the quadratic formula; use technology where appropriate. Include polynomial, exponential, logarithmic, and trigonometric functions; expressions involving absolute values; trigonometric relations; and simple rational expressions.	11/12	Patterns, relations, algebra
3.B.28c	12.P.9	Use matrices to solve systems of linear equations. Apply to the solution of everyday problems.	11/12	Patterns, relations, algebra
3.B.29c		Apply relational operators (equal, not equal, greater than, less than) and logical operators (and/or, not) in an expression.		Voc
3.B.30c		Use logic as a reasoning and critical evaluation tool for problem solving and decision making.		Voc
3.B.31c		Recognize and correct logical flows in analyses and arguments.		Voc

3.C Science and Engineering/Technology

VTE #	Acad #	Standard	Grade	Topic
3.C.01c	1	Differentiate between weight and mass, recognizing that weight is the amount of gravitational pull on an object.	Pre-9	Physics/Chem
3.C.02c	3	Recognize that the measurement of volume and mass requires understanding of the sensitivity of measurement tools (e.g., rulers, graduated cylinders, balances) and knowledge and appropriate use of significant digits.	Pre-9	Physics/Chem
3.C.03c	1.3	Describe the characteristics of waves (wavelength, frequency, velocity, amplitude).		Earth/Space
3.C.04c	1.1	Identify and explain the steps of the engineering design process, i.e., identify the problem, research the problem, develop possible solutions, select the best possible solution(s), construct a prototype, test and evaluate, communicate the solution(s), and redesign.		Eng/Tech
3.C.05c	1.2	Demonstrate knowledge of pictorial and multi-view drawings (e.g., orthographic projection, isometric, oblique, perspective) using proper techniques.		Eng/Tech
3.C.06c	1.5	Interpret plans, diagrams, and working drawings in the construction of a prototype.		Eng/Tech
3.C.07c	4.2	Give examples of how conduction, convection, and radiation are used in the selection of materials, e.g., home and vehicle thermostat designs, circuit breakers.		Eng/Tech
3.C.08c	5.2	Identify and explain the components of a circuit including a source, conductor, load, and controllers (controllers are switches, relays, diodes, transistors, integrated circuits).		Eng/Tech
3.C.09c	5.3	Explain the relationship between resistance, voltage, and current (Ohm's Law).		Eng/Tech
3.C.10c	5.4	Determine the voltages and currents in a series circuit and a parallel circuit.		Eng/Tech
3.C.11c	5.5	Identify appropriate units of measurement for current, voltage, and resistance, and explain how they are measured.		Eng/Tech

3.C.12c	5.6	Analyze circuits (find the current at any point and the potential difference between any two points in the circuit) using Kirchoff and Ohm's laws.		Eng/Tech
3.C.13c	6.1	Identify and explain the applications of light in communications, e.g., reflection, refraction, additive, and subtractive color theory.		Eng/Tech
3.C.14c	6.2	Explain how information travels through different media, e.g., electrical wire, optical fiber, air, space.		Eng/Tech
3.C.15c	6.3	Compare the difference between digital and analog communication devices.		Eng/Tech
3.C.16c	6.4	Explain the components of a communication system, i.e., source, encoder, transmitter, receiver, decoder, storage, retrieval, and destination.		Eng/Tech
3.C.17c	6.5	Identify and explain the applications of laser and fiber optic technologies, e.g., telephone systems, cable television, medical technology, and photography.		Eng/Tech
3.C.18c	7.2	Differentiate the selection of tools and procedures used in the safe production of products in the manufacturing process, e.g., hand tools, power tools, computer-aided manufacturing, three-dimensional modeling.		Eng/Tech
3.C.19c	7.3	Explain the process and the programming of robotic action utilizing three axes.		Eng/Tech
3.C.20c	1.12	Identify appropriate standard international units of measurement for force, mass, distance, speed, acceleration, and time, and explain how they are measured.		Physics
3.C.21c	2.6	Identify appropriate standard international units of measurement for energy, work, power, and momentum.		Physics
3.C.22c	4.4	Distinguish between mechanical and electromagnetic waves.		Physics
3.C.23c	4.7	Explain, graph, and interpret graphs of constructive and destructive interference of waves.		Physics
3.C.24c	5.1	Recognize the characteristics of static charge, and explain how a static charge is generated.		Physics

3.C.25c	5.3	Explain the difference in concept between electric forces and electric fields.		Physics
3.C.26c	5.4	Develop a qualitative and quantitative understanding of current, voltage, resistance, and the connection between them.		Physics
3.C.27c	5.6	Describe the differences between Alternating Current (AC) and Direct Current (DC).		Physics
3.C.28c		Explain the differences between analog and digital information and the use of binary numbers in data storage.		Voc
3.C.29c		Explain Mohr's Law.		Voc

Strand 4: Employability Knowledge and Skills

4.A Develop employability skills to secure and keep employment in chosen field.

- 4.A.01a Evaluate industries, organizations, and careers based on multiple sources of research and information.
- 4.A.02a Assess interest areas to determine potential career pathways, including career ladders.
- 4.A.03a Develop a career plan with alternatives.
- 4.A.04a Complete job applications and related employment documents (e.g. W-4).
- 4.A.05a Create professional cover letters, resumes, and portfolios in a variety of formats (print and electronic).
- 4.A.06a Apply job search skills to seek, evaluate, apply for, and accept employment.
- 4.A.07a Demonstrate good interviewing skills.
- 4.A.08a Demonstrate employability skills needed to get and keep a job.
- 4.A.09a Assess alternative occupational choices (e.g. working conditions, benefits, and opportunities to change).

Performance Examples:

1. Research positions open within a variety of companies and compare/contrast their descriptions, duties, and expectations.
2. Prepare responses to standard interview questions.
3. Participate in a mock-interview with industry professionals.

4.B Communicate in multiple modes to address needs within the career and technical field.

- 4.B.01a Apply strategies to enhance effectiveness of all types of communications in the workplace.
- 4.B.02a Apply reading skills and strategies to work-related documents.
- 4.B.03a Locate information from books, journals, magazines, and the Internet.
- 4.B.04a Apply basic writing skills to work-related communication.
- 4.B.05a Write work-related materials.
- 4.B.06a Explain information presented graphically.
- 4.B.07a Use writing/publishing/presentation applications.
- 4.B.08a Apply basic skills for work-related oral communication.
- 4.B.09a Explain proper telephone etiquette and skills.
- 4.B.10a Lead formal and informal group discussions.
- 4.B.11a Demonstrate effective negotiation and conflict management.
- 4.B.12a Apply active listening skills to obtain and clarify information.
- 4.B.13a Communicate with others in a diverse workforce.

Performance Examples:

1. Review a professional journal; choose one article to summarize.
2. Call the publisher for free products in journal.
3. Develop an oral presentation regarding an article in a journal.
4. Summarize trends presented in a graph.

4.C Solve problems using critical thinking.

- 4.C.01a Demonstrate skills used to define and analyze a given problem.

- 4.C.02a Explain the importance and dynamics of individual and teamwork approaches of problem solving.
- 4.C.03a Describe methods of researching and validating reliable information relevant to the problem.
- 4.C.04a Explain strategies used to formulate ideas, proposals and solutions to problems.
- 4.C.05a Select potential solutions based on reasoned criteria.
- 4.C.06a Implement and evaluate solution(s).

4.D Demonstrate positive work behaviors.

- 4.D.01a Identify time management and task prioritization skills.
- 4.D.02a Explain the importance of following workplace etiquette/protocol.
- 4.D.03a Demonstrate willingness to learn and further develop skills.
- 4.D.04a Demonstrate self-management skills.
- 4.D.05a List causes of stress and effective stress management techniques.
- 4.D.06a Describe the importance of having a positive attitude and techniques that boost morale.
- 4.D.07a Show initiative by coming up with unique solutions and taking on extra responsibilities.
- 4.D.08a Explain the importance of setting goals and demonstrate the ability to set, reach, and evaluate goals.
- 4.D.09a Explain the importance of taking pride in work accomplished and extrinsic and intrinsic motivators that can be used to increase pride.
- 4.D.10a Value the importance of professionalism, including reliability, honesty, responsibility, and ethics.
- 4.D.11a Demonstrate a respect for diversity and its benefit to the workplace.

Strand 5: Management and Entrepreneurship Knowledge and Skills

5.A Analyze basic business practices required to start and run a company/organization.

- 5.A.01a Define entrepreneurship.
- 5.A.02a Describe the relationship between suppliers, producers, and consumers.
- 5.A.03a Compare and contrast types of businesses, including sole proprietorships, small businesses, companies, corporations, governmental agencies, and non-profit organizations.
- 5.A.04a Describe practices that ensure quality customer service.
- 5.A.05a Explain the value of competition in business/field.

Performance Examples:

1. Prepare a business plan for a new company in your community.
2. Participate in a discussion with members of a local small-business incubator or chamber of commerce, identifying opportunities and summarizing best practices of new companies.
3. Create an equipment list, with costs, of equipment required for doing specific tasks.
4. Identify local zoning and environmental laws that apply to businesses in your industry.

5.B Manage all resources related to a business/organization.

- 5.B.01a Identify a company's/organization's chain of command and organizational structure.
- 5.B.02a Define and demonstrate leadership and teamwork skills.
- 5.B.03a Explain ways a company or organization can market itself, including choosing a name, designing logos and promotional materials, advertising, and the importance of word-of-mouth.
- 5.B.04a Identify methods to track inventory, productivity, income, expenses, and personnel.
- 5.B.05a Explain the importance of written operating procedures and policies.
- 5.B.06a Identify professional organizations and their benefits.
- 5.B.07a Explain methods to effectively run a meeting.

Performance Examples:

1. Create a plan to keep track of tools and supplies in your classroom/shop.
2. Work as a team to complete a project, including running and participating in problem-solving meetings.
3. Contact a relevant professional organization and request information about its benefits, membership requirements, and costs.
4. Clip print advertisements from local companies, identifying common themes and contrasting different styles.

5.C Describe methods for managing, organizing, retrieving and reporting financial data.

- 5.C.01a Explain the role of small businesses in the economy.
- 5.C.02a Extract and extrapolate data from financial documents, such as a pay-stub, budget, tax statement, and financial report.

Performance Examples:

1. Create and follow a budget for an in-class project.
2. Identify equipment in your shop/lab that are considered as capital.
3. From a pay-stub, determine gross salary, deductions, and net pay for a calendar year.
4. Create a rate card or other list of standardized costs for services provided, based on research of local rates and practices.

5.D Apply labor and civil rights law and guidelines to business practice and decisions.

- 5.D.01a List federal and state mandated employee rights.
- 5.D.02a Describe proper working conditions for your industry.
- 5.D.03a Explain the role of labor organizations.
- 5.D.04a Discuss the importance of diversity and list methods of encouraging diversity in the workplace.
- 5.D.05a Describe standard forms of employment contracts applicable to your industry.
- 5.D.06a State the current minimum wage, as well as wages for common jobs found within the field.
- 5.D.07a List opportunities for continual professional development.

Performance Examples:

1. Participate in and summarize a discussion with a member of a labor organization.
2. Participate in and summarize a discussion with a member of a civil rights organization.
3. While participating in a group project, write and follow job descriptions for each member of the team.
4. Evaluate a shop/lab in terms of safety, ergonomics, and workflow.

5.E Evaluate the effects of community relations on companies and the industry.

- 5.E.01a Describe the role that the industry/organization plays in different communities.
- 5.E.02a Describe the role that community interests play in a company's/organization's decision-making process.

Performance Example:

1. Participate in a service project or community-centered event.

5.F Apply legal requirements and ethical considerations to business practice and decisions.

- 5.F.01a Identify laws that regulate businesses/organizations in your field.
- 5.F.02a Define the requirements for and protections given by copyright and trademark law.
- 5.F.03a Define the impact of the Americans with Disabilities Act and other civil rights legislation on your business/organization, employees, and customers.
- 5.F.04a Define ethical business practices for your field.
- 5.F.05a Identify trade-specific practices that support clean energy technologies and encourage environmental sustainability.

Performance Examples:

1. Research the ethical guidelines set forth by a professional organization related to your industry and participate in a debate over how to apply these guidelines to a variety of situations.
2. Create a portfolio of a variety of completed contracts and their uses.
3. Participate in and summarize a discussion with a lawyer, consumer advocate, or other legal professional.
4. Create a quick reference outline listing legal topics and related resources.

Strand 6: Technological Knowledge and Skills

6.A Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.

- 6.A.01a Select and utilize the appropriate technology to solve a problem or complete a task.
- 6.A.02a Demonstrate file management skills (e.g., install new software, compress and expand files as needed, download files as appropriate).
- 6.A.03a Differentiate between different operating systems and demonstrate use of at least one to open and switch between programs and files.
- 6.A.04a Identify and demonstrate resolutions to simple hardware and software problems as they occur (e.g., frozen screen, disk error, printing problems).
- 6.A.05a Save, retrieve, load, format, and import data into, and export a variety of electronic documents (word processing, spreadsheet, database, AND desktop publishing).
- 6.A.06a Demonstrate the proper use of a variety of external peripherals and how they connect to a computer.
- 6.A.07a Illustrate methods of selecting and using search engines.
- 6.A.08a Send, receive, and manage electronic correspondence and files, in accordance with school policy.
- 6.A.09a Demonstrate proper use of electronic proofreading tools and explain reasons why these shouldn't be relied upon solely.

Performance Example:

1. In the development of work-based projects, students demonstrate computer skills inherent in the word processing techniques used, the organization of data, use of photographic representation, research projects, and other relevant project based activities.

6.B Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media.

- 6.B.01a Identify ways in which technology is used in the workplace and in society.
- 6.B.02a Summarize the rights and responsibilities of the school's Acceptable Use Policy.
- 6.B.03a Explain laws restricting use of copyrighted materials on the Internet.
- 6.B.04a Discuss the concerns about electronic communications, privacy and security, including protection from spyware and viruses.

Performance Example:

1. Describe how computers are used to increase efficiency, accuracy, and professionalism in the industry.

6.C Demonstrate ability to use technology for research, problem solving, and communication.

- 6.C.01a Locate, evaluate, collect, and process information from a variety of electronic sources.
- 6.C.02a Demonstrate the use of telecommunications and other media to interact or collaborate with peers, experts, and other audiences.

- 6.C.03a Demonstrate the use of appropriate electronic sources to conduct research (e.g., Web sites, online periodical databases, and online catalogs).
- 6.C.04a Demonstrate proper style (with correct citations) when integrating electronic research results into a research project.
- 6.C.05a Collect, organize, analyze, and graphically present data using the most appropriate tools.
- 6.C.06a Present information, ideas, and results of work using any of a variety of communications technologies (e.g., multimedia presentations, Web pages, videotapes, desktop-published documents).
- 6.C.07a Identify capabilities of technology resources and describe how they can be used for lifelong learning.
- 6.C.08a Demonstrate the proper use of electronic tools and office communications equipment (telephone, fax, copier, etc).

Performance Example:

1. Student is able to effectively use various technologies in the workplace.

6.D Manage files.

- 6.D.01c Explain directory structure.
- 6.D.02c Navigate directory structure to find a specific file/folder.
- 6.D.03c Explain and apply procedures used to manipulate folders.
- 6.D.04c Explain and apply procedures used to manipulate files.
- 6.D.05c Explain and apply procedures used to compress and uncompress files.
- 6.D.06c Explain and apply procedures used to associate file types with appropriate programs.
- 6.D.07c Differentiate between local and network drives, internet and intranet files.

Performance Example:

1. Plan and research for an event and use software applications to create a budget, manage mailing list, and design promotional materials.

6.E Use and relate common interfaces and applications.

- 6.E.01c Identify common user interface properties.
- 6.E.02c Identify common application components, such as help, file, view, tools, options.
- 6.E.03c Select source and destination applications.
- 6.E.04c Move/copy information between integrated applications.
- 6.E.05c Demonstrate how to link an object between applications.
- 6.E.06c Embed information between applications.

6.F Use word processing software.

- 6.F.01c Demonstrate keyboarding skills.
- 6.F.02c Explain and apply methods of formatting text.
- 6.F.03c Demonstrate commands used to find and replace text.
- 6.F.04c Demonstrate the use of spell check, grammar checker, and thesaurus.
- 6.F.05c Demonstrate ability to create and use tables.
- 6.F.06c Demonstrate use of headers and footers.

- 6.F.07c Demonstrate ways to insert hyperlinks, clip art, and pictures into documents.
 - 6.F.08c Demonstrate the proper way to use printing materials and functions.
 - 6.F.09c Demonstrate the use of help functions.
 - 6.F.10c Demonstrate how to merge documents.
- 6.G Create and use spreadsheets.**
- 6.G.01c Demonstrate how to create, edit, and save a spreadsheet.
 - 6.G.02c Demonstrate procedures used to open files, enter labels, enter values, and print worksheets.
 - 6.G.03c Explain and apply formulas and functions to a spreadsheet.
 - 6.G.04c Explain and apply "if" functions in a spreadsheet.
 - 6.G.05c Demonstrate how to format and manipulate cells, rows and columns.
 - 6.G.06c Demonstrate how to create charts and graphs.
 - 6.G.07c Demonstrate the use of help functions.
- 6.H Create and use databases.**
- 6.H.01c Demonstrate how to create a simple database.
 - 6.H.02c Demonstrate how to modify database structure.
 - 6.H.03c Demonstrate how to enter and edit data through datasheet/list view.
 - 6.H.04c Demonstrate how to enter and edit data through form view.
 - 6.H.05c Demonstrate techniques used to search/query database to locate specific information.
 - 6.H.06c Demonstrate how to create reports from a database.
 - 6.H.07c Demonstrate the use of help functions.
- 6.I Explain the various types of relationships between data in a database.**
- 6.I.01c Identify use of a simple relational database.
 - 6.I.02c Plan, design and create a simple relational database.
- 6.J Create presentations using software application.**
- 6.J.01c Demonstrate how to create, edit, and deliver a simple slide presentation.
 - 6.J.02c Explain considerations with and insert multimedia elements into a slide.
 - 6.J.03c Enhance presentations using animation and transitions.
 - 6.J.04c Demonstrate how slide shows can be run manually and automatically.
 - 6.J.05c Identify and print formats using single slides, entire presentation, outlines and notes.
 - 6.J.06c Demonstrate the use of help functions.
- 6.K Explain underlying concepts of and effectively use the internet.**
- 6.K.01c Identify components of the internet.
 - 6.K.02c Identify components incorporated in a web site.
 - 6.K.03c Identify the components of an internet address (URL).
 - 6.K.04c Describe the function of search engines.
 - 6.K.05c Demonstrate strategies to locate and retrieve electronic information.
 - 6.K.06c Create and organize bookmarks in a browser.
 - 6.K.07c Explain laws relating to copyright and internet use.
 - 6.K.08c Evaluate electronic sources of information for authenticity.
 - 6.K.09c Properly document and cite electronic sources of information.

- 6.K.10c Discuss the concerns regarding electronic communication and privacy.
- 6.K.11c Define of E-Mail protocol and uses.
- 6.K.12c Define of Instant Messaging protocol and uses.

6.L Protect a computer against viruses.

- 6.L.01c Define the various virus types and their potential effects.
- 6.L.02c Perform anti virus procedures, including installing, updating and scanning.
- 6.L.03c Identify potential sources of virus infection.
- 6.L.04c Identify basic security risks to system and personal computing equipment.
- 6.L.05c Explain the benefits and demonstrate the use of privacy, password, and protection utilities.

Performance Example:

1. Identify and implement the basic tools and resources to protect a single user station from current viruses.