**Competency Cross-Reference - Machinist Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Directions:** Evaluate the student by recording the appropriate number to indicate the degree of competency. The rating for each task should reflect employability readiness rather than the grades given in class.

|  |
| --- |
| **Rating Scale (0-6):** |
| 0 | **No Exposure -** no experience /knowledge in this area; program / course did not provide instruction in this area |
| 1 | **Unsuccessful Attempt -** unable to meet knowledge or performance criteria and /or required significant assistance |
| 2 | **Partial Demonstration** - met some of the knowledge or performance criteria with or without minor assistance |
| 3 | **Knowledge Demonstrated** - met knowledge criteria without assistance at least once |
| 4 | **Performance Demonstrated** - met performance criteria without assistance at least once |
| 5 | **Repetitive Demonstration** - met performance and /or knowledge criteria without assistance on multiple occasions |
| 6 | **Mastered** - successfully applied knowledge or skills in this area to solve related problems independently |
| N /A | Not observed or does not apply |
| ***Score*** | ***No.*** | ***Competency*** | ***Academic / Technical Standards*** | ***SkillsUSA Framework*** | ***Instructional Strategy*** | ***Assessment(s)*** |
| Safety (to be integrated throughout the program) |
|  | 1 | Demonstrate appropriate workplace safety practices (e.g., hand tools, power tools, fluid power, electrical and environmental hazards) SDS. | RI.1.A-D, SL.2.A-C, A2.DS.A.7 | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility, Self-Motivation **Workplace Skills:** Communication, Decision Making, Teamwork, Planning, Organizing & Management **Technical Skills:** Job-Specific Skills, Safety & Health | Lecture and demonstration of general shop safety rules (i.e. clothing requirements and other general shop practices) | Assessed daily and graded weekly (Shop safety grade) |
|  | 2 | Adhere to state and federal environmental/regulatory requirements/codes (e.g., OSHA 10 and EPA). | RI.1.A-D | OSHA 10 General Shop Safety online module completion | Online modules and tests |
|  | 3 | Recognize when first aid is needed for occupational injuries and follow proper procedures. | RI.1.A-D | Lecture and demonstration of first aid practices. Include identification of the location of first aid supplies. | First Aid Test (100% required) |
|  | 4 | List machine shop safety rules and regulations. | RI.1.A-D | Discussion of Machine Tool Safety rules specific to individual machines, including each machine's particular dangers. | Safety tests for each of the individual machine tools (100% required) |
| **I** | Applied Mathematics and Measuring |
| **A** | Machine Tool Calculations |
|  | 1 | Convert common fractions to decimal fractions and vice versa. | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Using a tape measure with 1/16th - 1/64th scales, convert fractions to decimals, and decimals to fractions in reference to common shop tools without using a calculator. | Students complete hands-on measuring demonstration, list all fractional scales from memory, and complete a daily board quiz to show proficiency. A periodic review is conducted each quarter. |
|  | 2 | Calculate measurement of right triangles. | G.SRT.C.5-7 | **Technical Skills:** Job-Specific Skills | Demonstrate shop uses of trigonometric measurement (i.e. sine bar, hole patterns, print interpretations). | Demonstrate proficiency with trigonometric formulas and concepts using prints with missing dimensions. |
|  | 3 | Determine tap drill size with formula and chart. | RI.1.A-D, A1.IF.B.3-6, A2.IF.A | **Workplace Skills:** Decision Making | Instruct use of a tap drill chart to use correct drill size for specific thread size. | Quiz requiring the use of a tap drill chart |
|  | 4 | Convert customary measurements to metric and vice versa. | RI.1.A-D, A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate conversions between standard measurements and metric | Quiz using the conversion formulas |
|  | 5 | Use a calculator to perform mathematical operations. | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Instruct how to translate common shop math requirements into usable calculator operations. | Assessed with every shop project. Incorporate the use of a Project Inspection Sheet. Students list featured and actual dimensions. |
|  | 6 | Verify the accuracy of calculations derived with a calculator. | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Basic math skills, including converting fractions to decimals | Completion of bell/exit work converting common shop tool fractions to decimals |
|  | 7 | Calculate the amount of stock required. | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate how to calculate stock amounts required to manufacture a part, including rough stock for saw operation.  | Use normal shop projects to calculate stock required for a given production job.  |
|  | 8 | Calculate part and feature dimensions and locations. | A1.NQ.B.3-5, G.GMD.A.2, G.GMD.B.3-4, G.MG.A.1-3 | **Technical Skills:** Job-Specific Skills | Demonstrate how to find missing dimensions using known dimensions. Not all print dimensions are required if all the important ones are present. | Provide students with print drawings containing only some dimensions and require them to find all missing dimensions.  |
|  | 9 | Convert revolutions per minute (RPM) to surface feet per minute (SFPM). | RI.1.A-D, A1.NQ.B.3-5, G.GMD.A.2, G.GMD.B.3-4, G.MG.A.1-3 | **Technical Skills:** Job-Specific Skills | Demonstrate how to calculate SFPM using RPM and diameter.SFPM = (RPM x D) / 3.8 | Quiz using common project information students will see in the shop |
|  | 10 | Calculate feeds and speeds. | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate lathe chart for feeds and speeds | Students demonstrate using the lathe charts to set feed rates and RPM |
|  | 11 | Determine tapers for machine set-up per formulas and charts. | RI.1.A-D, A1.IF.B-C, A2.IF.A, G.SRT.C.5-7 | **Workplace Skills:** Decision Making | Calculate the rise of an angle using right triangle formulas and the Pythagorean Theorem. | Students calculate multiple circle bolt-hole patterns  |
|  | 12 | Determine sine bar set-up with formulas and charts. | A1.IF.B.3-6, A2.IF.A, G.SRT.C.5-7 | **Workplace Skills:** Decision Making | Perform calculations using the Pythagorean Theorem and right triangle formulas for a 5” sine bar. | Demonstrate setting up the sine bar in a vise and give students specific angles to calculate. |
|  | 13 | Perform angular and simple indexing calculations. | A1.IF.B.3-6, A2.IF.A, G.SRT.C.5-7 | **Technical Skills:** Job-Specific Skills | Use an indexing table and a dividing head to demonstrate the purpose of the calculations required. | Solve problems using common indexing tables and dividing heads with different ratios. |
| **B** | Machined Parts Measurement |
|  | 1 | Measure using direct-reading instruments (e.g., scales, protractors, and precision levels). | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate making measurements with 1/16th, 1/32nd, 1/64th scales, machinist scale, and vernier scale. | Students should be able to write the 1/64th scale from memory. Read common tape and scale measurements. |
|  | 2 | Measure using precision measuring instruments (e.g., micrometers, gauge blocks, verniers, dial indicators, and digital calipers). | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate correct practices of using direct reading precision measuring tools. | Practice measuring random parts using mics, dial calipers, and vernier calipers.  |
|  | 3 | Measure using transfer instruments (e.g., plain inside and outside calipers, telescoping gauges, and adjustable hole gages). | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate correct practices of using indirect measuring tools (particularly telescoping gages, small hole gages, angle gages, and radius gages). | Allow students to practice using the tools to understand how to correctly utilize them in the future.  |
|  | 4 | Measure using surface plate instruments (e.g., height gages, angle plates, and sine bars and plates). | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate correct practices of using surface plate measuring instruments. | Test students' knowledge with a simple layout project using the height gauge and other layout measuring instruments. |
|  | 5 | Measure using comparison instruments (e.g., radius gages, squares, cutter tooth gages, and center gauges). | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate correct practices of using measuring tools as gages to define or check part geometry. | Check the squareness of a saw part. Define the radius of a turning tool or insert. |
|  | 6 | Measure using other instruments (e.g., optical comparators). | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate the uses of optical comparators. | Measure the radius/angle of a machined part.  |
|  | 7 | Measure pitch diameters using thread wires. | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate how to calculate thread size using the 3-wire system. Must have correct wires and charts. | Have students measure common bolt sizes to verify capability and understanding |
|  | 8 | Measure using unconventional methods (e.g., digital readouts on milling machines). | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate how to use the digital readout on the machine  | This will be demonstrated in every project where a digital readout is allowed to be used. |
|  | Designs/Drawings and Plan Work |
| **C** | Interpreting Designs, Drawings, and Specifications |
|  | 1 | Interpret blueprints including common drafting symbols. | RI.1.A-D, A1.NQ.B.3-5, G.GMD.A.2, G.GMD.B.3-4, G.MG.A.1-3 | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Define common drafting symbols and highlight common drawing principles. | Assess student knowledge with example prints containing common symbols. |
|  | 2 | Make a sketch from a finished workpiece. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Job-Specific Skills | Provide students with a simple part to measure and sketch. | Individual and group assignments. |
|  | 3 | Calculate tolerances and allowances. | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Demonstrate the +/- of tolerance and dimensioning | Test for understanding with appropriate projects or prints with block tolerancing.  |
|  | 4 | Calculate missing dimensions. | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Perform basic calculations of known dimensions to solve for missing.  | Interpret prints with missing dimensions for a project in the shop. |
|  | 5 | Use geometric dimensioning and tolerancing (GD&T) | A1.NQ.B.3-5 | **Technical Skills:** Job-Specific Skills | Create prints using GD&T principles and symbols | Give students prints for a project using GD&T symbols.  |
| **D** | Plan Work |
|  | 1 | Use Machinery’s Handbook to plan work. | RI.3.D | **Workplace Skills:** Planning, Organizing & Management | Establish rules for the order of operations when doing plan work. | Creation of a print for a layout project. |
|  | 2 | Plan the sequence of part layout based on blueprint information. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Identify sequence and order of operation strategies | Have students write a step-by-step order of how to perform each task needed for the layout part. |
|  | 3 | Identify cutting tool types (e.g., steel and carbide) and their applications (e.g., mills and lathes). | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Job-Specific Skills | Demonstrate common tool types, tool holders, and applications for tools as required by project work. | Introduce as needed for specific projects. This will be ongoing and implemented in stages. Each project builds upon the knowledge learned. |
|  | 4 | Plan sequence of machining operations. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Demonstrate logic for sequence machining and developing a planned order of operation. | Required with every project |
|  | 5 | Plan tooling sequences for machining operations. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Identify staging techniques for smoother operations. | Assessed in the shop with project work. |
|  | 6 | Calculate machining operation, setup, and tear-down times. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to quote a part based on machine time, setup, and tear down. | Log hours for a project and have students figure out manufacturing costs.  |
| **III** | Inspection of Machined Parts |
| **A** | Inspecting Machined Parts |
|  | 1 | Inspect part using appropriate measuring instruments (e.g., scales, micrometers, verniers, and protractors). | A1.NQ.B.3-5 | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Introduce the Inspection Sheet process early. Students should be able to provide accurate reports for every project. | Inspection Sheets are part of every project. |
|  | 2 | Inspect part using surface plate instruments (e.g., indicators, height gauges, angle plates, height-transfer gauges, and sine bars and plates). | A1.NQ.B.3-5 | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | When needed, introduce surface plate instruments and tools to inspect parts. | Assessed with accurate inspection of actual parts made by the student. |
|  | 3 | Inspect part using an optical comparator. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Demonstrate the uses of optical comparators. | Require features such as radii and angles to be measured for accuracy using an optical comparator. |
|  | 4 | Inspect part using coordinate measuring machine (CMM). | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Identify what a CMM is and how it is used. | Students compare measurement accuracy from hand measuring tools to the CMM. |
| **B** | Collection and Analysis of Quality Control Data |
|  | 1 | Inspect part using appropriate measuring instruments (e.g., scales, micrometers, verniers, and protractors). | A1.NQ.B.3-5 | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Introduce the Inspection Sheet process early. Students should be able to provide accurate reports for every project. | Inspection Sheets are part of every project. |
|  | 2 | Inspect part using surface plate instruments (e.g., indicators, height gauges, angle plates, height-transfer gauges, and sine bars and plates). | A1.NQ.B.3-5 | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | When needed, introduce surface plate instruments and tools to inspect parts. | Assessed with accurate inspection of actual parts made by the student. |
|  | 3 | Inspect part using an optical comparator. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Demonstrate the uses of optical comparators. | Require features such as radii and angles to be measured for accuracy using an optical comparator. |
|  | 4 | Identify Industry Inspection processes. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Demonstrate how part and feature tolerancing dictates inspection tools required to ensure accuracy. | Provide projects with varying degrees of tolerancing requiring the use of all Inspection processes. |
|  | 5 | Follow a quality plan as would be required by local/regional industry using processes the shop's standard plan for this process, inspecting parts along the way | RI.1.A-D | **Personal Skills:** Integrity, Work Ethic, Self-Motivation**Workplace Skills:** Decision Making, Planning, Organizing & Management**Technical Skills:** Job-Specific Skills, Safety & Health, Service Orientation | Establish principles of a quality plan required by industry. | Require students to follow the quality plan to completion of a project. |
|  | 6 | Analyze the performance of a single-part production process and how long the production takes for one part. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Analyze a part by individual operations required.  | Students build a cost per operation analysis based on quantity and operation time per operation. |
|  | 7 | Analyze the performance of a production process. Estimate how long it will take to run this operation on a certain quantity of parts. | SL.1.A-C | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Identify operations that take more time and look for ways to speed up the process. | Have students self-evaluate operations that cost them time, and brainstorm ways to improve. |
| **IV** | Layout and Fabrication |
| *Competencies 10-19 involve multiple benchwork tools and special processes not labeled in the NIMS Machining Knowledge Requirements. This content is necessary for all Machining courses due to the amount of bench work inherent in the Machining industry.* |
|  | 1 | Cut materials with a hand hack saw. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how a hack saw cuts and the best techniques. | Develop a project using a hacksaw. |
|  | 2 | Mark locations with prick and center punches. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to center punch using a punch and hammer/spring-loaded punch. | Design a layout part and use a center punch to locate the hole locations. |
|  | 3 | Locate holes with transfer screws and transfer punches. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper hole transfer techniques and tools. | Project requiring the transfer of holes from one part to another. |
|  | 4 | Bench file/deburr workpiece. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper filing techniques and how to clean a file. | Required for every project completed. |
|  | 5 | Cut threads with a die. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper use of a thread die. | Cut external threads using a thread die. |
|  | 6 | Cut threads with a hand tap. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper use of a hand tap. | Cut internal threads using a hand tap. |
|  | 7 | Ream holes with a hand reamer. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper use of a hand reamer. | Hand ream a hole using a hand reamer. |
|  | 8 | True and dress grinding wheels on a pedestal/bench grinder. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate safe practices of dressing glazed or loaded wheels on a pedestal grinder. | Allow students to dress the wheel under close supervision. |
|  | 9 | Grind and shape tools on pedestal/bench grinder. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to grind lathe cutting tools from HSS. | Students create a left and right-hand cutting tool for the lathe. |
|  | 10 | Use abrasives/whetting/polishing/lapping. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper techniques of using sandpaper and other polishing materials. | Assess with project work. |
|  | 11 | Grind using an appropriate hand grinder. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate safe practices of various types of hand grinders. | Safety tests and assessments when used for project-specific work. |
|  | 12 | Remove damaged screws. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Introduce various tools and techniques for removal of threaded fasteners. | Assess as needed for broken threaded fasteners |
|  | 13 | Remove broken drills and taps. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Introduce various tools and techniques for removal of broken tools | Assess as needed for removing broken tools |
|  | 14 | Remove and install dowel pins. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper use of pin punches to remove and install dowel pins. | Project using dowels to assemble parts. |
|  | 15 | Install a thread insert. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify and demonstrate the use of various types of thread repair tools. | Fix damaged threaded holes using each technique. |
|  | 16 | Straighten workpiece on arbor press. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Lecture and demonstrate common material stress relief created by the machining process. | Use an arbor press to straighten stress-relieved materials. |
|  | 17 | Assemble and disassemble the workpiece with an arbor press. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Introduce press-fit parts such as bearings and sleeves. | Use an arbor press to remove or replace pressed components or parts. |
|  | 18 | Broach workpiece with a broaching tool. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify common keyway sizes and rationale for using a keyway. | Use an arbor press and broach to create a keyed I.D. hole. |
|  | 19 | Assemble and disassemble precision parts. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify common practices for assembling precision parts. | Use bolts, dowel pins, and other methods to assemble precision parts. |
| **V** | Material Sciences |
| *Competencies 6-8 relate to heat treatment processes that are not outlined in the NIMS Machining Knowledge Requirements provided. This content is necessary for all Machining courses due to the vast differences in part requirements regarding hardness in the Machining industry.* |
|  | 1 | Identify types of metals and related materials. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Identify non-ferrous, ferrous metals and other materials used in the manufacture of parts and components. | Design various projects that require the use of different materials. |
|  | 2 | List properties that affect machinability. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Discuss alloy metals and identify the Rockwell system for hardness identification. | Assess knowledge by test and project work. |
|  | 3 | Correlate types of materials to their properties. | RI.1.A-D, A1.DS.A.8, A2.DS.A.7 | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Demonstrate Identifiable traits of common materials (weight, color, magnetism, etc) | Student demonstrate the ability to pick material by common identifiable traits. |
|  | 4 | List major cutting tool variables. | A1.IF.B.3-6, A2.IF.A | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Identify the differences between HSS and carbide tools | Students identify HSS and carbide tools. |
|  | 5 | Perform heat treatment process. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify the different heat treatment processes. | Perform a project requiring heat treating of materials. |
|  | 6 | Test the workpiece for hardness with and without hardness tester. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to use a hardness tester or a file to test the hardness of materials | Students identify hard materials using a file and test them with a hardness tester. |
|  | 7 | Interpret time-temperature-transformation diagrams. | RI.1.A-D, A1.DS.A.1, A2.DS.A.7 | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Identify the different time and temperature requirements for specific material alloys. | Students determine how long to heat-treat material and at what temperature, using heat-treating diagrams. |
|  | 8 | Identify the effect of heat treatment on materials. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Discuss the tensile strength, durability, and wearability of different alloys after heat treatment. | Students determine the Rockwell hardness required for a project based on material properties and necessary application. |
| **VI** | Tool operation |
| **A** | Power Saws |
|  | 1 | Perform power saw care and maintenance. | RI.1.A-D | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility**Technical Skills:** Job-Specific Skills, Safety & Health | Demonstrate safe practices for cleaning and performing common maintenance of power saws | Students perform weekly scheduled maintenance of power saws |
|  | 2 | Select blade type for sawing operations and materials. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Discuss Saw blade styles for different applications and material types. | Students select blade type by application needed. |
|  | 3 | Cut and weld band saw blades. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate weld process for band saw blades | If a band welder is available, have students perform a weld on a blade. |
|  | 4 | Select and set speeds and feeds on a power saw. | A1.IF.B.3-6, A2.IF.A | **Workplace Skills:** Planning, Organizing & Management | Identify motor speed and feed rate options for power saws. | Assess students' knowledge and understanding during the operation of power saws |
|  | 5 | Cut material to length with a power saw. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper measuring on the power saw | Students measure and cut material on the power saw to specs detailed in the project order of operation for saw cut. |
|  | 6 | Select and apply cutting fluids. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Identify cutting fluid types and mixtures for power saws | Allow students to refill as needed following guidelines. |
|  | 7 | Contour saw to a scribed line. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate contour cuts on a vertical band saw. Discuss parameters of contour cutting. | Allow students to perform contour cutting |
|  | 8 | Saw internal contours with a band saw. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate the benefits of welding a blade inside of a part to perform internal contour cuts. | Provide an opportunity for student participation if a band welder is available. |
| **B** | Drill Presses |
|  | 1 | Perform drill press care and maintenance. | RI.1.A-D | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility**Technical Skills:** Job-Specific Skills, Safety & Health | Shop safety and machine operation | Demonstrate proper care of drill press machines. |
|  | 2 | Set up and clamp the workpiece to the drill press table. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Drill press setup and safe practices for work-holding devices. | Project work observations. |
|  | 3 | Select drill type based on job requirements. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Tool planning for part alloy and drawing size specifications | Project work observations, inspections of the finished part |
|  | 4 | Determine cutting tool variables before use. | RI.1.A-D, A1.DS.A.1, A1.IF.B.3-6,  | **Workplace Skills:** Planning, Organizing & Management | Demonstrate the differences between drill bit material types and applications, as well as the rules for RPM. | Use project work to assess knowledge. |
|  | 5 | Set up drill press according to calculated feeds and speeds. | RI.1.A-D, A2.IF.A | **Workplace Skills:** Planning, Organizing & Management | Demonstrate how to change the RPM on the drill press. | Observe students choose and set the proper RPM for each operation. |
|  | 6 | Select and apply cutting fluids. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Define cutting fluids and explain their proper uses. | Observe students using cutting fluids properly. |
|  | 7 | Drill holes to specification using manual and automatic feed. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper hole drilling techniques. | Observe students properly drilling holes to specifications. |
|  | 8 | Countersink hole to specifications. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper use and RPM of a countersink. | Observe students properly countersinking holes. |
|  | 9 | Counterbore hole to specifications. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Define and demonstrate how to use a counterbore. | Observe students properly counterboring holes. |
|  | 10 | Spotface to specific dimensions. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate what spotfacing is and the proper tools to use for it. | Observe students performing spotfacing operations. |
|  | 11 | Mount workpiece on V-blocks. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper uses for v-blocks. | Observe students using a v-block to hold a workpiece. |
|  | 12 | Power ream hole to size. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper reaming techniques under machine power. | Observe students using machine power to properly ream a hole. |
|  | 13 | Use drill jigs and bushings. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate the uses of drill jigs and bushings. | Observe students properly using a drill jig with bushings. |
|  | 14 | Hand tap a hole using a drill press. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate safe and proper hand-tapping techniques. | Observe students correctly hand-tapping holes. |
|  | 15 | Tap a hole with tapping attachments. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate using a tapping head for the drill press. | Observe students using a tapping head to tap holes. |
|  | 16 | Perform taper reaming and subsequent pipe tapping. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify techniques of tapered pipe threading. | Perform tapered pipe threading processes |
|  | 17 | Sharpen drills at a pedestal grinder or with grinding attachments and specialized grinders. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify ways to sharpen drills using hand techniques as well as commercial drill sharpeners | Observe students sharpening drill bits to drill to the correct size. |
|  | 18 | Set up radial drill press. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify a radial drill press and how it is set up | Observe students perform a setup on a radial drill press |
| **C** | Lathes |
|  | 1 | Perform lathe care and maintenance. | RI.1.A-D | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility**Technical Skills:** Job-Specific Skills, Safety & Health | Explain, identify, and demonstrate proper machine care and maintenance. | Schedule weekly maintenance routines for students to follow. |
|  | 2 | Align lathe centers using test bar and dial indicators. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Demonstrate the process of aligning the Tailstock with the headstock | Test students' performance in aligning the Tailstock to the headstock |
|  | 3 | Select a cutting tool based on job requirements. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Identify the different types of cutting tool geometries and how they are used. | Observe students using the correct tools for each job process. |
|  | 4 | Calculate feeds and speeds for lathe set-up. | RI.1.A-D, A1.IF.B.3-6, A1.DS.B.6, A2.IF.A | **Technical Skills:** Job-Specific Skills | Demonstrate how to calculate feeds and speeds and how to set the lathe accordingly | Observe students using the correct settings per the job requirements |
|  | 5 | Free-hand grind turning and facing tools. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to grind a HSS tool for turning and facing | Require students to use a tool they ground for a project |
|  | 6 | Select and apply cutting fluids. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Identify cutting fluid types and applications | Observe the correct usage of cutting fluids |
|  | 7 | Operate lathe controls. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify all lathe controls and correct operational purposes | Test student knowledge of lathe controls, observe usage |
|  | 8 | Face workpiece and center drill. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate facing and center drilling techniques | Test students' ability to face and center drill projects |
|  | 9 | Set up tooling. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Identify work-holding devices and other fixturing options | Observe students' knowledge and ability with multiple tools |
|  | 10 | Turn the workpiece between centers. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate turning between centers using a lathe dog and face plate | Observe students safely turning between centers using a lathe dog and face plate |
|  | 11 | Indicate workpiece in four-jaw chuck. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to indicate a part in a four-jaw chuck | Test student's ability to indicate in a four-jaw chuck |
|  | 12 | Drill, ream, bore, and countersink holes. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate various ways to make an accurate hole on the lathe | Test student's ability to perform tight tolerance holes on the lathe using each of these processes |
|  | 13 | Counterbore holes. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate what a counterbore is and its purpose | Observe students counterboring holes to specs |
|  | 14 | Knurl parts. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate knurling | Observe students knurling |
|  | 15 | Free-hand grind 60-degree threading tool. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to grind a tool for threading | Test students' ability to grind tools to single-point thread |
|  | 16 | Chase external/internal threads. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate thread-chasing techniques | Observe thread-chasing operations by students |
|  | 17 | Chase metric threads. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate thread-chasing techniques | Observe thread-chasing operations by students |
|  | 18 | Cut multiple lead threads. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify a multiple-lead thread and demonstrate how to cut one using a lathe. | Test student knowledge with the performance of cutting a multi-lead thread |
|  | 19 | Cut acme threads. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify Acme threads and tools for cutting them | Observe students cutting Acme threads |
|  | 20 | Use a compound rest to cut short external/internal tapered surfaces. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate cutting tapers using the compound rest | Observe students using the compound rest to cut tapers |
|  | 21 | Cut tapers by offset tailstock. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate offsetting the tailstock to cut tapers | Observe students cutting tapers with offset tailstock |
|  | 22 | Cut external tapered surface with a taper attachment. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to set up and use a tapering attachment to cut external tapers. | Observe student performance using a tapering attachment to cut external tapers |
|  | 23 | Cut internal tapered surface with a taper attachment. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to set up and use a tapering attachment to cut internal tapers. | Observe student performance using a tapering attachment to cut internal tapers |
|  | 24 | Align a workpiece on a faceplate. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to set and align a part on a faceplate | Observe student performance |
|  | 25 | Perform lathe filing. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate safe practices for using a file on the lathe | Observe students safely filing a part on the lathe |
|  | 26 | Polish a workpiece. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate polishing techniques | Observe students safely polishing different types of metals. |
|  | 27 | Turn or thread long workpieces using follower and steady rest. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify and demonstrate how to use a follower and steady rest for turning or threading | Observe students setting up and using a follower and steady rest |
|  | 28 | Use form tooling. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate the processes of using form tooling | Observe student performance |
|  | 29 | Use a mandrel. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Identify mandrels and their uses | Observe student performance |
| **D** | Milling Machines |
|  | 1 | Perform care and maintenance of the milling machine. | RI.1.A-D, SL.2.A-C | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility**Technical Skills:** Job-Specific Skills, Safety & Health | Explain, identify, and demonstrate proper machine care and maintenance. | Schedule weekly maintenance routines for students to follow. |
|  | 2 | Tram (align) mill head. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper tramming techniques | Students must tram the mill head in less than 10 minutes. |
|  | 3 | Select milling machine attachments according to job requirements. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Identify and explain various milling machine attachments and their uses. | Observe students using correct job-specific machine attachments. |
|  | 4 | Align the workpiece mounted on the machine table. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate using an indicator to align a workpiece mounted to the machine table. | Observe students correctly aligning a workpiece using an indicator. |
|  | 5 | Calculate feeds and speeds and set up the mill accordingly. | A1.IF.B.3-6, A1.DS.B.6, A2.IF.A | **Technical Skills:** Job-Specific Skills | Demonstrate how to change the RPM/feed rate on the mill and quill feed. | Test student knowledge with various metal and tool variables for RPM/feed rate. |
|  | 6 | Select and apply cutting fluids. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Identify proper cutting fluids per job-specific needs | Observe students selecting proper cutting fluids. |
|  | 7 | Select cutting tools based on job requirements. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Describe differences in various cutting tools used on the milling machine. | Observe students selecting the proper tools for each project. Assess proper understanding and use. |
|  | 8 | Square up workpiece in milling vise using face mill. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper squaring techniques using a face mill and vise. | Assess student understanding with project work. |
|  | 9 | Mill workpiece with an end mill. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper milling techniques when using end mills. | Assess student understanding with project work. |
|  | 10 | Locate work with edge finder. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate proper use of an edge-finder. | Observe students properly using an edge-finder |
|  | 11 | Drill holes with a milling machine. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate drilling holes with the milling machine | Assess with project work. |
|  | 12 | Ream holes. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate reaming processes | Assess with project work. |
|  | 13 | Bore holes with a milling machine. | RI.1.A-D, SL.2.A-C | **Technical Skills:** Job-Specific Skills | Demonstrate using a boring head on the milling machine. | Assess with project work. |
|  | 14 | Use a form cutter to mill the workpiece. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate using form-cutting tools mounted to arbors. | Assess with project work. |
|  | 15 | Machine workpiece mounted on V-blocks. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate mounting a workpiece in a V-block | Assess with project work. |
|  | 16 | Machine external straight keyway. | RI.1.A-D, SL.2.A-C | **Technical Skills:** Job-Specific Skills | Explain and demonstrate the process of machining keyways | Assess with project work. |
|  | 17 | Machine woodruff keyway. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Explain and demonstrate the process of machining keyways | Assess with project work. |
|  | 18 | Mill simple and compound angles. | RI.1.A-D, G.C.A.2, G.C.B.4, G.CO.D.11, G.GMD.B.3-4 | **Technical Skills:** Job-Specific Skills | Demonstrate milling angles using various assistive tools (sine-bar, angle parallels, etc) | Assess with computing sine dimensions for use with sine-bar with project work. |
|  | 19 | Mill an external radius with a rotary table. | RI.1.A-D, G.C.A.2, G.C.B.4, G.CO.D.11, G.GMD.B.3-4 | **Technical Skills:** Job-Specific Skills | Demonstrate functions of a rotary table | Assess with project work. |
|  | 20 | Mill an internal radius with a rotary table. | RI.1.A-D, G.C.A.2, G.C.B.4, G.CO.D.11, G.GMD.B.3-4 | **Technical Skills:** Job-Specific Skills | Demonstrate functions of a rotary table. | Assess with project work. |
|  | 21 | Mill workpiece using simple indexing operation. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate functions of a dividing head. | Perform mathematical calculations for project work. |
|  | 22 | Use digital readout. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Demonstrate functions of digital readouts. | Assess with project work. |
| **E** | Grinders |
|  | 1 | Perform grinder care and maintenance. | RI.1.A-D | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility**Technical Skills:** Job-Specific Skills, Safety & Health | Describe and demonstrate proper grinder maintenance and care. | Students perform monthly maintenance checks and routine care when using. |
|  | 2 | Select and apply cutting fluids. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Identify proper cutting fluid mixture and levels | Observe students filling coolant tanks as needed. |
|  | 3 | Inspect and ring-test the grinding wheel. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Demonstrate proper ring test and inspection of grinding wheels | Test student knowledge |
|  | 4 | Balance grinding wheel. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate techniques and tools for balancing grinder wheels. | Test student skills at balancing grinder wheels |
|  | 5 | Select and mount the grinding wheel. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Define different types of wheels and the uses of those wheel types | Observe students choosing wheel types by job specifics |
|  | 6 | True and dress machine tool grinding wheel. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate dressing a grinding wheel. | Observe students dressing a grinding wheel. |
|  | 7 | Grind workpiece on magnetic chuck using power feed. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to set up the power feed to perform surface grinding at proper SFM. | Assess with project work. |
|  | 8 | Square up the workpiece on a surface grinder. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate how to use a grinder vise to ensure a square workpiece on the grinder. | Assess with project work. |
|  | 9 | Indicate the workpiece to be ground. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate indicating a workpiece | Assess with project work. |
|  | 10 | Dress form on a grinding wheel. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Describe and demonstrate using a form tool to dress angles or radii on a wheel | Observe students safely dressing a wheel using a form tool. |
|  | 11 | Grind angular surfaces. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate angular grinding | Assess with project work. |
|  | 12 | Grind straight and tapered surfaces between centers using cylindrical grinding. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate using an O.D. grinder machine or tool-post grinder on a lathe | Observe students safely O.D. grinding between centers. |
| **F** | Cutting Tool Fabrication and Resurfacing |
|  | 1 | Perform care and maintenance of tool-and-cutter grinder. | RI.1.A-D | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility**Technical Skills:** Job-Specific Skills, Safety & Health | Demonstrate proper maintenance of tool grinders | Observe students perform proper maintenance |
|  | 2 | Inspect and ring-test grinding wheels. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Demonstrate ring testing of grinding wheels | Observe students' ring test grinder wheels |
|  | 3 | Select and mount the grinding wheel. | RI.1.A-D | **Workplace Skills:** Planning, Organizing & Management | Define different types of wheels and the uses of those wheel types | Observe students choosing wheel types by job specifics |
|  | 4 | True and dress grinding wheel. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate process to dress wheels on tool grinders | Observe students dressing a grinding wheel. |
|  | 5 | Set up the machine. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate machine setup for proper tool grinding | Observe students perform proper setup for grinding tools |
|  | 6 | Sharpen cutters on tool-and-cutter grinders. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate techniques for sharpening tools and define what a sharp tool should look like. | Assess student performance |
| **G** | Computerized Numerical Control (CNC) Machines |
|  | 1 | Perform machine care and maintenance. | RI.1.A-D | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility**Technical Skills:** Job-Specific Skills, Safety & Health | Explain, identify, and demonstrate proper machine care and maintenance. | Schedule weekly maintenance routines for students to follow. |
|  | 2 | Calculate the coordinates and dimensions needed for the CNC program. | A1.BF.A.1, A1.IF.B.3-6, G.CO.A.2-5, G.CO.D.11, G.GMD.B.3-4, G.GPE.B.4, G.MG.A.1-3 | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Demonstrate methods of plotting coordinates and points for writing CNC programs | Assess with project work. |
|  | 3 | Write a program for a CNC machine. | W.3.A | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Lecture and demonstrate the CNC program structure | Assess with project work. |
|  | 4 | Set up a CNC machine. | RI.1.C | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Define machine setup sequence | Assess student performance |
|  | 5 | Machine workpiece with CNC machine. | RI.1.A-D | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Demonstrate program verification process, dry run, and first part safety operation | Assess with project work. |
| **H** | Electric Discharge Machines (EDM) |
|  | 1 | Describe the electric discharge line theory. | RI.1.A-D, SL.2.A-C | **Workplace Skills:** Communication, Decision Making**Technical Skills:** Computer & Technology Literacy, Job-Specific Skills | Explain the EDM | Assess student knowledge of EDM theory |
|  | 2 | Operate a wire electric discharge machine. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate operational practices of a wire EDM | Assess with project work. |
|  | 3 | Operate a plunge electric discharge machine. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate operational practices of a plunge EDM | Assess with project work. |
|  | 4 | Operate a two-axis electric discharge machine. | RI.1.A-D | **Technical Skills:** Job-Specific Skills | Demonstrate operational practices of a two-axis EDM | Assess with project work. |
| Employability (to be integrated throughout the program) |
|  | 1 | Demonstrate an understanding of SkillsUSA, its structure, and activities. | RI.1.A-D | **Workplace Skills:** Teamwork, Multicultural Sensitivity & Awareness, Planning, Organizing & Management, Leadership**Technical Skills:** Service Orientation, Professional Development | Utilize SkillsUSA print materials to introduce Students to the theme, motto, and activities for each year | Assess student knowledge of SkillsUSA theme, motto, and activities. |
|  | 2 | Demonstrate an understanding of one’s personal values. | RI.1.A-D | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility, Adaptability/Flexibility, Self-Motivation | Discuss individual values and importance of knowing them | Students write a short essay outlining personal values and how those affect their daily life |
|  | 3 | Perform tasks related to effective personal management skills. | SL.1.A-C | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility, Adaptability/Flexibility, Self-Motivation | Assign deadlines for project work. Introduce timesheets | Have students document time spent on projects and process cost per project. |
|  | 4 | Demonstrate interpersonal skills. | SL.1.A-C | **Personal Skills:** Integrity, Work Ethic, Professionalism, Responsibility, Adaptability/Flexibility, Self-Motivation**Workplace Skills:** Communication, Teamwork, Multicultural Sensitivity & Awareness, Leadership | Introduce Peer-teaching and effective communication techniques.  | Assess Students abilities to teach others what they have learned by effective communication. |
| Academic Skills |
|  | English/Language Arts |
|  | 1 | Analyze text and visual elements to create an objective and concise summary that includes analysis of what is said or shown and inferences or conclusions that can be drawn, including where the text or visual elements leave matters uncertain. | RI.1.A-D | **Workplace Skills:** Communication | Included in lessons | Included in lessons |
|  | 2 | Read and comprehend informational text independently and proficiently. | RI.3.D |
|  | 3 | Work with peers to promote discussions and decision-making, set clear goals, and establish individual roles. Evaluate a speaker’s point of view by posing and responding to questions and evidence. Consider and respond thoughtfully to diverse perspectives. | SL.1.A-C |
|  | 4 | Speak audibly using conventions of language, eye contact, gestures, and movement appropriate to task, purpose and audience. | SL.2.A-C |
|  | 5 | Review, revise, and edit writing with consideration for the task, purpose, and audience. | W.3.A |
|  | Mathematics |
|  | 1 | Analyze the effect of translations and scale changes on functions. | A1.BF.A.1 | **Workplace Skills:** Planning, Organizing, & Management**Technical Skills:** Computer & Technology Literacy | Included in lessons | Included in lessons |
|  | 2 | Analyze and interpret graphical displays of data. | A1.DS.A.1 |  |  |
|  | 3 | Distinguish between correlation and causation. | A1.DS.A.8 |  |  |
|  | 4 | Using tables, graphs, and verbal descriptions, interpret the relationship between two quantities, the rate of change over time, and the parameters in terms of context. | A1.IF.B.3-6 |  |  |
|  | 5 | Use units of measure to solve problems involving quantities using appropriate units and labels, converting units and rates, using graphical representation as needed. | A1.NQ.B.3-5 |
|  | 6 | Evaluate reports based on data. | A2.DS.A.7 |
|  | 7 | Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems. | A2.IF.A |
|  | 8 | Identify and describe relationships among inscribed angles, radii and chords of circles. | G.C.A.2 |
|  | 9 | Derive the formula for the length of an arc of a circle. | G.C.B.4 |
|  | 10 | Describe and represent transformations and functions in the plane, rotational and lines of symmetry, reflections and translations of angles, circles, perpendicular and parallel lines and line segment, and a transformations between congruent figures. | G.CO.A.2-5 |
|  | 11 | Construct geometric figures using various tools and methods. | G.CO.D.11 |
|  | 12 | Use volume formulas for cylinders, pyramids, cones, spheres and composite figures to solve problems. | G.GMD.A.2 |
|  | 13 | Identify the shapes of two-dimensional cross-sections of three-dimensional objects and vice versa. | G.GMD.B.3-4 |
|  | 14 | Prove the slope criteria for parallel and perpendicular lines and use them to solve problems. | G.GPE.B.4 |
|  | 15 | Use geometric shapes, their measures and their properties to describe objects in terms of using density, area, volume using mathematical modeling. | G.MG.A.1-3 |
|  | 16 | Understand ratios in triangles, trigonometric ratios for angles, the relationship between the sine and cosine of complementary angles, and use of the Pythagorean Theorem to solve right triangles. | G.SRT.C.5-7 |