June, 2008

Mathematics Alignment Guide
Mason-Lake Tech Prep
Course: Advanced Manufacturing

Information in Blue relates to specialists in Computer Aided Design.
Information in Red relates to specialists in Manufacturing Technology.
Information in Black relates to both areas.
*** *Note: If a standard is covered partially, then the part that is covered is underlined.*

High School Content Expectations							
Standard	Level of Coverage		Activities Linked to this Standard	Assessment Method		Assessment Correlation	Approximate Time Spend of on the Standard
	Partial	Complete		Performance Based	Written		
L1.1.1 Know the different properties that hold in different number systems, and recognize that the applicable properties change in the transition from the positive integers, to all integers, to the rational numbers, and to the real numbers	x		Students recognize that when working within the positive integer system they do not need to use absolute values relationships, however when working in the number system with all integers, they need to account for measurements in certain situations that apply absolute value relationships (applies in CNC programming for coordinate location in MasterCAM.)	x	x	Students demonstrate proficiency on: 1) in-class projects, 2) quizzes, 3) project on competency test.	Approximately 9 weeks

L2.3.1 Convert units of measurement within and between systems; explain how arithmetic operations on measurements affect units, and carry units through calculations correctly.		x	Students encounter conversions in multiple fashions such as: 1) students convert within systems of measure when going from taper per foot to taper per inch, 2) students convert between systems of measure when converting taper per foot to angle measurements, 3) students convert within systems when converting between decimal and fractions and vice-versa, 4) students convert between English units and metric units, 5) students understand how arithmetic operations (multiplication or division) may affect the units, 6) students carry units through from the title block to the actual measurements on a drawing.	x	x	Students demonstrate proficiency on: 1) brass hammer project, 2) creation of punches, 3) blueprint reading, 4) written test, 5) scaling, 6) plotting/printing.	Students encounter this concept throughout the course of the year

L2.4.1 Determine what degree of accuracy is reasonable for measurements in a given situation; express accuracy through use of significant digits, error tolerance, or percent of error; describe how errors in measurements are magnified by computation; recognize accumulated error in applied situations.	x		Students determine the degree of accuracy needed for tolerances and fits, and general tolerances for machining. Students understand the meaning of significant decimal places as it relates to tolerances. Students meet requirements by satisfying blueprint specifications. Students use significant digits with tolerances. (For example, .300 should not be simplified to .3 unless the blueprint dimension fits with the tolerance.) Students verify the chain of dimensions when adding dimensional lengths and need to stay within blueprint standards for overall lengths.	x		Using knowledge pertaining to degree of accuracy and/or error tolerance is pertinent to completing all in-class projects.	Students encounter this concept throughout the course of the year
L2.4.2 Describe and explain round-off error, rounding, and truncating.		x	Students round and/or truncate to the appropriate decimal place when converting from fractions to decimals. Students account for round-off error when working with the CNC.	x	x	Students demonstrate proficiency on: 1) quizzes, 2) in-class projects, 3) final exam, 4) competency test.	Students encounter this concept throughout the course of the year

G1.1.1 Solve multi-step problems and construct proofs involving vertical angles, linear pairs of angles supplementary angles, complementary angles, and right angles.	x		Students apply concepts of complimentary angles and right angles to angles and tapers. Students apply the concept supplementary angles and linear pairs to creating angles from different reference lines in geometry (multi-view projections and pattern lay-out.)	x		Students demonstrate proficiency on: 1) in-class projects, 2) competency test (All concepts on design articulation test, complementary part only for manufacturing articulation test.)	Continuously throughout school year
G1.1.2 Solve multi-step problems and construct proofs involving corresponding angles, alternate interior angles, alternate exterior angles, and same-side (consecutive) interior angles.	x		Students apply concepts of angles related to parallel lines to included angles for drill tips (e.g. blind hole with a drill depth specification.) Students apply concepts of angles related to parallel lines in Solidworks.	x	x	Students demonstrate proficiency on: 1) in-class projects, 2) quizzes, 3) competency test.	Concepts related to angles associated with parallel lines are essential to projects over the course of the year
G1.2.1 Prove that the angle sum of a triangle is 180° and that an exterior angle of a triangle is the sum of the two remote interior angles.	x		Students use the angle sum of triangles to be 180 when making chamfers. (Students are not expected to "prove" but to "use" this property.)	x		Students demonstrate proficiency on: 1) in-class projects, 2) CNC programming.	Approximately 3 weeks

G1.2.5 Solve multi-step problems and construct proofs about the properties of medians, altitudes, perpendicular bisectors to the sides of a triangle, and the angle bisectors of a triangle. Using a straightedge and compass, construct these lines.	x		Students construct these special segments in triangles using Solidworks, Cadkey, and/or Mastercam.	x		Students demonstrate proficiency on locating intersections and midpoints on in-class projects.	Concepts related to these geometric construction techniques are essential to projects over the course of the year
G1.2.4 Prove and use the relationships among the side lengths and the angles of 30º- 60º- 90º triangles and 45º- 45º- 90º triangles.	x		Used when sketching and developing project ideas, checking projects for squareness, specifications for chamfers and countersunk holes, programming CNC machining center.	x		Students demonstrate proficiency on in-class projects.	Approximately 9 weeks

G2.2.1 Identify or sketch a possible 3-dimensional figure, given 2-dimensional views (e.g., nets, multiple views); create a 2-dimensional representation of a 3-dimensional figure.		x	Given a 2-dimensional view, students need to draw other 2-D and 3-D views. Students take the 2-dimensional view created in design and manufacture it. Students take the 3-D object and create the 2-D drawing. Students do reverse-engineering applications.	x	x	Students demonstrate proficiency on: 1) quizzes, 2) tests, 3) in-class projects, 4) group projects, 5) final exams, 6) competency exams.	Continuously throughout school year

ACT Standards							
Perform one-operation computation with whole numbers and decimals (Range 13 – 15)		x	Students perform one-step operations in various situations, some of which include: 1) using known dimensions of an object to determine missing but needed dimensions, 2) doing calculations that include error tolerances, 3) calculating unknown angle measurements, 4) calculating spindle speeds and feed rates, 5) converting within or between units of measure.	x	x	Students demonstrate proficiency on: 1) daily required projects, 2) tests / quizzes, 3) competency test, 4) building gage blocks.	Students encounter this concept throughout the course of the year
Solve problems in one or two steps using whole numbers (Range 13 – 15)		x	Students use whole numbers with scaling drawings.	x		Students demonstrate proficiency while determining scale for drawings.	Approximately 1 week to learn the concept and then incorporated as needed through the remainder of the year

Perform common conversions (e.g., inches to feet or hours to minutes) (Range 13 – 15)		x	Students encounter conversions in multiple fashions such as: 1) students convert within systems of measure when going from taper per foot to taper per inch, 2) students convert within systems when converting between decimal and fractions and vice-versa, 3) students convert between English units and metric units of length.	x	x	Students demonstrate proficiency on: 1) brass hammer project, 2) creation of punches, 3) blueprint reading, 4) written test, 5) scaling, 6) plotting/printing.	Students encounter this concept throughout the course of the year
Perform a single computation using information from a table or chart (Range 13 – 15)		x	Students calculate speeds and feeds from a machining chart. Students use information from a cutting speed chart and calculate how fast the spindle should turn based on a series of variables. Students use information from a threading chart to calculate the thread height. Students use information from diagrams to calculate the size of a head for a bolt based on the major diameter of the bolt. Students use information from tables on distances across center to calculate chordal height.	x		Students demonstrate proficiency on in-class projects. Students take quizzes on how to calculate the height of a thread.	Students encounter this concept throughout the second semester Approximately 9 weeks

Recognize equivalent fractions and fractions in lowest terms (Range 13 – 15)		x	Students determine equivalent fractions or fractions in lowest terms when verifying that object dimensions match the overall length.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the course of the year
Solve equations in the form x + a = b, where a and b are whole numbers or decimals (Range 13 – 15)		x	Students verify distances based on a total dimension length and a feature location.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the course of the year
Identify the location of a point with a positive coordinate on the number line (Range 13 – 15)		x	Students use an edgefinder to locate the center of a spindle over a hole using x-coordinates and y-coordinates. Students create drawings using absolute and relative coordinates. Students calculate tool compensation when creating CNC programs.	x	x	Students demonstrate proficiency on in-class projects. Students demonstrate proficiency on test/quiz questions.	Students encounter this concept throughout the course of the year
Estimate or calculate the length of a line segment based on other lengths given on a geometric figure (Range 13 – 15)		x	Students verify distances based on a total dimension length and a feature location.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the course of the year

Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent (Range 16 – 19)		x	Students perform one-step operations in various situations, some of which include: 1) using known dimensions of an object to determine missing but needed dimensions, 2) doing calculations that include error tolerances, 3) calculating unknown angle measurements, 4) calculating spindle speeds and feed rates, 5) converting within or between units of measure, 6) students use percents in scaling drawings.	x	x	Students demonstrate proficiency on: 1) daily required projects, 2) tests/quizzes, 3) building gage blocks.	Students encounter this concept throughout the course of the year
Solve some routine two-step arithmetic problems (Range 16 – 19)		x	Students do multi-step problems when calculating: 1) RPM, 2) feed rate, 3) single depth, 4) thread depth for unified thread.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the course of the year

Read tables and graphs (Range 16 – 19)		x	Students read various tables and graphs, such as: 1) tap drill charts, 2) thread nomenclature charts, 3) American National Standard Machine Screw Chart, 4) inscribed and circumscribed dimensional polygon chart.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the course of the year
Perform computations on data from tables and graphs (Range 16 – 19)		x	Students calculate speeds and feeds from a machining chart. Students use information from a cutting speed chart and calculate how fast the spindle should turn based on a series of variables. Students use information from a threading chart to calculate the thread height. Students use information from diagrams to calculate the size of a head for a bolt based on the major diameter of the bolt. Students use information from tables on distances across center to calculate chordal height.	x		Students demonstrate proficiency on in-class projects. Students take quizzes on how to calculate the height of a thread.	Students encounter this concept throughout the second semester Approximately 9 weeks

Identify a digit's place value (Range 16 – 19)		x	Students identify place value of decimal numbers for reading precision measurement tools and for working to appropriate tolerances ranges.	x	x	Students demonstrate proficiency on: 1) quizzes, 2) tests, 3) in-class projects, 4) group projects, 5) final exams, 6) competency exams.	Continuously throughout school year
Substitute whole numbers for unknown quantities to evaluate expressions (Range 16 – 19)		x	Students demonstrate proficiency in multiple fashions some of which include: 1) calculating in-feed, 2) calculating speeds and feeds, 3) calculating the drawing scale.	x		Students demonstrate proficiency on in-class projects. Students demonstrate proficiency on quizzes.	Students encounter this concept throughout the course of the year
Solve one-step equations having integer or decimal answers (Range 16 – 19)		x	Students perform one-step operations in various situations, some of which include: 1) using known dimensions of an object to determine missing but needed dimensions, 2) calculating spindle speeds, 3) calculating feed rates, 4) calculating pitch, 5) calculating single depth.	x	x	Students demonstrate proficiency on: 1) daily required projects, 2) tests/quizzes.	Students encounter this concept throughout the course of the year

Locate points on the number line and in the first quadrant (Range 16 – 19)		x	Students use an edgefinder to locate the center of a spindle over a hole using x-coordinates and y-coordinates. Students create drawings using absolute and relative coordinates. Students calculate tool compensation when creating CNC programs.	x	x	Students demonstrate proficiency on in-class projects. Students demonstrate proficiency on test/quiz questions.	Students encounter this concept throughout the course of the year
Exhibit some knowledge of the angles associated with parallel lines (Range 16 – 19)		x	Students apply concepts of angles related to parallel lines to included angles for drill tips (e.g. blind hole with a drill depth specification). Students apply concepts of angles related to parallel lines in Solidworks.	x	x	Students demonstrate proficiency on: 1) in-class projects, 2) quizzes, 3) competency test.	Concepts related to angles associated with parallel lines are essential to projects over the course of the year
Compute the perimeter of polygons when all side lengths are given (Range 16 – 19)		x	Students VERIFY (not calculate) the perimeter using CAD/CAM software.	x		Students demonstrate proficiency on in-class projects.	Approximately 1 semester
Compute the area of rectangles when whole number dimensions are given (Range 16 – 19)		x	Students VERIFY (not calculate) the area using CAD/CAM software.	x		Students demonstrate proficiency on in-class projects.	Approximately 1 semester

Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor (Range 20 – 23)	x		Students round when doing measurement conversions and tolerances. Students order decimals to determine appropriate tooling sizes. Students use absolute value for placement of geometry in the Cartesian Coordinate plane. Students identify patterns for linear or circular bolt hole patterning operations in CAD/CAM.	x	x	Students demonstrate proficiency on: 1) quizzes, 2) tests, 3) in-class projects, 4) group projects, 5) final exams, 6) competency exams.	Continuously throughout school year
Evaluate algebraic expressions by substituting integers for unknown quantities (Range 20 – 23)		x	Students demonstrate proficiency in multiple fashions some of which include: 1) calculating in-feed, 2) calculating speeds and feeds, 3) calculating the drawing scale.	x		Students demonstrate proficiency on in-class projects. Students demonstrate proficiency on quizzes.	Students encounter this concept throughout the course of the year
Locate points in the coordinate plane (Range 20 – 23)		x	Students have a basic understanding of Computer Numerical Control Programing. Students locate data using the Cartesian Coordinate Plane using CAD applications.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the year

Comprehend the concept of length on the number line (Range 20 – 23)		x	Students relate the length of the number line to reading rule-precision measurement and scaling.	x	x	Students demonstrate proficiency on: 1) quizzes/tests, 2) in-class projects, 3) competency tests, 4) reading micrometers or calipers.	Students encounter this concept throughout the year
Find the measure of an angle using properties of parallel lines (Range 20 – 23)		x	Students apply concepts of angles related to parallel lines to included angles for drill tips (e.g. blind hole with a drill depth specification). Students apply concepts of angles related to parallel lines in Solidworks.	x	x	Students demonstrate proficiency on: 1) in-class projects, 2) quizzes, 3) competency test.	Concepts related to angles associated with parallel lines are essential to projects over the course of the year.
Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°) (Range 20 – 23)		x	Students apply concepts of complimentary angles and right angles to angles and tapers. Students apply the concept supplementary angles and linear pairs to creating angles from different reference lines in geometry (multi-view projections and pattern lay-out). Students use angle sums of 360 to determine bolt circle patterns.	x		Students demonstrate proficiency on: 1) in-class projects, 2) competency test (All concepts on design articulation test, complementary part only for manufacturing articulation test.)	Continuously throughout school year

Compute the area and perimeter of triangles and rectangles in simple problems (Range 20 – 23)		x	Students VERIFY (not compute) the perimeter and area of triangles and rectangles using CAD/CAM software.	x		Students demonstrate proficiency on in-class projects.	Approximately 1 semester
Use geometric formulas when all necessary information is given. (Range 20 – 23)		x	Students calculate the circumference of a circle using various methods, such as: 1) mathematical methods using various formulas, 2) rectifying circular arcs, 3) construction methods.	x		Students demonstrate proficiency on in-class projects and worksheets.	Approximately 2 days
Solve multi-step arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour) (Range 24 – 27)		x	Students performing conversions from revolutions per minute to feet per minute to inches per minute.	x		Students demonstrate proficiency on in-class projects.	Used throughout the second semester

Manipulate data from tables and graphs (Range 24 – 27)		x	Students calculate speeds and feeds from a machining chart. Students use information from a cutting speed chart and calculate how fast the spindle should turn based on a series of variables. Students use information from a threading chart to calculate the thread height. Students use information from diagrams to calculate the size of a head for a bolt based on the major diameter of the bolt. Students use information from tables on distances across center to calculate chordal height.	x		Students demonstrate proficiency on in-class projects. Students take quizzes on how to calculate the height of a thread.	Students encounter this concept throughout the second semester. Approximately 9 weeks
Order fractions (Range 24 – 27)		x	Students order fractions when determining appropriate drawing scales. Students order fractions when selecting proper tool size.	x		Students demonstrate proficiency on in-class projects.	Used throughout the year
Exhibit some knowledge of the complex numbers (Range 24 – 27)		x	Students work with complex fractions when working with speeds and feeds calculations.	x		Students demonstrate proficiency on in-class projects.	Used throughout the year

Find the midpoint of a line segment (Range 24 – 27)		x	Students use midpoints with edgefinders to find reference points on a work piece. Students find midpoints to bisect segments, to mirror geometry over an axis, find the centerline of holes and/or arcs.	x		Students demonstrate proficiency on in-class projects.	Used throughout the year
Use several angle properties to find an unknown angle measure (Range 24 – 27)		x	Students apply concepts of complimentary angles and right angles to angles and tapers. Students apply the concept supplementary angles and linear pairs to creating angles from different reference lines in geometry (multi-view projections and pattern lay-out). Students use angle sums of 360 to determine bolt circle patterns.	x		Students demonstrate proficiency on: 1) in-class projects, 2) competency test (All concepts on design articulation test, complementary part only for manufacturing articulation test.)	Continuously throughout school year
Use properties of isosceles triangles (Range 24 – 27)	x		In geometric constructions, students use the length of the sides to find the distance of the shoulder to the point in CNC programming.	x		Students demonstrate proficiency on in-class projects.	Approximately 1 week

Compute the area and circumference of circles after identifying necessary information (Range 24 – 27)		x	Students VERIFY (not calculate) the area and circumference using CAD/CAM software.	x		Students demonstrate proficiency on in-class projects.	Approximately 1 semester
Interpret and use information from figures, tables, and graphs (Range 28 – 32)		x	Students calculate speeds and feeds from a machining chart. Students use information from a cutting speed chart and calculate how fast the spindle should turn based on a series of variables. Students use information from a threading chart to calculate the thread height. Students use information from diagrams to calculate the size of a head for a bolt based on the major diameter of the bolt. Students use information from tables on distances across center to calculate chordal height.	x		Students demonstrate proficiency on in-class projects. Students take quizzes on how to calculate the height of a thread.	Students encounter this concept throughout the second semester. Approximately 9 weeks

Apply number properties involving positive/negative numbers (Range 28 – 32)		x	Students recognize that when working within the positive integer system they do not need to use absolute values relationships, however when working in the number system with all integers, they need to account for measurements in certain situations that apply absolute value relationships (applies in CNC programming for coordinate location in MasterCAM.)	x	x	Students demonstrate proficiency on: 1) in-class projects, 2) quizzes, 3) project on competency test.	Approximately 9 weeks
Apply properties of 30°-60°-90°, 45°-45°-90°, similar, and congruent triangles (Range 28 – 32)	x		Students use properties of similar figures to reduce or enlarge shapes on the plasma cutter. Students use properties of 45-45-90 triangles to create or represent chamfers on drawings and projects.	x		Students demonstrate proficiency on in-class projects.	Approximately 1 week for the use of similar figures; on a daily basis for chamfers

Analyze and draw conclusions based on information from figures, tables, and graphs (Range 33 – 36)		x	Students calculate speeds and feeds from a machining chart. Students use information from a cutting speed chart and calculate how fast the spindle should turn based on a series of variables. Students use information from a threading chart to calculate the thread height. Students use information from diagrams to calculate the size of a head for a bolt based on the major diameter of the bolt. Students use information from tables on distances across center to calculate chordal height.	x		Students demonstrate proficiency on in-class projects. Students take quizzes on how to calculate the height of a thread.	Students encounter this concept throughout the second semester. Approximately 9 weeks
Solve problems integrating multiple algebraic and/or geometric concepts (Range 33 – 36)		x	Students integrate the use of formulas and expressions to manufacture products based on 2-D and/or 3-D representations. Students use Boolean operations to create composite solid models.	x		Students demonstrate proficiency on in-class projects.	Approximately 1 semester

Draw conclusions based on a set of conditions (Range 33 – 36)		x	Students apply this concept in various ways including: 1) based on end products, students determine the quality of finish and cutting performance, 2) students analyze operating conditions and variables to optimize cutting performance.	x		Students demonstrate proficiency on in-class projects.	Throughout the year
Solve multi-step geometry problems that involve integrating concepts, planning, visualization, and/or making connections with other content areas (Range 33 – 36)		x	Students use Boolean operations to create composite solid models for real-world applications. Students use angle relationships, distance measurements, true positions, and calculations to plan, visualize, and produce a machined part.	x		Students demonstrate proficiency on in-class projects.	Used for approximately 1 semester
Use scale factors to determine the magnitude of a size change (Range 33 – 36)		x	Students use scale factors to meet machine capabilities and design specifications.	x		Students demonstrate proficiency on in-class projects.	Used for approximately 1 semester
Compute the area of composite geometric figures when planning or visualization is required (Range 33 – 36)		x	Students use Boolean operations to create composite solid models for real-world applications.	x		Students demonstrate proficiency on in-class projects.	Used for approximately 1 semester

WorkKeys Standards							
Solve problems that require a single type of mathematics operation (addition, subtraction, multiplication, and division) using whole numbers (Level 3)		x	Students perform one-step operations in various situations, some of which include: 1) using known dimensions of an object to determine missing but needed dimensions, 2) doing calculations that include error tolerances, 3) calculating unknown angle measurements, 4) calculating spindle speeds and feed rates, 5) converting within or between units of measure.	x	x	Students demonstrate proficiency on: 1) daily required projects, 2) tests/quizzes, 3) competency test, 4) building gage blocks.	Students encounter this concept throughout the course of the year
Add or subtract negative numbers (Level 3)		x	Students add and subtract negative numbers when determining distances in the Cartesian Coordinate System.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the second semester

Change numbers from one form to another using whole numbers, fractions, decimals, or percentages (Level 3)		x	When doing conversions on measurements, students change number forms between whole numbers, fractions, and decimals. Students change percentages to decimals when working with scaling.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the year
Solve problems that require one or two operations (Level 4)		x	Students do multi-step problems when calculating: 1) RPM, 2) feed rate, 3) single depth, 4) thread depth for unified thread. Students perform one-step operations in various situations, some of which include: 1) using known dimensions of an object to determine missing but needed dimensions, 2) doing calculations that include error tolerances, 3) calculating unknown angle measurements, 4) calculating spindle speeds and feed rates, 5) converting within or between units of measure.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the course of the year

Multiply negative numbers (Level 4)		x	Students verify total distances of negative products in drawings.	x		Students demonstrate proficiency on in-class projects.	Use as needed on projects
Calculate averages, simple ratios, simple proportions, or rates using whole numbers and decimals (Level 4)		x	Students are given tolerances and find a nominal size of a hole (using averages). Students use ratios and proportions when developing a plot scale and/or print scale to a drawing. Students determine feed rates and verify spindle speeds in the process of creating a CNC program.	x	x	Students demonstrate proficiency on in-class projects and worksheets.	Students encounter this concept throughout the course of the year
Add commonly known fractions, decimals, or percentages (e.g., 1/2, .75, 25%) (Level 4)	x		Students add fractions and decimals when verifying dimensions of a project.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the course of the year
Add up to three fractions that share a common denominator (Level 4)		x	Students add up to three fractions when verifying dimensions of a project.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the course of the year
Multiply a mixed number by a whole number or decimal (Level 4)		x	Students multiple mixed numbers by whole numbers or decimals and performing conversions.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the course of the year

Put the information in the right order before performing calculations (Level 4)		x	Students set up the format of a drawing with all appropriate units and dimension settings. Upon printing, students need to figure out the print scale based on the title block scale and the units of the drawing.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept for approximately one semester
Decide what information, calculations, or unit conversions to use to solve the problem (Level 5)		x	Students determine the information they need to design and manufacture a project (this includes determining which tools to use, which processes are appropriate, which unit conversions are necessary, which calculations are necessary, what error tolerance is appropriate, how long should the project take, etc.). This will typically include converting units within or between systems of measure and performing calculations to accurately use tools.	x		Students demonstrate proficiency on in-class projects.	Students encounter this concept throughout the year

Look up a formula and perform single-step conversions within or between systems of measurement (Level 5)		x	Students calculate speeds and feeds from a machining chart. Students use information from a cutting speed chart and calculate how fast the spindle should turn based on a series of variables. Students use information from a threading chart to calculate the thread height. Students use information from diagrams to calculate the size of a head for a bolt based on the major diameter of the bolt. Students use information from tables on distances across center to calculate chordal height.	x		Students demonstrate proficiency on in-class projects. Students take quizzes on how to calculate the height of a thread.	Students encounter this concept throughout the second semester. Approximately 9 weeks
Calculate perimeters and areas of basic shapes (rectangles and circles) (Level 5)		x	Students VERIFY (not calculate) area and perimeter using CAD/CAM software.	x		Students demonstrate proficiency on in-class projects.	Approximately 1 semester

Use fractions, negative numbers, ratios, percentages, or mixed numbers (Level 6)		x	Students perform mathematical operations in various situations, some of which include: 1) calculating spindle speeds and feed rates, 2) converting within or between units of measure using ratios, mixed numbers, and fractions, 3) using percents and ratios in scaling drawings, 4) verifying total distances of negative products in drawings.	x	x	Students demonstrate proficiency on: 1) daily (on required projects), 2) tests /quizzes.	Students encounter this concept throughout the course of the year
Use two formulas to change from one unit in one system of measurement to a unit in another system of measurement (Level 6)		x	Students perform conversions from revolutions per minute to feet per minute to inches per minute.	x		Students demonstrate proficiency on in-class projects.	Used throughout the second semester
Find the volume of rectangular solids (Level 6)		x	Students VERIFY (not calculate) volume using CAD/CAM software.	x		Students demonstrate proficiency on in-class projects.	Approximately 9 weeks

Calculate multiple rates (Level 6)		x	Students calculate RPM and feed rates.	x		Students demonstrate proficiency on in-class projects. Students demonstrate proficiency on quizzes.	Students encounter this concept throughout the course of the year
Convert between systems of measurement that involve fractions, mixed numbers, decimals, and/or percentages (Level 7)	x		Students encounter conversions in multiple fashions such as: 1) students convert between systems of measure when converting taper per foot to angle measurements, 2) students convert between English units and metric units.	x	x	Students demonstrate proficiency on: 1) brass hammer project, 2) creation of punches, 3) blueprint reading, 4) written test, 5) scaling, 6) plotting/printing.	Students encounter this concept throughout the course of the year
Calculate multiple areas and volumes of spheres, cylinders, or cones (Level 7)		x	Students VERIFY (not calculate) area and volume using CAD/CAM software.	x		Students demonstrate proficiency on in-class projects.	Approximately 1 semester

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