SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Applied Trades Mathematics	**Length of Course:** 15 cycles
Grade Level(s): 9-11	**Periods Per Cycle:** 6
Units of Credit: 0.5	**Length of Period:** 43 minutes
Classification: Elective	**Total Instructional Time:** 64.5 hours

Course Description

Applied Trades Mathematics will focus on skills and knowledge that is commonly used in the workplace, apprenticeships, and trades environments. Students will explore the concepts of algebra and geometry and its application to the trade industry. Students will complete projects and solve problems within Industrial Arts, Engineering, Architecture, and Design career areas by applying algebra and geometry concepts in real-world applications.

Instructional Strategies, Learning Practices, Activities, and Experiences

Critical Thinking Guided Practice Warm-Up/Closures	Class Discussions Flexible Groups Best Practices Strategies	Teacher Demonstrations Project Examples Hands on Projects

Assessments

Written Tests	Application Projects/Exercises	Verbal Discussions

Materials/Resources

Teacher Generated Materials		

Adopted: 5/24/21
Revised:

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Expressions, Equations, and Functions • Evaluate expressions • Apply the Order of Operations • Write expressions, equations, and inequalities • Represent functions as rules and tables • Find the unit rate for a given situation • Represent functions as graphs • Use formulas to solve application problems	**CC.2.1.HS.F.1** Apply and extend the properties of exponents to solve problems with rational exponents. **CC.2.1.HS.F.2** Apply properties of rational and irrational numbers to solve real-world or mathematical problems. **CC.2.1.HS.F.3** Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. **CC.2.2.HS.D.1** Interpret the structure of expressions to represent a quantity in terms of its context. **CC.2.2.HS.D.2** Write expressions in equivalent forms to solve problems. **CC.2.2.HS.D.10** Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Properties of Real Numbers • Classify real numbers • Use integers and rational numbers • Find square roots and compare real numbers	**CC.2.1.HS.F.1** Apply and extend the properties of exponents to solve problems with rational exponents. **CC.2.1.HS.F.2** Apply properties of rational and irrational numbers to solve real-world or mathematical problems. **CC.2.2.HS.D.2** Write expressions in equivalent forms to solve problems. **CC.2.2.HS.D.9** Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Solving Linear Equations • Solve one-step equations • Solve two-step equations • Solve multi-step equations • Write ratios and proportions • Solve proportions • Determine percentage • Rewrite formulas	**CC.2.1.HS.F.3** Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. **CC.2.1.HS.F.4** Use units as a way to understand problems and to guide the solution of multi-step problems. **CC.2.1.HS.F.5** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **CC.2.2.HS.C.3** Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.D.7** Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.8** Apply inverse operations to solve equations or formulas for a given variable. **CC.2.2.HS.D.9** Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. **CC.2.4.HS.B.1** Summarize, represent, and interpret data on a single count or measurement variable. **CC.2.4.HS.B.3** Analyze linear models to make interpretations based on the data.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Graphing Linear Equations and Functions • Plot points on a coordinate plane • Graph linear functions • Graph using intercepts • Find the slope and rate of change • Graph using slope intercept form • Define a function and find the domain and range of a function • Identify parallel lines	**CC.2.1.HS.F.3** Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays. **CC.2.2.HS.C.1** Use the concept and notation of functions to interpret and apply them in terms of their context. **CC.2.2.HS.C.2** Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.4.HS.B.2** Summarize, represent, and interpret data on two categorical and quantitative variables. **CC.2.2.HS.C.5** Construct and compare linear, quadratic, and exponential models to solve problems. **CC.2.2.HS.C.6** Interpret functions in terms of the situations they model. **CC.2.4.HS.B.1** Summarize, represent, and interpret data on a single count or measurement variable.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Writing Linear Equations • Write equations in slope intercept form • Write linear equations in point-slope form • Write equations of parallel and perpendicular lines • Scatterplots (trend lines/line of best fit) • Make predictions using best fit lines	**CC.2.4.HS.B.1** Summarize, represent, and interpret data on a single count or measurement variable. **CC.2.4.HS.B.2** Summarize, represent, and interpret data on two categorical and quantitative variables. **CC.2.4.HS.B.3** Analyze linear models to make interpretations based on the data. **CC.2.2.HS.C.1** Use the concept and notation of functions to interpret and apply them in terms of their context. **CC.2.2.HS.C.2** Graph and analyze functions and use their properties to make connections between the different representations. **CC.2.2.HS.C.3** Write functions or sequences that model relationships between two quantities. **CC.2.2.HS.C.5** Construct and compare linear, quadratic, and exponential models to solve problems. **CC.2.2.HS.C.6** Interpret functions in terms of the situations they model.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Systems of Equations and Inequalities • Graph systems of linear equations • Solve systems by substitution • Solve systems by elimination	**CC.2.2.HS.D.9** Use reasoning to solve equations and justify the solution method. **CC.2.1.HS.F.5** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **CC.2.2.HS.D.7** Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.9** Use reasoning to solve equations and justify the solution method. **CC.2.2.HS.D.10** Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically. **CC.2.1.HS.F.5** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **CC.2.2.HS.D.7** Create and graph equations or inequalities to describe numbers or relationships. **CC.2.2.HS.D.10** Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Reasoning and Proof • Use inductive reasoning • Describe and solve patterns • Write mathematical conjectures • Apply deductive reasoning • Use postulates and diagrams that involve angle and segment measurements • Reason using properties from Algebra to form logical arguments • Problem-solve with real-world situations	**CC.2.3.HS.A.3** Verify and apply geometric theorems as they relate to geometric figures. **CC.2.3.HS.A.6** Verify and apply theorems involving similarity as they relate to plane figures. **CC.2.3.HS.A.8** Apply geometric theorems to verify properties of circles. **CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Parallel and Perpendicular Lines • Identify and solve angle pairs formed by two intersecting lines • Identify and solve angle pairs formed by three intersecting lines • Identify and solve angle pairs formed by parallel lines and a transversal • Use angle relationships to prove lines are parallel • Solve and compare slopes of lines • Write and graph equations of lines • Write equation of lines that are parallel • Write equation of lines that are perpendicular • Find the distance between two points on the coordinate plane • Find the distance between a point and a line • Problem-solve with real-world situations	**CC.2.3.HS.A.3** Verify and apply geometric theorems as they relate to geometric figures. **CC.2.3.HS.A.11** Apply coordinate geometry to prove simple geometric theorems algebraically. **CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Congruent Triangles • Classify sides and angles of a triangle • Classify sides of a triangle on the coordinate plane • Find the perimeter of a triangle on the coordinate plane • Solve the interior angles of a triangle • Solve the exterior angles of a triangle • Solve angles of a right triangle • Learn properties of congruent triangles • Apply theorems of congruent triangles • Solve for angle measurements using isosceles and equilateral triangles theorems • Problem-solve with real-world situations	**CC.2.3.HS.A.3** Verify and apply geometric theorems as they relate to geometric figures. **CC.2.3.HS.A.7** Apply trigonometric ratios to solve problems involving right triangles. **CC.2.3.HS.A.11** Apply coordinate geometry to prove simple geometric theorems algebraically. **CC.2.3.HS.A.13** Analyze relationships between two-dimensional and three-dimensional objects. **CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems. **CC.2.2.HS.C.9** Prove the Pythagorean identity and use it to calculate trigonometric ratios.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Surface Area and Volume of Solids • Find the areas of triangles and parallelograms • Solve areas of trapezoids, rhombuses, and kites • Draw three dimensional figures • Identify and explore solids • Solve surface area of prisms and cylinders • Solve surface area of pyramids and cones • Solve volume of prisms and cylinders • Solve volume of pyramids and cones • Solve surface area and volume of spheres • Problem-solve with real-world situations	**CC.2.3.HS.A.3** Verify and apply geometric theorems as they relate to geometric figures. **CC2.3.HS.A.4** Apply the concept of congruence to create geometric constructions. **CC.2.3.HS.A.6** Verify and apply theorems involving similarity as they relate to plane figures. **CC.2.3.HS.A.8** Apply geometric theorems to verify properties of circles. **CC.2.3.HS.A.9** Extend the concept of similarity to determine arc lengths and areas of sectors circles. **CC.2.3.HS.A.12** Explain volume formulas and use them to solve problems. **CC.2.3.HS.A.13** Analyze relationships between two-dimensional and three-dimensional objects. **CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems. **CC.2.2.HS.C.9** Prove the Pythagorean identity and use it to calculate trigonometric ratios.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Similarity • Simplify and write ratios • Solve problems by writing ratios into proportions • Create proportions to solve geometry problems • Use proportions to identify similar polygons • Use proportions with similar triangles • Problem-solve with real-world situations	**CC.2.3.HS.A.1** Use geometric figures and their properties to represent transformations in the plane. **CC.2.3.HS.A.3** Verify and apply geometric theorems as they relate to geometric figures. **CC.2.3.HS.A.6** Verify and apply theorems involving similarity as they relate to plane figures. **CC.2.3.HS.A.11** Apply coordinate geometry to prove simple geometric theorems algebraically. **CC.2.3.HS.A.13** Analyze relationships between two-dimensional and three-dimensional objects. **CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Quadrilaterals • Establish the classifications of polygons • Find the interior and exterior angle measures in polygons • Develop the properties of parallelograms • Discover the theorems for angles and sides of a parallelogram • Show by proving on the coordinate plane that a quadrilateral is a parallelogram • Discover and use properties of rhombuses, rectangles, and squares	**CC.2.3.HS.A.1** Use geometric figures and their properties to represent transformations in the plane. **CC.2.3.HS.A.3** Verify and apply geometric theorems as they relate to geometric figures. **CC2.3.HS.A.4** Apply the concept of congruence to create geometric constructions. **CC.2.3.HS.A.6** Verify and apply theorems involving similarity as they relate to plane figures. **CC.2.3.HS.A.11** Apply coordinate geometry to prove simple geometric theorems algebraically. **CC.2.3.HS.A.13** Analyze relationships between two-dimensional and three-dimensional objects. **CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Right Triangles and Trigonometry • Apply the Pythagorean theorem • Formulate Pythagorean Triples • Use the converse of the Pythagorean Theorem to prove right triangles • Classify triangle angles by the three-side lengths • Use the theorems for special right triangles to solve for sides and angles • Apply the tangent, sine, and cosine ratios to solve for side lengths • Apply the inverse tangent, sine, and cosine ratios to solve for angle measurements • Problem-solve with real-world situations	**CC.2.3.HS.A.3** Verify and apply geometric theorems as they relate to geometric figures. **CC.2.3.HS.A.7** Apply trigonometric ratios to solve problems involving right triangles. **CC.2.3.HS.A.13** Analyze relationships between two-dimensional and three-dimensional objects. **CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems. **CC.2.2.HS.C.9** Prove the Pythagorean identity and use it to calculate trigonometric ratios.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Properties of Circles • Solve for the circumference and area of circles • Find Arc Measures • Identify arcs, congruent arcs, and congruent circles • Use Inscribed Angles and Polygons to solve for angles and arc measurements • Find the measure of an intercepted arc • Use inscribed polygons and circumscribed circles to solve for angle measurements • Apply and find angle measurements inside and outside a circle • Write and graph equations of circles • Problem-solve with real-world situations	**CC.2.3.HS.A.3** Verify and apply geometric theorems as they relate to geometric figures. **CC.2.3.HS.A.8** Apply geometric theorems to verify properties of circles. **CC.2.3.HS.A.9** Extend the concept of similarity to determine arc lengths and areas of sectors circles. **CC.2.3.HS.A.13** Analyze relationships between two-dimensional and three-dimensional objects. **CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Measuring Length and Area • Find the ratios of similar polygons • Find the perimeter and area of similar figures • Use the circumference to find the distance traveled • Find arc length • Use arc lengths to find measures and distances • Solve for the area of circles and sectors • Find the measure of the central angle • Problem-solve with real-world situations	**CC.2.3.HS.A.3** Verify and apply geometric theorems as they relate to geometric figures. **CC.2.3.HS.A.8** Apply geometric theorems to verify properties of circles. **CC.2.3.HS.A.9** Extend the concept of similarity to determine arc lengths and areas of sectors circles. **CC.2.3.HS.A.13** Analyze relationships between two-dimensional and three-dimensional objects. **CC.2.3.HS.A.14** Apply geometric concepts to model and solve real world problems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS

Units of Measure
• Fractions
• Decimals
• Percentages
• Chart Reading
• Metric Units of Measure
• Standard Units of Measure
• Conversions
• Measure Devices
  o Tape Measure
  o Micrometer
  o Caliper
  o Multimeter (amps, volts, resistance)
  o Measuring: Distances, Weights, Angles, Level/Plumb
	3.4.10.A3
	Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function.
	3.4.12.A3
	Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM).
	3.4.10.C2
	Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments.
	3.4.12.C3
	Apply the concept that many technological problems require a multi-disciplinary approach.
	3.4.10.D1
	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product.
	3.4.12.D2
	Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
	3.4.10.D2
	Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it.
	3.4.12.E6
	Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world.
	3.4.12.E7
	Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
2 & 3 Dimensional Units of Measure • Surface Area • Volume • Formulas	**3.4.10.A3** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.C2** Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments. **3.4.12.C3** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.10.D1** Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product. **3.4.12.D2** Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it. **3.4.12.E6** Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7** Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Land Surveying: • Elevation Change • Rate of Change (Grade) • Pythagorean Theorem • Coordinate Geometry	**3.4.10.A3** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B3** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.10.C2** Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments. **3.4.12.C3** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.10.D1** Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product. **3.4.12.D2** Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it. **3.4.12.E6** Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7** Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Construction/Design - Bridge Building • Construction History • Proportions/Scaled Drawings • Ratios • Material Costs • Materials in Compression/Tension • Design Evaluation and Rebuild	**3.4.10.C2** Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments. **3.4.12.C3** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.10.D1** Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product. **3.4.12.D2** Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it. **3.4.12.E6** Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7** Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS

Material/Project Cost
• Calculating Material Cost (examples)
  ○ Concrete
  ○ Carpet
  ○ Board Feet
  ○ Mulch
  ○ Stone
  ○ Paint
  ○ Roofing
	3.4.10.B3
	Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies.
	3.4.10.C2
	Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments.
	3.4.12.C3
	Apply the concept that many technological problems require a multi-disciplinary approach.
	3.4.10.D1
	Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product.
	3.4.12.D2
	Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly.
	3.4.12.E6
	Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world.
	3.4.12.E7
	Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Simple Machines • Pulleys • Gears • Levers • Screws • Incline Plane • Wheels/Axle • Wedge	**3.4.10.A3** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.C2** Analyze a prototype and/or create a working model to test a design concept by making actual observations and necessary adjustments. **3.4.12.C3** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.10.D1** Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product. **3.4.12.D2** Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it. **3.4.10.E7** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.