

Course Description: *Math Modeling* is a course in which students will explore key mathematical concepts through real-world problem-solving. The course is divided into two semesters. Semester B focuses on ratio and proportion, function types, congruence and similarity, transformations, trigonometric ratios, and periodic behavior. Through this work, students will learn about, and complete tasks that involve applying what they have learned to create physical and mathematical models to represent real-world scenarios.

Module	Lesson Title	Objectives
Module 7: Ratios & Proportions	7.1 Ratios	- Write a simplified ratio in the forms a to b, $a:b$, and a/b. - Fluently convert among ratio notations. - Write and simplify ratios that represent real-world scenarios.
	7.2 The Golden Ratio	- Use the golden ratio to find the dimensions of a geometric figure. - Identify examples of the golden ratio in the world.
	7.3 Comparing Ratios	Determine if ratios presented within real-world contexts are equal.
	7.4 Proportional Relationships	- Define proportional relationships. - Determine if a relationship is proportional.
	7.5 Writing & Solving Proportions	- Write proportions that represent real-world situations. - Solve proportions that represent real-world situations.
	7.6 Proportions & Measurement	- Explain that there are two systems of measurement. - Identify units in each system of measurement. - Convert between systems of measurement.
	7.7 Scale Factors	- Define and solve for a scale factor. - Calculate the missing term in real-world scale factor proportions.

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	7.8 Scale Models	- Calculate unknown measurements using the relationship between the scale model and the actual object. - Explain why scale models are important as a proof of concept.
Module 8: Function Types	8.1 Direct Variation	- Identify linear functions. - Define direct variation. - Solve real-world direct variation problems.
	8.2 Inverse Variation	- Define <i>inverse variation</i>. - Compare direct and inverse variation. - Solve real-world inverse variation problems.
	8.3 Joint Variation	- Define <i>joint variation</i>. - Compare direct, inverse, and joint variation. - Solve real-world joint variation problems.
	8.4 Combined Variation	- Define <i>combined variation</i>. - Compare direct, inverse, joint, and combined variation. - Solve real-world combined variation problems.
	8.5 Applications of Variation	- Derive equations for variation problems. - Solve real-world applications of direct, inverse, joint, and combined variation.
	8.6 Exponential Growth	- Explain exponential growth. - Fit an exponential growth model to real-world data using technology. - Interpret the exponential growth model.
	8.7 Exponential Decay	- Explain exponential decay. - Fit an exponential decay model to real-world data using technology. - Interpret the exponential decay model.
	8.8 Quadratic Motion	- Interpret the solutions of quadratic functions. - Model quadratic motion in standard form. - Model quadratic motion using technology.

Module	Lesson Title	Objectives
Module 9: Congruent & Similar	9.1 Area	• Define area. • Calculate area of common shapes. • Calculate the area of real-world objects.
	9.2 Surface Area	• Define surface area. • Calculate the surface area of common shapes. • Calculate the surface area of real-world objects.
	9.3 Volume	• Define volume. • Calculate the volume of common shapes. • Calculate the volume of real-world objects.
	9.4 Congruence	• Identify congruent shapes. • Show that real world objects are congruent.
	9.5 Dilation	• Dilate shapes in the coordinate plane. • Show that the figure resulting from dilation is not congruent to the original figure.
	9.6 Similarity	• Distinguish between congruence and similarity. • Use proportional relationships to determine side lengths in similar figures. • Recognize and create similar shapes using dilation.
	9.7 2D Scale Factors	• Calculate the value of a scale factor from 2D shapes. • Determine if two shapes are similar or congruent. • Investigate proportional and non-proportional changes in perimeter and area of 2D scaled figures.
	9.8 3D Scale Factors	• Calculate the value of a scale factor from 3D figures. • Investigate proportional and nonproportional changes in surface area and volume of 3D scaled figures.

Module	Lesson Title	Objectives
Module 10: Transformations	10.1 Types of Rigid Motion	- Identify examples of rigid motion from geometric scenarios. - Examine how to preserve angles and lengths in transformations.
	10.2 Translations	- Identify properties of translations. - Translate shapes in the coordinate plane. - Identify examples of translation in real world scenarios.
	10.3 Reflections	- Identify properties of reflections. - Reflect shapes in the coordinate plane. - Identify examples of reflection in real-world scenarios.
	10.4 Rotations	- Identify properties of rotations. - Rotate shapes in the coordinate plane. - Identify examples of rotation in real-world scenarios.
	10.5 Identifying Transformations	- Transform figures using multiple rigid motions and dilation. - Identify the types of transformations that will carry one shape onto another.
	10.6 Transformation Problems	- Distinguish between different types of transformations. - Distinguish between rotational and reflectional symmetry. - Solve problems using transformations.
	10.7 Tessellations	- Identify examples of tessellations. 2. Explain how to use transformations to create tessellations.
	10.8 Tessellation Application	- Classify tessellations. - Analyze tessellations. - Model real world scenarios using tessellations.
Module 11: Trig Ratios	11.1 Types of Triangles	- Classify triangles based on their angles and side lengths. - Recognize and identify when a triangle does not exist due to side lengths or angle measurements. - Calculate a triangle's missing angle measures.

Module	Lesson Title	Objectives
	11.2 The Pythagorean Theorem	- Calculate the missing side length in a right triangle. - Apply the Pythagorean theorem to solve problems in real-world contexts.
	11.3 The Distance Formula	- Calculate the distance between horizontal and vertical points in the coordinate plane. - Calculate distance in the coordinate plane using the Pythagorean theorem. - Connect the Pythagorean theorem to the distance formula. - Apply the distance formula to solve real world problems.
	11.4 Special Right Triangles	- State the relationship between the sides of special right triangles. - Calculate missing side lengths in special right triangles. - Calculate the area of a special right triangle.
	11.5 The Sine Ratio	- Calculate the sine ratio. - Calculate angle and side length values using the sine function and inverse sine function. - Solve real-world problems using the sine ratio.
	11.6 The Cosine Ratio	- Calculate the cosine ratio. - Calculate angle and side length values using the cosine function and inverse cosine function. - Solve real-world problems using the cosine ratio.
	11.7 The Tangent Ratio	- Calculate the tangent ratio. - Calculate angle and side length values using the tangent function and inverse tangent function. - Solve real-world problems using the tangent ratio.
	11.8 Solving Triangles	- Use the sine, cosine, and tangent ratios to solve right triangles. - Convert degree measurements to radians. - Convert radian measurements to degrees.
	12.1 Ratios & the Unit Circle	- Find values of trigonometric functions for general angles. - Find values of trigonometric functions using reference angles.

Module	Lesson Title	Objectives
Module 12: Periodic Behavior	12.2 Sine Graphs	• Evaluate a sine function using its graph and properties. • Determine features of the sine function, including period, amplitude, and midline. • Solve real-world problems using the graph of a sine function.
	12.3 Cosine Graphs	• Evaluate a cosine function using its graph and properties. • Determine features of the cosine function, including period, amplitude, and midline. • Solve real-world problems using the graph of a cosine function.
	12.4 Tangent Graphs	• Determine features of the tangent function. • Evaluate a tangent function using its graph and properties. • Solve real-world problems using the graph of a tangent function.
	12.5 Reciprocal Functions	• Explain the relationship between a trigonometric function and its reciprocal. • Evaluate a reciprocal function using its graph and properties. • Solve real world problems using reciprocal functions.
	12.6 Trigonometric Equations	• Explain the difference between an inverse trigonometric function and a reciprocal trigonometric function. • Calculate the value of an inverse trigonometric function. • Solve trigonometric equations using inverse trigonometric functions.
	12.7 Law of Sines	• Solve triangles using the law of sines. • Calculate the area of a triangle using the law of sines.
	12.8 Law of Cosines	• Solve triangles using the law of cosines. • Choose the best method for solving a triangle.