

# Unit 6- Formulas and Functions

Content Area: **Mathematics**  
Course(s): **Algebra, Math 8**  
Time Period: **December**  
Length: **25 Days**  
Status: **Published**

## Unit Summary

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This unit has 2 parts, Functions and Formulas.

### Functions:

A new concept for the 8th grade level is the idea of a function. Students define what a function is and evaluate and compare different types of functions using tables, maps, equations, and graphs. They describe the characteristics of functions and compare them mathematically as transformations on a parent equation. Students tie the idea of output versus input to representations using function notation. Part of this concept is the ability to re-arrange equations so the output variable is isolated and to know the difference between evaluating a function and solving a function.

### Formulas:

The formulas portion of this unit addresses geometry concepts. Students will prove and use the Pythagorean Theorem and the related topic of distance between points. Students use their experience comparing features of geometrical figures in earlier grades as well as the application of rigid and non-rigid transformations to explore and prove congruency and similarity. Students use their understanding of volume to solve problems with cylinders, spheres, and cones.

## Standards

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MA.8.F.A	Define, evaluate, and compare functions.
MA.8.F.A.1	Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.
MA.8.F.B	Use functions to model relationships between quantities.
MA.8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.
MA.8.G	Geometry
MA.8.G.A	Understand congruence and similarity using physical models, transparencies, or geometry software.
MA.8.G.A.1	Verify experimentally the properties of rotations, reflections, and translations:
MA.8.G.A.2	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.
MA.8.G.A.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.
MA.8.G.A.4	Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

MA.8.G.A.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles.
MA.8.G.A.1a	Lines are transformed to lines, and line segments to line segments of the same length.
MA.8.G.A.1b	Angles are transformed to angles of the same measure.
MA.8.G.A.1c	Parallel lines are transformed to parallel lines.
MA.8.G.B	Understand and apply the Pythagorean Theorem.
MA.8.G.B.6	Explain a proof of the Pythagorean Theorem and its converse.
MA.8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
MA.8.G.B.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.
MA.8.G.C	Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.
MA.8.G.C.9	Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.
MA.F-BF.A	Build a function that models a relationship between two quantities
MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.F-BF.A.1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.
MA.F-BF.A.1b	Combine standard function types using arithmetic operations.
MA.F-BF.A.1c	Compose functions.
MA.F-IF.A	Understand the concept of a function and use function notation
MA.F-IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If $f$ is a function and $x$ is an element of its domain, then $f(x)$ denotes the output of $f$ corresponding to the input $x$ . The graph of $f$ is the graph of the equation $y = f(x)$ .
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.F-IF.A.3	Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers.
MA.F-IF.B	Interpret functions that arise in applications in terms of the context
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.4	Model with mathematics.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.
CAEP.9.2.8.B.3	Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

TECH.8.1.8.A.CS1	Understand and use technology systems.
TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.D.CS2	Demonstrate personal responsibility for lifelong learning.

## Student Learning Objectives

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- Students will learn to distinguish between functions and relations.
- Students will learn to determine if a relation is a function.
- Students will learn to find domain and range of functions.
- Students will learn to use function notation.
- Students will learn to evaluate and solve functions.
- Students will learn to identify a function family from a graph or equation.
- Students will learn to represent mathematical relationships using graphs, tables, and expressions.
- Students will learn to solve problems involving the Pythagorean Theorem.
- Students will learn to rewrite, use, and solve literal equations.
- Students will learn to calculate the volume of 3-dimensional figures including cylinders, cones, and spheres.
- Students will learn to perform transformations on figures in the coordinate plane.
- Students will learn to use rigid and non-rigid transformations to prove congruency and similarity.
- Students will learn to use the AA Similarity Criterion to prove that 2 triangle are similar.
- Students will learn to apply rules for similarity to set up and solve problems.
- Students will learn to use unit/dimensional analysis to convert units and solve problems.

## Essential Questions

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- How do humans explain their world through quantitative representations?
- How would your life be affected if the machines around you behaved unpredictably?
- How are right triangles used to understand and model our physical world?

## Enduring Understandings

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- Students will understand that mathematics is a language of carefully designed terms and symbols.
- Students will understand that mathematics is used to make informed decisions about problems in everyday life.
- Students will understand that a function means to predict an outcome.

## Application

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- Students will be able to independently use their learning to explain the characteristics of functions and identify the correct family.
- Students will be able to independently use their learning to use function notation to describe sequences.
- Students will be able to independently use their learning to use formulas/equations in order to solve for an unknown.
- Students will be able to independently use their learning to perform unit conversions.

- Students will be able to independently use their learning to use transformations to prove congruency and similarity.

## **Skills**

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Students will be skilled at:

- Applying the Pythagorean Theorem to right triangles.
- Utilizing formulas for cylinders, cones and spheres.
- Rewriting formulas/literal equations to express output as a function of input.
- Stating and applying rules for transformations.