



## Mathematics – Grade 8

In eighth grade, students will develop skills and abilities in six mathematics domains:

### Mathematical Practices

- make sense of problems and persevere in solving them
- reason abstractly and quantitatively
- construct viable arguments and critique the reasoning of others
- model with mathematics
- use appropriate tools strategically
- attend to precision
- look for and make use of structure
- look for and express regularity in repeated reasoning.

### The Number System

- know that numbers that are not rational are called irrational; understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number
- use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions.

### Expressions and Equations

- know and apply the properties of integer exponents to generate equivalent numerical expressions
- use square root and cube root symbols to represent solutions to equations of the form  $x^2 = p$  and  $x^3 = p$ , where  $p$  is a positive rational number; evaluate square roots of small perfect squares and cube roots of small perfect cubes; know that  $\sqrt{2}$  is irrational
- use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other
- perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used; use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading); interpret scientific notation that has been generated by technology
- graph proportional relationships, interpreting the unit rate as the slope of the graph; compare two different proportional relationships represented in different ways
- solve linear equations in one variable
- analyze and solve pairs of simultaneous linear equations.

### Functions

- 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
- compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions)
- interpret the equation  $y = mx + b$  as defining a linear function whose graph is a straight line; give examples of functions that are not linear
- construct a function to model a linear relationship between two quantities; determine the rate of change and initial value of the function from a description of a relationship or from two  $(x, y)$  values, including reading these from a table or from a graph; interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values

- describe qualitatively the functional relationship between two quantities by analyzing a graph; sketch a graph that exhibits the qualitative features of a function that has been described verbally

### **Geometry**

- verify experimentally the properties of rotations, reflections, and translations:
  - lines are taken to lines, and line segments to line segments of the same length
  - angles are taken to angles of the same measure
  - parallel lines are taken to parallel lines
- 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.
- describe the effects of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates
- 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
- apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions
- apply the Pythagorean Theorem to find the distance between two points in a coordinate system
- know the formulas for the volumes of cones, cylinders, and spheres, and use them to solve real-world and mathematical problems.

### **Statistics and Probability**

- construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities; describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association
- know that straight lines are widely used to model relationships between two quantitative variables; for scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line
- use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.

### Middle School Mathematics Department

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