



GRADE

8

**D91 Pathway to the
Common Core Standards
Mathematics**

In grade eight, students take their understanding of unit rates and proportional relationships to a new level, connecting these concepts to points on a line and ultimately using them to solve linear equations requiring algebraic reasoning and knowledge of the properties of operations. Students will also expand their understanding of numbers beyond rational numbers to include numbers that are irrational—meaning that they cannot be written as a simple fraction, such as the square root of 2 or $2^{\frac{1}{2}}$. Activities in these areas will include:

- Understanding that every rational number (such as $\frac{1}{2}$, 0.3, 2, or -2) can be written as a decimal, but that the decimal form of an irrational number (such as $2^{\frac{1}{2}}$) is both non-repeating and infinite
 - Applying the properties of exponents to generate equivalent numerical expressions
 - Determining the value of square roots of small perfect squares (such as $49=7^2$) and cube roots of small perfect cubes (such as $3^3=27$)
 - Graphing proportional relationships and interpreting the unit rate as the slope (how steep or flat a line is)
 - Solving and graphing one- and two-variable linear equations
 - Understanding that a function is a rule that assigns to each value of x exactly one value of y , such as $y=2x$, a rule that would yield such ordered pairs as (-2,-4), (3,6), and (4,8)
 - Comparing the properties of two functions represented in different ways (in a table, graph, equation, or description)
 - Determining congruence (when shapes are of equal size and shape) and similarity (same shape but different sizes)
 - Learning and applying the Pythagorean Theorem (an equation relating the lengths of the sides of a right triangle: $a^2 + b^2 = c^2$)
 - Solving problems involving the volume of cylinders, cones, and spheres
- supporting your child In GRADE eight MATHEMATICS 2.

Partnering with your child's teacher

Don't be afraid to reach out to your child's teacher—you are an important part of your child's education. Ask to see a sample of your child's work or bring a sample with you. Ask the teacher questions like:

- Where is my child excelling? How can I support this success?
- What do you think is giving my child the most trouble? How can I help my child improve in this area?
- What can I do to help my child with upcoming work?

Here are just a few examples of how students will learn about and work with expressions and equations in grade eight.

Grade Seven Mathematics

- Re-write an expression in different forms to show how quantities are related
- Use variables to represent quantities and construct simple equations and inequalities to solve problems
- Solve multi-step word problems involving positive and negative numbers
- Understand that solving an inequality or an equation such as $\frac{1}{4}(x+5) = 21$ means answering the questions, *what number does x have to be to make this statement true?*

Grade Eight Mathematics

- Understand the connections between proportional relationships, lines, and linear equations
- Use linear equations to graph proportional relationships, interpreting the unit rate as the slope of the graph
- Know and apply the properties of integer exponents (positive numbers, negative numbers, or 0) to write equivalent expressions (such as $4^2 \cdot 4^3 = 4^5$)

High School Mathematics

- Solve quadratic equations (equations that include the square of a variable, such as $5x^2 - 3x + 3 = 0$)
- Use the structure of an expression to identify ways to rewrite it. For example, $x^4 - y^4 = (x^2)^2 - (y^2)^2$

"•" is a multiplication symbol students use in grade eight

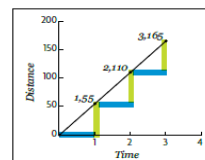
Problem: Two cars are traveling from point A to point B. Their speeds are represented on a graph and in a table. Which car is traveling faster?

Solution: Even though car #1 starts out ahead by 4 miles, students identify the rate of change—or slope—of the equations presented in the table and graph as equal (55 miles per hour), meaning that both cars are travelling at the same speed.

Car # 1
 $y = 55x + 4$

Time (x)	Distance (y)
1	59
2	114
3	169

Car # 2
 $y = 55x$



Here are just a few examples of how an understanding of rates, ratios, and proportions will help students learn about and work with functions in grade eight and high school.

Grade Seven Mathematics

- Analyze proportional relationships and use them to solve real-world problems
- Calculate the unit rates associated with ratios of fractions, such as the ratio of $\frac{1}{2}$ a mile for every $\frac{1}{4}$ of an hour
- Recognize and represent proportional relationships in various ways, including using tables, graphs, and equations
- Identify the unit rate in tables, graphs, equations, and verbal descriptions of proportional relationships

Grade Eight Mathematics

- Understand that a function is a rule that assigns to each input exactly one output, and the graph of a function is the set of ordered pairs consisting of an input and the corresponding output
- Compare the properties of two functions each represented in a different way (for example, in a table, graph, equation, or description)
- Determine the rate of change and initial value of a function based on a description of a proportional relationship or at least two given (x,y) values

High School Mathematics

- Calculate and interpret the average rate of change of a function over a given interval
- Understand and use function notation (for example, $f(x)$ denotes the output of f corresponding to the input x)
- For a function that models a relationship between two quantities, interpret key features of graphs and tables, including intercepts, intervals where the function is increasing or decreasing, relative maximums and minimums, etc.

This table shows the height of a tree, in inches, in the months after it was planted.

Month	Height, in inches
3	51
5	54
9	60
11	63

Given these sets of values, students determine that the rate of change is constant: a tree replanted as a sapling grows 3 inches every 2 months, which is $\frac{3}{2}$ —or 1.5— inches each month. Therefore, students can compute the tree's height when it was replanted by taking its height at month 3 (51 inches) and subtracting 3 months of growth: $51 - \frac{3}{2} \cdot 3 = 51 - 4.5 = 46.5$ inches.

Helping your child on the path to success...

1. Ask your child to do an Internet search to determine how mathematics is used in specific careers. This could lead to a good discussion and allow students to begin thinking about their future aspirations.
2. Have your child use magazines, clip art, and other pictures to find and describe examples of *similar* and *congruent* figures.
3. Using different objects or containers (such as a can of soup or a shoebox), ask your child to estimate surface area and volume, and check the answer together.
4. Encourage your child to stick with it whenever a problem seems difficult. This will help your child see that everyone can learn math.
5. Prompt your child to face challenges positively and to see mathematics as a subject that is important. Avoid statements like “*I wasn’t good at math*” or “*Math is too hard.*”
6. Praise your child when he or she makes an effort, and share in the excitement when he or she solves a problem or understands something for the first time.



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