Department of Education
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Council of the Great City Schools

parent ROADMAP

SUPPORTING YOUR CHILD IN GRADE EIGHT

MATHEMATICS

America's schools are working to provide higher quality instruction than ever before.

The way we taught students in the past simply does not prepare them for the higher demands of college and careers today and in the future. Your school and schools throughout the country are working to improve teaching and learning to ensure that all children will graduate high school with the skills they need to be successful.

In mathematics, this means three major changes. Teachers will concentrate on teaching a more focused set of major math concepts and skills. This will allow students time to master important ideas and skills in a more organized way throughout the year and from one grade to the next. It will also call for teachers to use rich and challenging math content and to engage students in solving real-world problems in order to inspire greater interest in mathematics.

What your child will be learning in grade eight 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 that require them to apply algebraic reasoning as well as 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 $\sqrt{2}$. Activities in these areas will include:

- Understanding that every *rational* number (such as ½, 0.3, 2, or -2) can be written as a decimal, but that the decimal form of an *irrational* number (such as $\sqrt{2}$) 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 $\sqrt{49}$= 7) and cube roots of small perfect cubes (such as $\sqrt[3]{64}$=4)
- 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

A linear equation is an equation such as y = mx + b that makes a straight line when it is graphed. Students learn that the values of **(x,y)** *on the graph are the solutions of the equation, and* **m** *is the slope of the line.*

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	Grade Eight Mathematics	High School 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 ¼ (x+5) = 21 means answering the questions, *what number does x have to be to make this statement true?*	• 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 $4^2 \bullet 4^3 = 4^5$)	• 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

Students interpret and compare linear relationships represented in different ways, making the connection between equations, tables of values, and graphs.

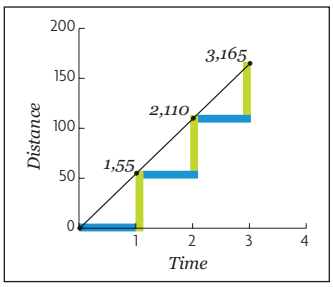
Problem: Two cars are traveling from point A to point B. Their speeds are represented on a graph and in a table. Which car is traveling faster?

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	Grade Eight Mathematics	High School 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 ½ a mile for every ¼ 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	• 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	• 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.

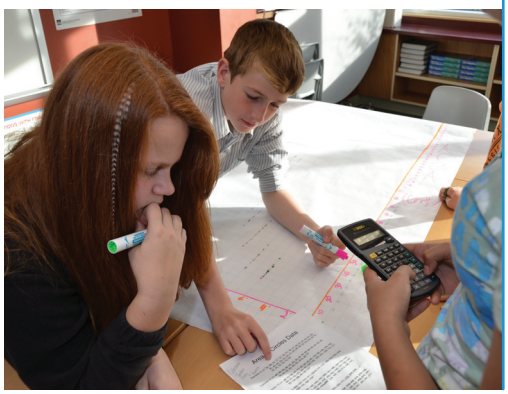
Students apply their understanding of rates and ratios to analyze pairs of inputs and outputs and to identify rates of change and specific values at different intervals.

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 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: $51 - 3/2 \cdot 3 = 51 - 4.5 = 46.5$ inches.

Helping your child learn outside of school



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.

Additional Resources

For more information on the Common Core State Standards for mathematics, go to http://www.corestandards.org/about-the-standards/key-points-in-mathematics or http://www.commoncoreworks.org.

For more information on the standards in mathematics related to ratio and proportion and expressions and equations, go to http://commoncoretools.me/category/progressions/.

For math games and challenges to do at home, go to http://www.figurethis.org/download.htm, www.24game.com, and http://www.kenken.com/play_now.