

# Sixth Grade Math

Here are just a few examples of how students will learn about and work with fractions in grade six.

## Grade Five Mathematics

- Add and subtract fractions with different denominators (bottom numbers)
- Multiply a fraction by a whole number or another fraction
- Divide fractions by whole numbers and whole numbers by fractions to solve word problems

## Grade Six Mathematics

- Divide fractions by fractions using models and equations to represent the problem
- Solve word problems involving division of fractions by fractions

## Grade Seven Mathematics

- Add, subtract, multiply, and divide rational numbers in any form, including whole numbers, fractions, and decimals)
- Solve multi-step problems involving positive and negative rational numbers



Real-world problems give students a context for dividing fractions by fractions.

## Example of a problem involving the division of fractions.

Ann has  $3\frac{1}{2}$  lbs of peanuts for the party. She wants to put them in small bags each containing  $\frac{1}{2}$  lb. How many small bags of peanuts will she have?



Students use their knowledge of fractions to see that there are 7 halves in  $3\frac{1}{2}$  lbs, so there will be 7 bags of peanuts.



Students can also find how many halves are in  $3\frac{1}{2}$  by applying the traditional procedure of dividing  $3\frac{1}{2}$  by  $\frac{1}{2}$ .

$$3\frac{1}{2} \div \frac{1}{2}$$

$$\frac{1}{2} \times \frac{1}{2} = \frac{1}{2} \times 2\frac{1}{2} = 7$$

Here are just a few examples of how students will develop an understanding of ratios and proportions in grade six.

## Grade Five Mathematics

- Explain why a fraction is equal to another fraction
- Interpret multiplication as scaling (resizing)

## Grade Six Mathematics

- Understand the concept of a ratio and use the correct language to describe it
- Understand the concept of a unit rate (the rate per unit, or a ratio with a denominator of 1) and use the correct language to describe it
- Use ratio and rates to solve real-world problems

## 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



Students use diagrams and tables to think through and solve real-world problems involving ratios.

## Example of a problem involving ratios

A slime mixture is made by mixing glue and liquid laundry starch in a ratio of 3 to 2. How much glue and how much starch are needed to make 90 cups of slime?

Glue                      Starch

Parts	Quantities
5 parts	90 cups
1 part	$90 \div 5 = 18$ cups
2 parts	$2 \times 18 = 36$ cups
3 parts	$3 \times 18 = 54$ cups

Using knowledge of ratios and proportions, students see that if each cup of slime is made up of 3 parts glue and 2 parts starch, there are 5 parts in each cup. They can then compute the quantity of one, two, and three parts of 90 cups to determine the exact amounts of glue and starch needed.

1. Ask your child to calculate the unit rates of items purchased from the grocery store. For example, if 2 pounds of flour cost \$3.00, how much does flour cost per pound?
2. Have your child determine the amount of ingredients needed when cooking. For example, if a recipe calls for 8 cups of rice to serve 4 people, how many cups of rice do you need to serve 6 people?
3. Encourage your child to stick with it whenever a problem seems difficult. This will help your child see that everyone can learn math.
4. 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.

# Seventh Grade Math

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

## Grade Six Mathematics

- Write and evaluate numerical expressions involving whole number exponents (such as  $5+3^2$ )
- Read, write, and evaluate expressions in which letters stand for numbers. For example, "subtract  $y$  from 5" can be written  $5-y$
- Understand that solving an inequality or an equation such as  $2+x=12$  means answering the question, "what number does  $x$  have to be to make this statement true?"
- Represent two quantities that change in relationship to one another (for example, weight increasing along with height)

## Grade Seven Mathematics

- Re-write an expression in different forms to show different solutions to a problem or how quantities are related
- Use variables to represent quantities and construct simple equations and inequalities (for example,  $5x + 2 > 10$ ) 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?"

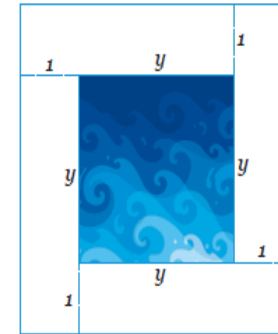
## Grade Eight Mathematics

- Know and apply the properties of integer exponents (positive numbers, negative numbers, or 0) to write equivalent expressions (such as  $4^2 \cdot 4^3 = 4^5$ , where " $\cdot$ " means to multiply)
- Graph proportional relationships, identifying the unit rate as the slope (how steep or flat a line is)
- Solve linear equations (equations that make a straight line when they are graphed, such as  $y=2x+1$ )



Writing the same expression in different ways allows students to think through and solve real-world problems.

Example of a problem involving mathematical expressions



In expressing the number of one foot square tiles needed to border a square pool with a length of  $y$  (where  $y$  represents a whole number), students might write  $4y+1+1+1+1$ ,  $4y + 4$ , or  $4(y + 1)$ . All are different ways to express the same value.

Here are just a few examples of how students will develop an understanding of ratios and proportions in grade seven.

## Grade Six Mathematics

- Understand the concept of a ratio and use the correct language to describe it
- Understand the concept of a unit rate (the rate per unit, or a ratio with a denominator of 1) and use the correct language to describe it
- Use ratio and rates to solve real-world problems

## 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

## Grade Eight Mathematics

- Understand the connections between proportional relationships, lines, and linear equations
- Graph proportional relationships, interpreting the unit rate as the slope of the graph
- Use physical models, transparencies, or other tools to show that similar objects have the same shape but different sizes (for example, a small square magnified into a larger square)



In grade seven, students use diagrams to solve problems involving proportions. Students use diagrams and tables to think through and solve real-world problems involving ratios.

Example of a problem involving proportions

**Problem:** After a 20% discount, the price of a skateboard is \$148. What was the price before the discount?

**Solution:** After a 20% discount, the price is 80% of the original price. So 80% of the original price is \$148. Students use this information to find the value of 20% and 100% of the original price.

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Students will also learn to write and solve the equation representing this situation as  $0.8x = 148$

1. Ask your child to calculate the unit rates of items purchased from the grocery store. For example, if 2 pounds of flour cost \$3.00, how much does flour cost per pound?
2. Use store advertisements to engage your child in working with numbers. For example, if a store advertises 30% off, have your child estimate the dollar amount of the discount, as well as the sale price of an item.
3. Have students use four 4's and any of the four arithmetic operations to write the numbers from 0 to 20 (for example,  $44-44=0$ ;  $4\cdot4-4\cdot4 = 0$ . How do you get 1?  $4/4+4-4=1$ ).
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. 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.

# Eighth Grade Math

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



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

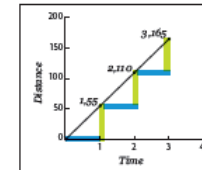
**Problem:** Two cars are traveling from point A to point B. Their speeds are represented on a graph and in a table. Which car is traveling faster?

**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

- 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.



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  $\frac{3}{2}$ —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.

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.”