

# Math

## Common Core State Standards

# 6th Grade

Ratios & proportions, division, integers, expressions & equations, geometry, volume, area, data analysis, probability & more!

### RATIOS & PROPORTIONS

**Ratio:** Compares two numbers by division, expressed in one of three ways: 3 to 2, 3 to 2, or  $\frac{3}{2}$ ; ratios can be shown in different ways:



- **Part to part:** The ratio of white stars to gold stars is  $\frac{2}{3} = \frac{1}{1.5}$
- **Part to whole:** The ratio of white stars to the total number of stars is  $\frac{2}{5} = \frac{1}{2.5}$
- **Whole to whole:** The number of circles to the number of stars is  $\frac{10}{5}$

**Rate:** A ratio comparing two numbers representing different units by division; rates must have labels; unit rate has a denominator of 1;  
EX: 18 miles per gallon

**Percent (%)**: Means "out of 100"; a ratio comparing a number to 100

**Proportions:** Two equal ratios; if two ratios are equal, then their cross products are equal

EX:  $\frac{2}{3} = \frac{4}{6}$ , so  $2 \times 6 = 3 \times 4$ , and  $12 = 12$

#### Percent Ratios

$x$  is what percent of  $y$ ?

Solve using:  $\frac{x}{100} = \frac{y}{100}$

$$\frac{100x}{y} = \frac{x}{100}$$

EX: What is 60% of 90?  $\frac{x}{90} = \frac{60}{100}$

1,000 is what percent of 500?  $\frac{1,000}{500} = \frac{x}{100}$

20 is 75% of what number?  $\frac{20}{x} = \frac{75}{100}$

#### Speed formula:

$$s = \frac{d}{t}, \text{ where: } s = \text{speed (rate)} \\ d = \text{distance} \\ t = \text{time}$$

A car travels at a constant speed of 65 miles per hour.  
How far will the car travel in 3.5 hours?

The car will travel 227.5 miles in 3.5 hours.

#### Equivalent Ratios

Legs	4	8	12	16	20
Feet	1	2	3	4	5
Ratio	1:4	2:8	3:12	4:16	5:20

Minutes	60	120	180	240	300
Hours	1	2	3	4	5
Ratio	1:60	2:120	3:180	4:240	5:300

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Hours	24	48	72	96	120
Days	1	2	3	4	5
Ratio	1:24	2:48	3:72	4:96	5:120

Days	7	14	21	28	35
Weeks	1	2	3	4	5
Ratio	1:7	2:14	3:21	4:28	5:35

Weeks	4.1	8.2	12.3	16.4	20.5
Months	1	2	3	4	5
Ratio	1:4.1	2:8.2	3:12.3	4:16.4	5:20.5

Months	12	24	36	48	60
Years	1	2	3	4	5
Ratio	1:12	2:24	3:36	4:48	5:60

#### Rate Conversions

To change 4 kilometers per minute to kilometers per hour:

$$\frac{4 \text{ km}}{1 \text{ min}} = \frac{60 \text{ min}}{1 \text{ hr}} = 240 \text{ km/hr}$$

To change 120 ounces per square inch to pounds per square foot:

$$\frac{120 \text{ oz}}{1 \text{ in}^2} = \frac{144 \text{ oz}}{1 \text{ ft}^2} = \frac{144}{16} = 9 \text{ lbs} = \frac{144 \text{ oz}}{16 \text{ oz}} = 9 \text{ lbs}$$

EX: Madeline works 60 hours every 3 weeks. At this rate, how many hours will Madeline work in 12 weeks?

First, find the unit rate:

$$\frac{60}{3} = \frac{20}{1}$$

$$20 \times 12 = 240$$

Madeline will work 240 hours in 12 weeks.

Pens are being sold at a price of 3 pens for \$2.70. How much would 10 pens cost?

First, find the unit price:

$$\$2.70 \div 3 = \$0.90$$

$$\$0.90 \times 10 = \$9.00$$

Ten pens would cost \$9.00.

### DIVISION

#### Dividing Fractions

Need common denominator?	No
Use a mixed number?	No, change to improper fraction
Cross cancel?	Yes
Use the reciprocal?	Multiply by the reciprocal
Process	"Keep it, change it, flip it", then use multiplication rules
Reduce (simplify) to lowest terms?	Yes

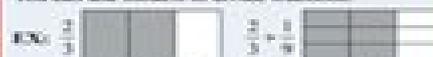
EX:

$$\frac{5}{8} \div \frac{4}{9} = \frac{5}{8} \times \frac{9}{4} = \frac{45}{32} = 1 \frac{13}{32}$$

$$\frac{3}{5} \div \frac{2}{3} = \frac{3}{5} \times \frac{3}{2} = \frac{9}{10}$$

$$\frac{1}{3} \div \frac{7}{8} = \frac{18}{3} \times \frac{8}{7} = \frac{18 \times 8}{3 \times 7} = \frac{2 \times 8}{1 \times 7} = \frac{16}{7} = 2 \frac{2}{7}$$

You can use models to divide fractions:



There are six  $\frac{1}{9}$ 's in  $\frac{2}{3}$ , so  $\frac{2}{3} \div \frac{1}{9} = 6$

Jane is making bows that require  $2 \frac{3}{4}$  feet of ribbon each.

How many bows can Jane make if

she has a spool of ribbon with  $7 \frac{1}{2}$  yards of ribbon on it?

$$\left( \frac{15}{2} \div \frac{11}{4} \right) = \frac{15}{2} \times \frac{4}{11} = \frac{60}{22} = \frac{30}{11} = 2 \frac{8}{11}$$

Jane can make 2 bows and will have  $\frac{8}{11}$  feet of ribbon left over.



#### Dividing Multi-Digit Numbers

• Write the problem in long-division format	$\begin{array}{r} 207 \\ 25 \overline{)5207} \\ \underline{-500} \\ 207 \\ \underline{-200} \\ 7 \\ \underline{-7} \\ 0 \end{array}$
• Use compatible numbers to predict the first digit	
• Multiply	
• Subtract	
• Bring down the next digit, if there is one	
• Repeat the process until the number is too small to divide	
• Record the remainder	$207 \text{ R } 12$ $211 \frac{12}{25}$ $\approx 211.48$

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**Yijin Wang**



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