

6th Grade Mathematics Reference Guide

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Note: Topics 1, 3 - 5 are no calculators. Topics 2, 6 - 14 calculators are allowed.

(Revised July of 2016)

Topic One: Order of Operations

If you read a book from right to left, it is not going to make much sense. If you do math in the wrong order you will get the wrong answer as well. The order of operations tells you what order to do math. Here's the order:

- 1.) Grouping
- 2.) Exponents/Roots
- 3.) Multiplication/Division
- 4.) Addition/Subtraction

Grouping symbols

() Parentheses

[] Brackets

| | Absolute Value

{ } Braces

Fraction

Bar

$\sqrt{\text{Underneath}}$

Examples: $6 \cdot (3+2)$

$$\frac{14 + 42}{7}$$

Exponents and Roots (left to right)

Examples: $2^3 + \sqrt{25}$

$$\sqrt{64} - 4^2$$

Exponent: Tells how many times to use the base as a factor.

Examples: $2^4 = 2 \times 2 \times 2 \times 2 = 16$

$$7^2 = 7 \cdot 7 = 49$$

$$5^3 = 5 \cdot 5 \cdot 5 = 125$$

$$9^1 = 9 = 9$$

Note: Anything to the power of 0, except zero, is equal to 1.

Examples: $4^0 = 1$ $3^0 = 1$ $19^0 = 1$

Root: This is a 7th grade standard so will not be focused on in sixth grade.

Multiply or Divide (left to right)

Examples: $3 \cdot 4 \div 6$

$$12 \div 6 = 2$$

$24 \div 3 \cdot 5$

$$8 \cdot 5 = 40$$

Forms of Multiplication: $3 \cdot 5 = 15$ $2(7) = 14$ $(5)(7) = 35$ $6 * 4 = 24$

Add or Subtract (left to right)

Examples: $13 + 20 - 6$

$$33 - 6 = 27$$

$48 - 18 + 24$

$$30 + 24 = 54$$

Important Notes:

- Each level is completed left to right. For example, if a problem has division, subtraction, addition, multiplication you would do division first, then multiplication, then the subtraction, and finally the addition.
- If there is more than one operation in a level, you would also go left to right. For example, if a problem has exponent #1, subtraction, multiplication, exponent #2 you would do exponent #1, then exponent #2, then multiplication, and finally the subtraction.

Examples:**Directions:** Simplify each expression

- 1.) $(9 - 3) \times 2^2 - 20 \div 5 + 3 =$ Groups are always number 1
- $6 \times 2^2 - 20 \div 5 + 3 =$ Little Miss Exponent must be 2nd
- $6 \times 4 - 20 \div 5 + 3 =$ Mom and Dad: Whoever is on the left
- $24 - 20 \div 5 + 3 =$ will go first
- $24 - 4 + 3 =$ Addison and Sister: Whoever is on the left
- $20 + 3 = 23$ will go first
- 2.) $9 - 1 + (15 \div 3) \times 3^2 =$ (Solve grouping first)
- $9 - 1 + 5 \times 3^2 =$ (Do exponent next)
- $9 - 1 + 5 \times 9 =$ (Multiplication next)
- $9 - 1 + 45 =$ (Subtraction is left of addition so subtraction is next)
- $8 + 45 = 53$ (Finally addition)
- 3.) $(15 - 10)^2 - 3^2 =$ (Solve grouping first)
- $(5)^2 - 3^2 =$ (Solve exponent on the left first)
- $25 - 3^2 =$ (Solve other exponent)
- $25 - 9 = 16$ (Finally subtraction)
- 4.) $5(8 - 4) + 2 =$ (Solve grouping first)
- $5(4) + 2 =$ (Multiplication next)
- $20 + 2 = 22$ (Finally addition)
- 5.) $(16 \div 4) + 4(2^2 - 2) =$ (Solve grouping on the left first)
- $4 + 4(2^2 - 2) =$ (Solving other grouping – since has both exponent and subtraction, do exponent first)
- $4 + 4(4 - 2) =$ (Complete subtraction in other grouping)
- $4 + 4(2) =$ (Multiplication next)
- $4 + 8 = 12$ (Finally addition)

Topic Two: GCF and LCM

Greatest Common Factors (GCF): the greatest whole number that divides evenly into each number of two (or more) whole numbers. The GCF is the largest common factor of two or more given numbers.

Examples:

What is the GCF of 27 and 45?

Factors of 27 = 1, 3, 9, 27

Factors of 45 = 1, 3, 5, 9, 15, 45

They both have 1, 3, and 9 as factors, but 9 is the largest. GCF = 9

What is the GCF of 12 and 36?

Factors of 12 = 1, 2, 3, 4, 6, 12

Factors of 36 = 1, 2, 3, 4, 6, 9, 12, 18, 36

They both have 1, 2, 3, 4, 6, and 12 as factors, but 12 is the largest. GCF = 12

What is the GCF of 15 and 22?

Factors of 15 = 1, 3, 5, 15

Factors of 22 = 1, 2, 11, 22

They both have 1 as the only factor. GCF = 1

Least Common Multiplies (LCM): smallest common (same) multiple of 2 or more numbers.

Examples:

What is the LCM of 4 and 6?

Multiples of 4 = 4, 8, 12, 16, 20, 24

Multiples of 6 = 6, 12, 18, 24, 30

They both have 12 and 24 as multiples, but 12 is the smallest.

LCM = 12

What is the LCM of 6 and 5?

Multiples of 6 = 6, 12, 18, 24, 30, 36

Multiples of 5 = 5, 10, 15, 20, 25, 30, 35

They both have 30 as the first multiple.

LCM = 30

What is the LCM of 7 and 14?

Multiples of 7 = 7, 14, 21, 28, 35, 42

Multiples of 14 = 14, 28, 42, 56, 70

They both have 14 and 28 as multiples, but 14 is the smallest.

LCM = 14

Topic Three: Equivalent Fractions

Equivalent Fractions: different expressions for the same nonzero number.

Example: $\frac{3}{5} = \frac{6}{10} = \frac{15}{25}$

Method of Finding Equivalent Fractions: Multiply or divide the fraction by a fraction equivalent to one. A fraction is equivalent to one if the numerator and denominator are the same number.

Fractions equivalent to 1: $\frac{3}{3} = \frac{10}{10} = \frac{25}{25} = \frac{79}{79}$

Examples of Finding Equivalent Fractions:

1.) $\frac{1}{2} \cdot \frac{2}{2} = \frac{2}{4}$ 2.) $\frac{1}{2} \cdot \frac{3}{3} = \frac{3}{6}$ 3.) $\frac{5}{6} \cdot \frac{5}{5} = \frac{25}{30}$ 4.) $\frac{9}{10} \cdot \frac{10}{10} = \frac{90}{100}$
 5.) $\frac{4}{8} \div \frac{2}{2} = \frac{2}{4}$ 6.) $\frac{34}{42} \div \frac{2}{2} = \frac{17}{21}$ 7.) $\frac{55}{75} \div \frac{5}{5} = \frac{11}{15}$ 8.) $\frac{70}{100} \div \frac{10}{10} = \frac{7}{10}$

Examples of Finding Missing Values of Two Equivalent Fractions:

1.) $\frac{2}{3} = \frac{\quad}{24}$ Think: 3 times what number equals 24? $3 \cdot 8 = 24$ $\frac{2}{3} \cdot \frac{8}{8} = \frac{16}{24}$ Answer = 16
 2.) $\frac{7}{2} = \frac{28}{\quad}$ Think: 7 times what number equals 28? $7 \cdot 4 = 28$ $\frac{7}{2} \cdot \frac{4}{4} = \frac{28}{8}$ Answer = 8
 3.) $\frac{35}{45} = \frac{\quad}{9}$ Think: 45 divided by what number equals 9? $45 \div 5 = 9$ $\frac{35}{45} \div \frac{5}{5} = \frac{7}{9}$ Answer = 7
 4.) $\frac{21}{35} = \frac{3}{\quad}$ Think: 21 divided by what number equals 3? $21 \div 7 = 3$ $\frac{21}{35} \div \frac{7}{7} = \frac{3}{5}$ Answer = 5

Reduced fraction/Simplest form/Lowest Terms: Fraction with no common factors.

Examples: $\frac{1}{2}$ or $\frac{3}{5}$ Non-Examples: $\frac{6}{12}$ or $\frac{9}{15}$

Method of Reducing Fractions: Divide numerator and denominator by same number until only can divide by 1.

Examples of Finding Equivalent Fractions:

1.) $\frac{8}{10} \div \frac{2}{2} = \frac{4}{5}$ 2.) $\frac{4}{16} \div \frac{2}{2} = \frac{2}{8} \div \frac{2}{2} = \frac{1}{4}$ or $\frac{4}{16} \div \frac{4}{4} = \frac{1}{4}$ 3.) $\frac{12}{20} \div \frac{4}{4} = \frac{3}{5}$

More Examples of Finding Equivalent Fractions:

$$4.) \frac{14}{21} \div \frac{7}{7} = \frac{2}{3} \quad 5.) \frac{12}{28} \div \frac{2}{2} = \frac{6}{14} \div \frac{2}{2} = \frac{3}{7} \quad \text{or} \quad \frac{12}{28} \div \frac{4}{4} = \frac{3}{7} \quad 6.) \frac{5}{16} \div \frac{1}{1} = \frac{5}{16}$$

Common Denominators: A denominator that is the same in two or more fractions.

Examples: $\frac{5}{8}$ and $\frac{2}{8}$ (both have common denominator of 8)

Method of Finding Common Denominators:

- 1.) Find the LCM of the denominators (See Topic 2).
- 2.) Multiply to make equivalent fractions.

Examples of Finding Common Denominators:

1.) $\frac{5}{8}$ and $\frac{3}{4}$ 1.) LCM is 8. [8 = 8, 16, 24, ... 4 = 4, 8, 12, ...]

2.) $\frac{5}{8} = \frac{5}{8}$ (Multiply by 1/1) Numerator will be 5.

$\frac{3}{4} = \frac{6}{8}$ (Multiply by 2/2) Numerator will be 6.

Answer: $\frac{5}{8}$ and $\frac{6}{8}$

2.) $\frac{4}{5}$ and $\frac{5}{6}$ 1.) LCM is 30. [5 = 5, 10, 15, 20, 25, 30, ... 6 = 6, 12, 18, 24, 30 ...]

2.) $\frac{4}{5} = \frac{24}{30}$ (Multiply by 6/6) Numerator will be 24.

$\frac{5}{6} = \frac{25}{30}$ (Multiply by 5/5) Numerator will be 25.

Answer: $\frac{24}{30}$ and $\frac{25}{30}$

3.) $\frac{5}{6}$ and $\frac{3}{4}$ 1.) LCM is 12. [6 = 6, 12, 18, ... 4 = 4, 8, 12, ...]

2.) $\frac{5}{6} = \frac{10}{12}$ (Multiply by 2/2) Numerator will be 10.

$\frac{3}{4} = \frac{9}{12}$ (Multiply by 3/3) Numerator will be 9.

Answer: $\frac{10}{12}$ and $\frac{9}{12}$

Topic Four: Multiplying/Dividing Fractions

Proper Fraction: A fraction in which the numerator is less than the denominator.

Examples: $\frac{3}{4}$ $\frac{1}{12}$ $\frac{7}{8}$

Improper Fraction: A fraction in which the numerator is greater than or equal to the denominator.

Examples: $\frac{4}{3}$ $\frac{17}{5}$ $\frac{9}{9}$

Mixed Number: A number made up of a whole number and a fraction.

Examples: $2\frac{2}{5}$ $6\frac{4}{5}$

How to change an improper fraction to a mixed number:

- 1.) Divide the numerator by the denominator.
- 2.) The divisor is the whole number.
- 3.) The remainder is the numerator.
- 4.) The denominator stays the same.

Examples: 1.) $\frac{7}{2}$ $2\overline{)7}$ $3\frac{1}{2}$ 2.) $\frac{8}{5}$ $5\overline{)8}$ $1\frac{3}{5}$

$$\begin{array}{r} 3 \\ 2 \overline{)7} \\ \underline{-6} \\ 1 \end{array}$$

$$\begin{array}{r} 1 \\ 5 \overline{)8} \\ \underline{-5} \\ 3 \end{array}$$

How to change a mixed number to an improper fraction:

- 1.) Multiply the whole number and denominator and add to the numerator to give you the new numerator.
- 2.) The denominator stays the same.

Examples: 1.) $3\frac{1}{2}$ $3 \times 2 + 1 = 7$ $\frac{7}{2}$ 2.) $2\frac{3}{4}$ $2 \times 4 + 3 = 9$ $\frac{9}{4}$

Steps for Multiplying Fractions:

Step 1: Multiply numerators
 Step 2: Multiply denominators Or
 Step 3: Simplify as needed
 Simplify means Proper Reduced Fraction

Step 1: Simplify by cross cancelling
 Step 2: Multiply numerators
 Step 3: Multiply denominators
 Step 4: Simplify if needed

Examples of Multiplying Fractions:

1.) $\frac{4}{5} \cdot \frac{5}{8} = \frac{20}{40} \div \frac{20}{20} = \frac{1}{2}$ or $\frac{\cancel{4}^1}{5} \cdot \frac{\cancel{5}_1}{8} = \frac{1}{1} \cdot \frac{1}{2} = \frac{1}{2}$

2.) $\frac{2}{7} \cdot \frac{1}{4} = \frac{2}{28} \div \frac{2}{2} = \frac{1}{14}$ or $\frac{\cancel{2}^1}{7} \cdot \frac{1}{\cancel{4}_2} = \frac{1}{7} \cdot \frac{1}{2} = \frac{1}{14}$

Steps for Multiplying Fractions by a Whole Number:

Step 1: Put a 1 under the whole number.

Step 2: Follow the steps for multiplying fractions.

Example of Multiplying Fractions by a Whole Number:

$$1.) \frac{3}{4} \cdot 6 = \frac{3}{4} \cdot \frac{6}{1} = \frac{18}{4} \div \frac{2}{2} = \frac{9}{2} = 4\frac{1}{2}$$

Steps for Multiplying Mixed Numbers:

Step 1: Turn mixed numbers into an improper fraction first! (THIS IS A MUST)

Step 2: Follow the steps for multiplying fractions.

Examples of Multiplying Mixed Numbers:

$$1.) 3\frac{3}{5} \cdot 1\frac{1}{12} = \frac{18}{5} \cdot \frac{13}{12} = \frac{234}{60} \div \frac{6}{6} = \frac{39}{10} = 3\frac{9}{10}$$

$$2.) 1\frac{2}{3} \cdot 4\frac{1}{2} = \frac{5}{3} \cdot \frac{9}{2} = \frac{45}{6} \div \frac{3}{3} = \frac{15}{2} = 7\frac{1}{2}$$

Reciprocal: A value by which one multiplies to get one.Examples: the reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$ the reciprocal of 12 is $\frac{1}{12}$ **Steps for Dividing Fractions:**

Step 1: Change division to multiplication.

Step 2: Find the reciprocal of the **second** fraction.

Step 3: Use the multiplication fractions steps.

Examples of Dividing Fractions:

$$1.) \frac{3}{4} \div \frac{4}{9} = \frac{3}{4} \cdot \frac{9}{4} = \frac{27}{16} = 1\frac{11}{16}$$

$$3.) 8 \div \frac{2}{3} = \frac{8}{1} \cdot \frac{3}{2} = \frac{24}{2} = 12$$

$$2.) \frac{2}{7} \div \frac{1}{5} = \frac{2}{7} \cdot \frac{5}{1} = \frac{10}{7} = 1\frac{3}{7}$$

$$4.) \frac{3}{5} \div 4 = \frac{3}{5} \div \frac{4}{1} = \frac{3}{5} \cdot \frac{1}{4} = \frac{3}{20}$$

Steps for Dividing Mixed Numbers:

Step 1: Turned mixed numbers into an improper fraction first! (THIS IS A MUST)

Step 2: Follow the steps for dividing fractions.

Examples of Dividing Mixed Numbers:

$$1.) 1\frac{1}{2} \div 1\frac{2}{3} = \frac{3}{2} \div \frac{5}{3} = \frac{3}{2} \cdot \frac{3}{5} = \frac{9}{10}$$

$$2.) 5 \div 3\frac{1}{2} = \frac{5}{1} \div \frac{7}{2} = \frac{5}{1} \cdot \frac{2}{7} = \frac{10}{7} = 1\frac{3}{7}$$

Topic Five: Multiplying/Dividing Decimals

Steps for Multiplying Decimals:

Step 1: Ignore the decimal point and multiply the two numbers.

Step 2: Put the decimal back by choosing one of two methods:

Method 1: Estimate by rounding to whole numbers. Place decimal for closest answer.

Method 2: Count how many decimal places are behind each decimal point for the two numbers multiplied. The answer will have as many decimal places as the two original numbers combined.

Examples of Multiplying Decimals:

1.) $21.8 \cdot 7 =$

Step 1: $218 \times 7 = 1526$ Step 2: Method 1: $22 \times 7 = 154$ so answer is 152.6

$$\begin{array}{r} 218 \\ \times 7 \\ \hline 1526 \end{array}$$

Method 2: 21.8 (1 number after decimal)

7 (0 numbers after decimal)

Total is 1 number after decimal so answer is 152.6

2.) $82.4 \cdot 0.75 =$

Step 1: $824 \times 75 = 61800$ Step 2: Method 1: $82 \times 1 = 82$ so answer is 61.800 or 61.8

$$\begin{array}{r} 824 \\ \times 75 \\ \hline 4120 \\ + 57680 \\ \hline 61800 \end{array}$$

Method 2: 82.4 (1 number after decimal)

0.75 (2 numbers after decimal)

Total is 3 numbers after decimal so answer is 61.800 or 61.8

Review from 5th grade of Steps for Dividing Whole Numbers:

(Think of a family with Dad, Mom, Sister, and Brother)

Step 1: (Dad) Divide

Step 2: (Mom) Multiply

Step 3: (Sister) Subtract

Step 4: (Brother) Bring Down

Keep repeating Steps 1 through 4 until reach zero and no more numbers

Repeat

Divide	Multiply	Subtract	Bring down
$7 \overline{)6027}$ $\underline{-56}$ 42	$7 \overline{)6027}$ $\underline{-56}$ 42 42	$7 \overline{)6027}$ $\underline{-56}$ 42 $\underline{-42}$ 0	$7 \overline{)6027}$ $\underline{-56}$ 42 $\underline{-42}$ 07

Then repeat again

Divide	Multiply
$7 \overline{)6027}$ $\underline{-56}$ 42 $\underline{-42}$ 07	$7 \overline{)6027}$ $\underline{-56}$ 42 $\underline{-42}$ 07 7

Subtract	Bring down
$7 \overline{)6027}$ $\underline{-56}$ 42 $\underline{-42}$ 07	$7 \overline{)6027}$ $\underline{-56}$ 42 $\underline{-42}$ 07 $\underline{-7}$ 0

There's nothing to bring down!
We are done!

Divide	Multiply
$7 \overline{)6027}$ $\underline{-56}$ 42	$7 \overline{)6027}$ $\underline{-56}$ 42 42
$7 \overline{)6027}$ $\underline{-56}$ 42 $\underline{-42}$ 07	$7 \overline{)6027}$ $\underline{-56}$ 42 $\underline{-42}$ 07

Dealing with Remainders:

Option 1: Write remainder as a fraction (mixed number)

Option 2: Write remainder as a decimal.

$$\begin{array}{r} \text{Option 1} \\ 5 \overline{)312} \\ \underline{-30} \\ 12 \\ \underline{-10} \\ 2 \end{array}$$

$$\begin{array}{r} \text{Option 2} \\ 5 \overline{)312.4} \\ \underline{-30} \\ 12 \\ \underline{-10} \\ 20 \\ \underline{-20} \\ 0 \end{array}$$

Steps for Dividing Decimals:

Step 1: Just move the decimal point straight up.

Step 2: Divide same way as dividing whole numbers.

Examples of Dividing Decimals:

1.) $6.4 \div 8 =$

$$\begin{array}{r} 0.8 \\ 8 \overline{)6.4} \\ \underline{-6.4} \\ 0 \end{array}$$

2.) $1.64 \div 2 =$

$$\begin{array}{r} 0.82 \\ 2 \overline{)1.64} \\ \underline{-1.6} \\ 04 \\ \underline{-4} \\ 0 \end{array}$$

3.) $0.135 \div 5 =$

$$\begin{array}{r} 0.027 \\ 5 \overline{)0.135} \\ \underline{-10} \\ 35 \\ \underline{-35} \\ 0 \end{array}$$

Steps for Dividing Decimals by Decimals:

Step 1: Multiply BOTH divisor and dividend by a multiple of 10 so that the divisor becomes a whole number.

Step 2: Just move the decimal point straight up.

Step 3: Divide same way as dividing whole numbers.

$$24 \div 4 = 6$$

Quotient

$$\begin{array}{r} 6 \\ 4 \overline{)24} \end{array}$$

Divisor

Dividend

$12 = 12.0 = 12.000$

Examples of Dividing Decimals by Decimals:

1.) $4.32 \div 3.6$

$4.32 \div 3.6 = 43.2 \div 36$

$$\begin{array}{r} \times 10 \quad 1.2 \quad \times 10 \\ 36 \overline{)43.2} \\ \underline{-36} \\ 72 \\ \underline{-72} \\ 0 \end{array}$$

2.) $16 \div 0.05 =$

$\times 100 \quad \times 100$

$1600 \div 5 =$

$$\begin{array}{r} 320 \\ 5 \overline{)1600} \\ \underline{-15} \\ 10 \\ \underline{-10} \\ 00 \\ \underline{-0} \\ 0 \end{array}$$

Topic Six: Decimal/Fraction Word Problems

The Problem Solving Process:

Step 1: Read the problem.

Step 2: Read the problem again, highlighting or underlining important information.

Step 3: Write an expression and solve.

Step 4: Check if makes sense.

Examples of Solving Problems:

1.) A restaurant leased its banquet hall for an event that was attended by 67 people. The cost was \$18.50 per person. What was the total cost of the event?

Step 1: Read the problem two or more times.

Step 2: \$18.50 per person. What was the total cost of the event?

Step 3: The total cost equals the cost per person times the number of people, so

$$\text{Cost per person} \cdot \text{number of people} = 18.50 \cdot 67 = 1239.5$$

Step 4: Cost is dollars. \$1239.5 does NOT make sense. \$1,239.50 would make sense.

Answer: The total cost of the event is \$1,239.50.

2.) Racquel eats $\frac{1}{5}$ of a bag of jellybeans that have 30 jelly beans. How many jellybeans did she eat?

Step 2: $\frac{1}{5}$ of a bag How many jellybeans did she eat?

Step 3: $\frac{1}{5}$ of 30 jellybeans equals jellybeans eaten $\frac{1}{5} \cdot 30 = 6$

Step 4: 6 out of 30 is $\frac{1}{5}$ of the bag so the answer is reasonable.

Answer: She ate 6 jellybeans.

3.) The front cover of your math book measures $8\frac{1}{2}$ inches by $11\frac{3}{4}$ inches. What is the area of the front cover?

Step 2: What is the area

$$\text{Step 3: area} = \text{base} \cdot \text{height} \quad 8\frac{1}{2} \cdot 11\frac{3}{4} = \frac{17}{2} \cdot \frac{47}{4} = \frac{799}{8} = 99\frac{7}{8}$$

Step 4: $8 \cdot 12 = 96$ so answer is reasonable.

Answer: The area is $99\frac{7}{8}$ square inches.

4.) A plumber needs pieces of pipe $2\frac{4}{5}$ feet long. How many of those pieces can be cut from a pipe that is $9\frac{4}{5}$ feet long?

Step 2: How many of those pieces can be cut from a pipe

$$\text{Step 3: } 9\frac{4}{5} \text{ cut into pieces } 2\frac{4}{5} \text{ long} = 9\frac{4}{5} \div 2\frac{4}{5} = \frac{49}{5} \div \frac{14}{5} = \frac{49}{5} \cdot \frac{5}{14} = \frac{245}{70} = \frac{7}{2} = 3\frac{1}{2}$$

Step 4: Yes answer is reasonable.

Answer: $3\frac{1}{2}$ pieces can be cut from the pipe.

Topic Seven: Percents

How to change a decimal into a fraction:

Step 1: Say the number correctly.

Step 2: Write it down.

Step 3: Reduce!

Thousands	Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths	Ten Thousandths	Hundred Thousandths	Millionths
	1	2	7	.	5	3	6	0		

↑
Decimal
point

Examples of Converting Decimals to Fractions:

$$1.) 0.018 = \frac{18}{1000} = \frac{\div 2}{\div 2} = \frac{9}{500}$$

$$2.) 0.28 = \frac{28}{100} = \frac{\div 4}{\div 4} = \frac{7}{25}$$

$$3.) 1.4 = 1\frac{4}{10} = \frac{\div 2}{\div 2} = 1\frac{2}{5}$$

How to change a fraction into a decimal:

Step 1: Divide the numerator by the denominator.

Examples of Converting Fractions to Decimals:

$$1.) \frac{1}{4} \rightarrow 1 \div 4 = 0.25$$

$$2.) \frac{2}{3} \rightarrow 2 \div 3 = 0.\bar{6}$$

$$3.) 7\frac{1}{2} = \frac{15}{2} \rightarrow 15 \div 2 = 7.5$$

How to change a percent into a fraction:

Step 1: Put the percent over 100.

Step 2: Reduce!

Examples of Converting Percents to Fractions:

$$1.) 36\% = \frac{36}{100} = \frac{9}{25}$$

$$2.) 25\% = \frac{25}{100} = \frac{1}{4}$$

$$3.) 8\% = \frac{8}{100} = \frac{2}{25}$$

How to change a percent into a decimal:

Step 1: Divide by 100.

Examples of Converting Percents to Decimals:

$$1.) 36\% = 36 \div 100 = 0.36 \quad 2.) 4.5\% = 4.5 \div 100 = 0.045 \quad 3.) 120\% = 120 \div 100 = 1.2$$

How to change a decimal into a percent:

Step 1: Multiply by 100.

Examples of Converting Decimals to Percents:

$$1.) 0.36 = 36 \times 100 = 36\% \quad 2.) 0.034 = 0.034 \times 100 = 3.4\% \quad 3.) 3.4 = 3.4 \times 100 = 340\%$$

How to change a fraction into a percent:

Step 1: Divide numerator by denominator.

Step 2: Multiply by 100.

Examples of Converting Fractions into Percents:

1.) $\frac{5}{8} = 0.625 \times 100 = 62.5\%$

$(5 \div 8)$

3.) $1\frac{1}{4} = \frac{5}{4} = 1.25 \times 100 = 125\%$

$(5 \div 4)$

2.) $\frac{1}{3} = 0.\bar{3} \times 100 = 33.\bar{3}\%$

$(1 \div 3)$

4.) $4\frac{7}{9} = \frac{43}{9} = 4.\bar{7} \times 100 = 477.\bar{7}\%$

$(43 \div 9)$

How to Find a Percent of a Number:

Step 1: Change the percent to a decimal.

Step 2: Write an equation. [Percent = %, of = multiply, is = equals]

Examples of Finding the Percent of a Number:

1.) What is 8% of 50?

$? = 0.08 \times 50$

$? = 4$

2.) What is 35% of 60?

$? = 0.35 \times 60$

$? = 21$

3.) What is 22% of 132?

$? = 0.22 \times 132$

$? = 29.04$

4.) 67% of a person's weight is water. A 6th grade boy weighs 90 pounds. How much of his weight is water?

$? = 0.67 \times 90$

$? = 60.3$

60.3 pounds is water for the 6th grade boy.5.) There are 300 6th graders at Washington. 93% were at school Monday. How many students attended school?

$? = 0.93 \times 300$

$? = 279$

279 students attended school on Monday.

How to Find a Percent Increase/Decrease:

Step 1: Find the amount increased or decreased.

Step 2: Add or subtract the amount increased or decreased.

Examples of Finding Percent Increase/Decrease:

1.) Shalaya bought a book at Barnes and Nobles for \$25. The city tax rate is 6.5%.

a.) What does she owe in tax?

$? = 0.065 \times 25$

$? = 1.625$

She will owe \$1.63 in tax.

b.) What is her total amount with tax?

$25 + 1.63 = 26.63$

Her total amount is \$26.63.

2.) Ms. Adams was getting \$50 an hour. But since she was having to work so hard, she was going to get a 10% raise?

a.) How much more will she earn per hour?

$$? = 0.10 \times 50$$

$$? = 5$$

She will earn \$5 more per hour.

b.) What is her new hourly wage?

$$50 + 5 = 55$$

Her new hourly wage is \$55 per hour.

3.) Ashley wanted to buy a TV for \$150. It is on sale for 20% off.

a.) How much money will Ashley save?

$$? = 0.20 \times 150$$

$$? = 30$$

She will save \$30.

b.) How much money will Ashley pay for the TV?

$$150 - 30 = 120$$

Ashley will pay \$120 for the TV.

Tips for Solving Word Problems

- 1.) Read the problem 2 or more times.
- 2.) Highlight or underline what the question is asking.
- 3.) Solve the problem.
- 4.) Ask yourself, "Does this make sense?"

Examples of Other Word Problems

- 1.) There are 250 movies in a store. Of all the movies, 30% are action, $\frac{2}{5}$ are comedies, 0.15 are dramas and the rest are science fiction. What percent of the movies are science fiction?

Change all to percents: Action = 30%

Comedies = $\frac{2}{5} = 0.4 = 40\%$

Dramas = $0.15 = 15\%$

Science Fiction = Rest

Add known portions: $30\% + 40\% + 15\% = 85\%$

Subtract from total amount of 100%: $100\% - 85\% = 15\%$

Answer: The percent of movies that are science fiction is 15%.

- 2.) Of 60 people, 45 are right handed. What percent of the people are right-handed?

Write part out of whole as a fraction: $\frac{45}{60}$

Change to decimal: 0.75, then change to a percent = 75%

Answer: 75% of the people are right handed.

- 3.) Of 40 pets, 18 of them are cats. What percent of the pets are cats?

Write part out of whole as a fraction: $\frac{18}{40}$

Change to decimal: 0.45

Change to percent: 45%

Answer: 45% of the pets are cats.

Topic Eight: Ratios/Rates

Ratio: A comparison of two quantities.

Example: Ratio of girls to boys is 6 to 8.

Forms of Writing Ratios:

- 1.) 3:2
- 2.) 3 to 2 (All are pronounced 3 to 2)
- 3.) $\frac{3}{2}$

Examples of Finding Ratios:

- 1.) A basket of fruit contains 6 apples, 4 bananas, and 3 oranges. What is the ratio of bananas to apples?

Answer: 4 to 6 OR 4:6 OR $\frac{4}{6}$

- 2.) A basket of fruit contains 6 apples, 4 bananas, and 3 oranges. What is the ratio of oranges to fruit?

Total fruit: $6 + 4 + 3 = 13$

Answer: 3 to 13 OR 3:13 OR $\frac{3}{13}$

Reducing Ratio: Reduce ratios in same method as reducing fractions, except do not turn into whole numbers or mixed numbers since a ratio must compare two things.

Examples of Reducing Ratios:

Write the following ratios in reduced form.

1.) $\frac{14}{7} \div \frac{7}{7} = \frac{2}{1}$

2.) 10 to 20

3.) $16:6 \div 2 = 8:3$

$\div 10 = 1 \text{ to } 2$

Rate: A comparison of two quantities that have different units.

Example: 100 yards in 18 seconds

Unit: One

Unit Rate: A rate in which the second quantity is 1.

Example: 55 miles per hour

Examples of Finding Unit Rates:

- 1.) A worker at Target earned \$32 in 4 hours. How much money did they earn per hour?

"Per" means to divide

$32 \div 4 = 8$

The worker earned \$8 per hour.

2.) Taco Bell sells 3 tacos for \$2.58. You're not very hungry and only care to buy 1 taco. How much should you be charged?

$$2.58 \div 3 = 0.86$$

You should be charged \$0.86.

3.) If Peterson could run 336 feet in 8 seconds, what would be his unit rate?

$$336 \div 8 = 42$$

His unit rate is 42 feet per second.

Examples of Solving Other Ratio and Unit Rates Problems:

1.) A bag of chips is 25% fat. A bag of crackers is $\frac{1}{6}$ fat. Which snack has a higher percentage of fat?

Step 1: Change both to percents

Chips: 25%

$$\text{Crackers: } \frac{1}{6} = 0.1\bar{6} = 16.\bar{6}\%$$

Step 2: Answer question of which is higher (greater/bigger)

25% is larger than 16%

Answer: The bag of crackers has a higher percentage.

2.) Martha can read 250 pages in 50 minutes.

a.) How much could she read in one minute?

Step 1: Find the unit rate.

$$250 \div 50 = 5$$

Answer: She could read 5 pages in one minute.

b.) How much could she read in 100 minutes?

Step 2: Use answer from step 1 to multiply unit rate by the 100 minutes.

$$5 \times 100 = 500$$

Answer: She could read 500 pages in 100 minutes.

3.) It costs \$2.88 for 3 boxes of pencils. How much would it cost for 11 boxes of pencils?

Step 1: Find the unit rate.

$$2.88 \div 3 = 0.96$$

Step 2: Use answer from step 1 to multiply unit rate by the 11 boxes of pencils.

$$0.96 \times 11 = 10.56$$

Answer: It would cost \$10.56 for 11 boxes of pencils.

4.) There are 4 dogs, 3 cats, and 7 fish. Write a fraction, reduced fraction, and percent that represent the number of fish out of all pets.

To find all pets: $4 + 3 + 7 = 14$

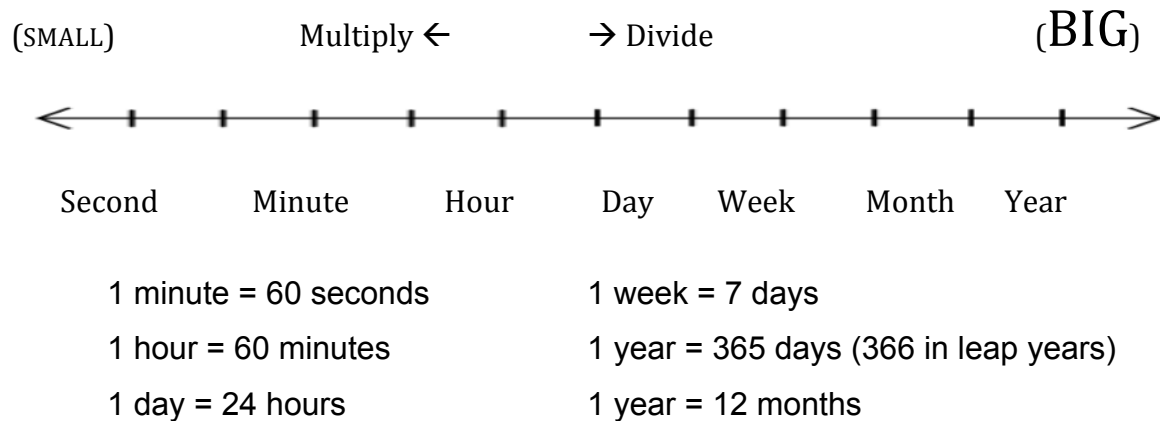
Fraction: $\frac{7}{14}$

Reduced Fraction: $\frac{7}{14} \div \frac{7}{7} = \frac{1}{2}$

Percent: $\frac{1}{2} = 0.5 = 50\%$

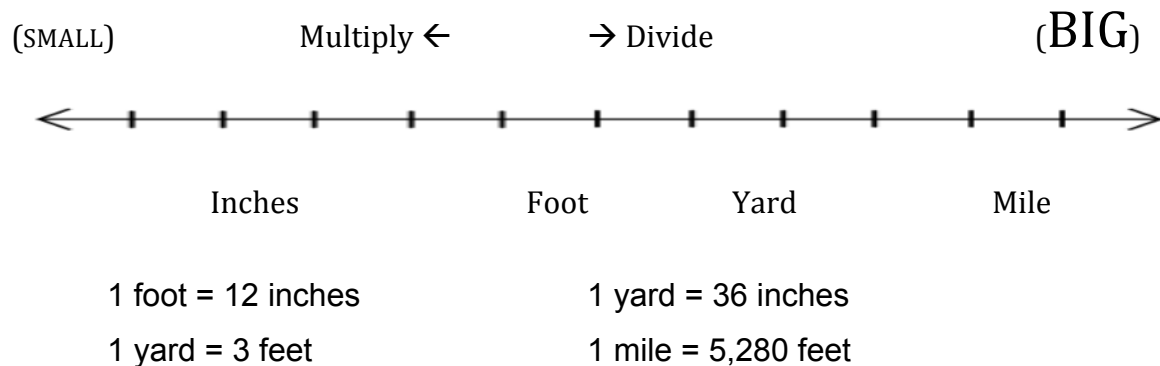
Topic Nine: Conversions

Time Conversions Notes

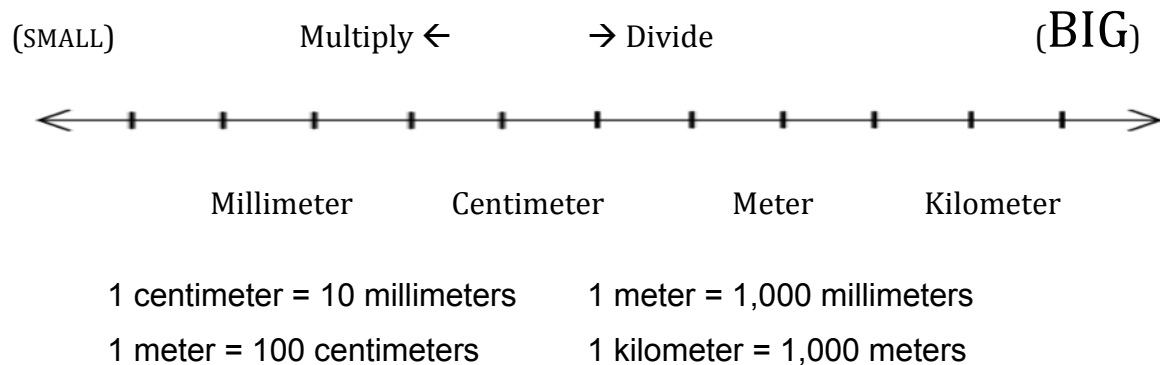


Distance Conversion Notes

Customary

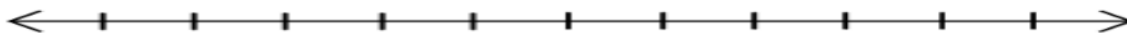


Metric



Weight Conversion Notes**Customary**

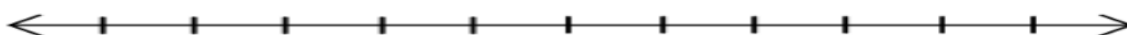
(SMALL) Multiply ← → Divide (BIG)



Ounce Pound Ton
 1 pound (lb) = 16 ounces (oz) 1 ton (T) = 2,000 pounds (lbs)

Metric

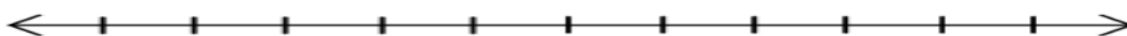
(SMALL) Multiply ← → Divide (BIG)



Milligram Gram Kilogram Metric Ton
 1 gram (g) = 1,000 milligrams (mg)
 1 kilogram (kg) = 1,000 grams (g)
 1 metric ton (mT) = 1,000 kilograms (kg)

Capacity Conversion Notes**Customary**

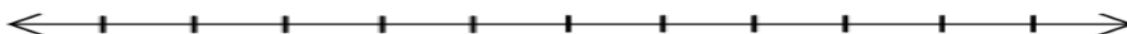
(SMALL) Multiply ← → Divide (BIG)



Fluid Ounce Cup Pint Quart Gallon
 1 cup (c) = 8 fluid ounces (fl oz) 1 quart (qt) = 2 pints (pt)
 1 pint (pt) = 2 cups (c) 1 gallon (gal) = 4 quarts

Metric

(SMALL) Multiply ← → Divide (BIG)



Milliliter Deciliter Liter Kiloliter
 1 deciliter (dL) = 100 milliliters (mL) 1 kiloliter (kL) = 1,000 liters
 1 liter (L) = 1,000 milliliters

To Solve Conversion Problems

Method 1: Set up two equivalent fractions.

Unit #1 Conversion = Variable

Unit #2 Conversion Information From Problem

Example 1: A box weighs 5 pounds. How many ounces does the box weight?

Unit 1: pounds Unit 2: ounces Conversion: 1 pound = 16 ounces

$$\begin{array}{l} \text{Pounds} \\ \text{Ounces} \end{array} \frac{1}{16} = \frac{5}{x} \quad (\text{Multiply top and bottom by 5}) \quad x = 80$$

The box weighs 80 ounces.

Example 2: There are 150 milliliters in a bathtub. How many liters are in the bathtub?

Unit 1: Liters Unit 2: Milliliters Conversion: 1 liter = 1,000 milliliters

$$\begin{array}{l} L \\ ML \end{array} \frac{1}{1,000} = \frac{x}{150} \quad (\text{Divide 150 by 1,000 to determine what bottom was multiplied by}) \quad x = 0.15$$

There are 0.15 liters in the bathtub.

Method 2: Use multiplication or division to solve the conversion. If you are converting to a smaller unit then multiply by the known conversion. If you are converting to a larger unit then divide by the known conversion.

Example 1: Demarco swam 150 yards in gym. How many feet did he swim?

We are going from yards to feet (big to small) so multiply. Conversion: 1 yd = 3 ft

$$150 \cdot 3 = 450 \quad \text{He swam 450 feet.}$$

Example 2: A movie is 270 minutes long. How many hours is that movie?

We are going from minutes to hours (small to big) so divide.

Conversion: 1 hour = 60 minutes.

$$270 \div 60 = 4.5 \quad \text{The movie is 4.5 hours long.}$$

Other Conversion Examples:

1.) Kobe went to basketball practice for 2 hours 34 minutes. How many seconds was he at basketball practice?

1 hour = 60 minutes so 2 hours = 120 minutes

Then add the 34 minutes: $120 + 34 = 154$ minutes

Then change 154 minutes to seconds (by multiplying by 60) = 9240

Answer: He was at basketball practice for 9,240 seconds.

2.) There are 20 fluid ounces in a bottle of Gatorade. How many cups are in 5 bottles of Gatorade?

Fluid ounces \rightarrow Cups (Small to Big = Divide) 1 cup = 8 fluid ounces

$20 \div 8 = 2.5$ There are 2.5 cups in 1 bottle, but we need to know for 5 bottles.

$2.5 \cdot 5 = 12.5$ There are 12.5 cups in 5 bottles of Gatorade.

Topic Ten: Equations

Variable: A letter that represents a value that can change or vary.

Examples: m A n x

Algebraic Expression: A number sentence with at least one variable but no equal signs.

Examples: $6x$ $7y - 8$ $g + 4$

Substitute: To replace a variable with a number (TRADE).

Example: $3g + 4$

$3 \cdot g + 4$ (letter out, number in)

$3 \cdot 2 + 4$

Evaluating Algebraic Expressions:

Step 1: Look for hidden multiplication.

Step 2: Substitute (Letters out, numbers in)

Step 3: Evaluate/Solve (USE Order of Operations)

Examples of Evaluating Algebraic Expressions:

1.) Evaluate $5y + 10$ for $y = 4$

Step 1: $5 \cdot y + 10$

Step 2: $5 \cdot 4 + 10$

Step 3: $20 + 10$

Answer: 30

2.) Evaluate $3(s - t)$ for $t = 2$ and $s = 10$

Step 1: $3 \cdot (s - t)$

Step 2: $3 \cdot (10 - 2)$

Step 3: $3 \cdot (8)$

Answer: 24

KEY MATH WORDS

Addition: increased by, more than, combined together, total of, sum, added to, gain, raise

Subtraction: decreased by, minus, less, loss, difference, between, less than, fewer than, take away

Multiplication: of, times, multiplied by, product of, double, twice, triple

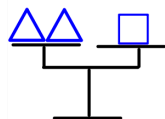
Division: per, a, out of, ratio of, quotient of, percent (divide by 100), divided equally

Equals: is, are, was, were, will be, gives, yields, sold for, result

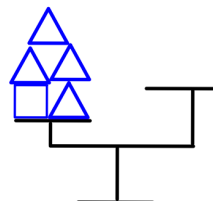
Equal Sign: = (Means balance and how both sides will have the same amount)

Example Problem

Balanced Scale



How many **squares** are needed to balance this scale?



Answer:
3 squares

Methods for Solving Equations

Guess and Test: Keep guessing until guess correctly.

Example: $10 + n = 12 + 9$

Guess $n = 5$ $10 + 5 = 12 + 9$

$15 \neq 21$

Guess $n = 10$ $10 + 10 = 12 + 9$

$20 \neq 21$ (But closer)

Guess $n = 11$ $10 + 11 = 12 + 9$

$21 = 21$

Answer: $n = 11$

Cover Up Method: Use finger to cover up variable,

Example: $10 + n = 12 + 9$

$10 + n = 21$ (Think what must go where n is to make this true?)

$10 + 11 = 21$

Answer: $n = 11$

Unwind: Work backwards.

Example: $10 + n = 12 + 9$

$12 + 9 = 21$

$21 - 10 = 11$

Answer: $n = 11$

Algebraic Method: Make changes to both sides of equation, keeping equation equal at all times.

Example: $10 + n = 12 + 9$

$10 + n = 21$

$\frac{-10 \quad -10}{}$

$0 + n = 11$

Answer: $n = 11$

Important note: No matter what method you use, the most important things to do is check your work.

Example: $10 + n = 12 + 9$ Think answer $n = 11$

Check: $10 + 11 = 12 + 9$

$21 = 21$

True so answer is indeed $n = 11$.

Another example: $g + 24 = g + g + g + 4$

$\frac{-g \quad -g}{}$

$0 + 24 = 0 + g + g + 4$

$24 = g + g + 4$

$\frac{-4 \quad -4}{}$

$20 = g + g + 0$

$20 = g + g$

Since $10 + 10 = 20$, $g = 10$

Check: $g + 24 = g + g + g + 4$ for $g = 10$

$10 + 24 = 10 + 10 + 10 + 4$

$34 = 34$

So answer is $g = 10$

Inverse Operation: Operations that undo each other.

Example: Addition and subtraction are inverse operations.

Multiplication and division are inverse operations.

Solving One Step Equations: Do the inverse operation.

Addition Equations: Inverse will be subtraction

Examples: 1.) $x + 8 = 12$

$$\begin{array}{r} -8 \quad -8 \\ x + 8 = 12 \\ \hline x = 4 \end{array}$$

$$x = 4$$

Check: $4 + 8 = 12$

$$12 = 12$$

2.) $4.2 = n + 0.7$

$$\begin{array}{r} -0.7 \quad -0.7 \\ 4.2 = n + 0.7 \\ \hline 3.5 = n \end{array}$$

$$3.5 = n$$

Check: $4.2 = 3.5 + 0.7$

$$4.2 = 4.2$$

$$3.) \frac{1}{5} + m = \frac{4}{5}$$

$$\begin{array}{r} -1/5 \quad -1/5 \\ \frac{1}{5} + m = \frac{4}{5} \\ \hline m = \frac{3}{5} \end{array}$$

$$m = \frac{3}{5}$$

Check: $1/5 + 3/5 = 4/5$

$$4/5 = 4/5$$

Subtraction Equations: Inverse will be addition

Examples: 1.) $24 = d - 6$

$$\begin{array}{r} +6 \quad +6 \\ 24 = d - 6 \\ \hline 30 = d \end{array}$$

$$30 = d$$

Check: $24 = 30 - 6$

$$24 = 24$$

2.) $y - 1.5 = 8.7$

$$\begin{array}{r} +1.5 \quad +1.5 \\ y - 1.5 = 8.7 \\ \hline y = 10.2 \end{array}$$

$$y = 10.2$$

Check: $10.2 - 1.5 = 8.7$

$$8.7 = 8.7$$

$$3.) 4\frac{3}{5} = x - \frac{2}{5}$$

$$\begin{array}{r} +2/5 \quad +2/5 \\ 4\frac{3}{5} = x - \frac{2}{5} \\ \hline 5 = x \end{array}$$

$$5 = x$$

Check: $4\frac{3}{5} = 5 - 2/5$

$$4\frac{3}{5} = 4\frac{3}{5}$$

Multiplication Equations: Inverse will be division

Examples: 1.) $16 = 8r$

$$\begin{array}{r} 8 \quad 8 \\ 16 = 8r \\ \hline r = 2 \end{array}$$

$$r = 2$$

Check: $16 = 8 \cdot 2$

$$16 = 16$$

2.) $1.2y = 3.6$

$$\begin{array}{r} 1.2 \quad 1.2 \\ 1.2y = 3.6 \\ \hline y = 3 \end{array}$$

$$y = 3$$

Check: $1.2 \cdot 3 = 3.6$

$$3.6 = 3.6$$

$$3.) 24 = \frac{2}{3}d$$

$$\begin{array}{r} 2/3 \quad 2/3 \\ 24 = \frac{2}{3}d \\ \hline 36 = d \end{array}$$

$$36 = d$$

Check: $24 = 2/3 \cdot 36$

$$24 = 24$$

Division Equations: Inverse will be multiplication

Examples: 1.) $\frac{v}{10} = 50$

$$10 \cdot \frac{v}{10} = 50 \cdot 10$$

$$v = 500$$

Check: $500 \div 10 = 50$

$$50 = 50$$

2.) $3 = \frac{x}{2.75}$

$$2.75 \cdot 3 = \frac{x}{2.75} \cdot 2.75$$

$$8.25 = x$$

Check: $3 = 8.25 \div 2.75$

$$3 = 3$$

3.) $\frac{m}{3} = \frac{1}{5}$

$$3 \cdot \frac{m}{3} = \frac{1}{5} \cdot 3$$

$$m = \frac{3}{5}$$

Check: $3/5 \div 3 = 1/5$

$$1/5 = 1/5$$

Examples of Equation Word Problems:

1.) Michael Jordan's highest point total in a game was 69 points. His entire team scored 117 points in the game. Write and solve an equation to find how many points (p) that Michael's teammates scored.

Equation: $69 + p = 117$ (Solve by subtracting 69 from both sides)

Answer: $p = 48$ (Check $69 + 48 = 117$)

Michael's teammates scored 48 points.

2.) After Deshawn deposited a check for \$50, his account balance was \$300. Write and solve an equation to show how much money (m) Deshawn had in his account before the deposit.

Equation: $m + 50 = 300$ (Solve by subtracting 50 from both sides)

Answer: $m = 250$ (Check $250 + 50 = 300$)

Deshawn had \$250 in his account before the deposit.

3.) After buying a dance ticket that costs \$5, Rayquan had \$15 dollars left. Write and solve an equation to find how much money (r) that Rayquan had before he bought a dance ticket.

Equation: $r - 5 = 15$ (Solve by adding 5 to both sides)

Answer: $r = 20$ (Check $20 - 5 = 15$)

Rayquan had \$20 before he bought a dance ticket.

4.) The cost of each ticket at a carnival was \$0.25. Li bought \$7.50 worth of tickets. Write and solve an equation to find how many tickets (t) that Li bought?

Equation: $0.25t = 7.50$ (Solve by dividing 0.25 from both sides)

Answer: $t = 30$ (Check $0.25 \cdot 30 = 7.50$)

Li bought 30 tickets.

5.) Five friends split a bag of candy. They each get 6 pieces of candy. Write and solve an equation to find how much candy (c) was in the bag.

Equation: $c \div 5 = 6$ (Solve by multiplying 5 to both sides)

Answer: $c = 30$ (Check $30 \div 5 = 6$)

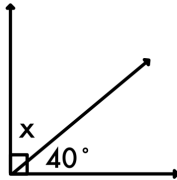
There were 30 pieces of candy in the bag.

Topic Eleven: Angle Relationships

How to find the Missing Angle in a Complementary or Supplementary Angle:

Complementary angles add up to 90 degrees. (Complementary angles look like a Corner).

Example of finding a missing complementary angle:

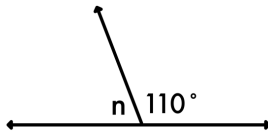


$$90 - 40 = 50^\circ$$

$$x = 50^\circ$$

Supplementary angles add up to 180 degrees. (Supplementary angles look like a Straight line).

Example of finding a missing supplementary angle:



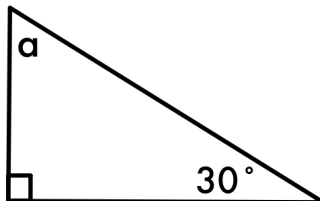
$$180 - 110 = 70^\circ$$

$$n = 70^\circ$$

How to find the Missing Angle in a Triangle:

Triangle angles add up to 180 degrees.

Example of finding a missing triangle angle:



$$30 + 90 = 120$$

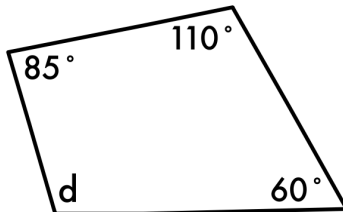
$$180 - 120 = 60^\circ$$

$$a = 60^\circ$$

How to find the Missing Angle in a Quadrilateral (Four sided shape):

Quadrilateral angles add up to 360 degrees.

Example of finding a missing quadrilateral angle:



$$85 + 110 + 60 = 255$$

$$360 - 255 = 105^\circ$$

$$d = 105^\circ$$

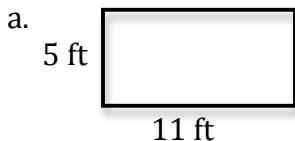
Topic Twelve: Area of Quadrilaterals

How to find the Area of Rectangles, Squares, Parallelograms, and Rhombuses:

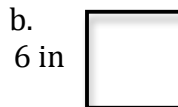
$$A = bh \quad [\text{Area} = \text{base times height}]$$

Examples of Finding Area of Squares and Rectangles:

1.) Find the area of each quadrilateral.



$$\begin{aligned} A &= bh \\ A &= 11 \cdot 5 \\ A &= 55 \text{ ft}^2 \end{aligned}$$



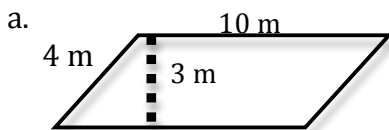
$$\begin{aligned} A &= bh \\ A &= 6 \cdot 6 \\ A &= 36 \text{ in}^2 \end{aligned}$$

2.) The area of a table is 15 ft². The length of the table is 5 ft. What is the width?

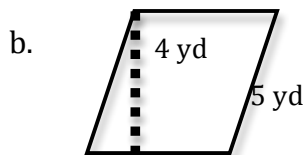
$$\begin{aligned} A &= bh \\ 15 &= 5 \cdot h \\ \frac{15}{5} &= \frac{5 \cdot h}{5} \quad \text{Width} = 3 \text{ feet} \\ 3 &= h \end{aligned}$$

Examples of Finding Area of Rhombuses and Parallelograms:

1.) Find the area of each quadrilateral.



$$\begin{aligned} A &= bh \\ A &= 10 \cdot 3 \\ A &= 30 \text{ m}^2 \end{aligned}$$



$$\begin{aligned} A &= bh \\ A &= 5 \cdot 4 \\ A &= 20 \text{ yd}^2 \end{aligned}$$

Special Note:
Height is always at a right angle (90 degree angle) to the base. (Do not mix up with the slant.)

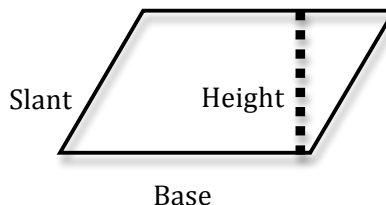
How to find the Area of Trapezoids

$$A = \frac{1}{2} h(b_1 + b_2) \quad A = \text{area}, b = \text{base}, h = \text{height}$$

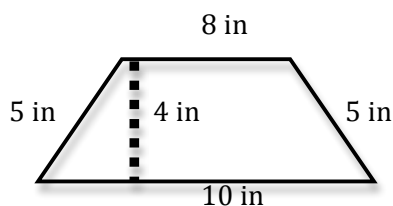
Step 1: Add two bases.

Step 2: Multiply by the height.

Step 3: Divide by two.

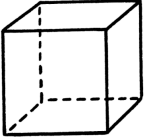
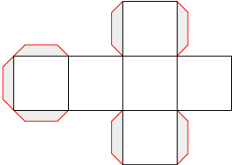
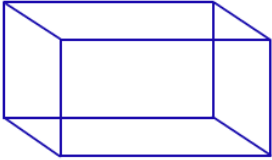
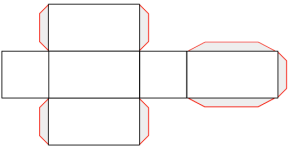
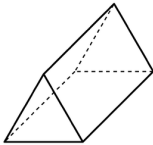
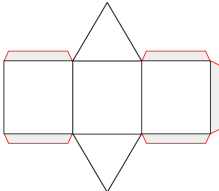


Examples of Finding Area of Trapezoids:



$$\begin{aligned} \text{Step 1: Add bases: } & 8 + 10 = 18 \\ \text{Step 2: Multiply by height: } & 18 \cdot 4 = 72 \\ \text{Step 3: Divide by 2: } & 72 \div 2 = 36 \\ \text{Answer: } & 36 \text{ in}^2 \end{aligned}$$

Topic Thirteen: Surface Area/Volume of Prisms

Name of Prism	Picture of Prism	Net of Prism
Cube		
Rectangular Prism		
Triangular Prism		

Surface Area measures the total area of the faces of a 3D shape.

How to Find the Area of a Rectangular Prism:

Step 1: Find area of each face. (Remember, each rectangle has a matched pair.)

Step 2: Add all faces together.

Example of Finding the Surface Area of a Rectangular Prism:

Step 1: Find area of each face.

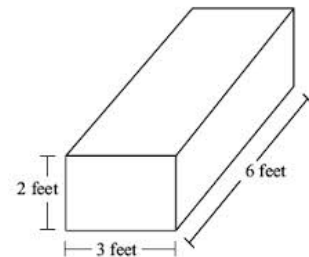
Front: $2 \cdot 3 = 6 \cdot 2 = 12$ (Times by 2 to get back)

Side: $2 \cdot 6 = 12 \cdot 2 = 24$ (Times by 2 to get other side)

Top: $3 \cdot 6 = 18 \cdot 2 = 36$ (Times by 2 to get bottom)

Step 2: Add all faces together.

$$12 + 24 + 36 = 72 \text{ ft}^2$$



How to Find the Area of a Triangular Prism:

Step 1: Find area of 2 triangles. $2 \cdot \frac{1}{2}bh$

Step 2: Find area of 3 rectangles.

Step 3: Add all together.

Example #1 of Finding the Surface Area of a Triangular Prism:

Step 1: Find area of 2 triangles.

$$2 \cdot \frac{1}{2}bh \quad 2 \cdot 0.5 \cdot 8 \cdot 3 = 24$$

Step 2: Find area of 3 rectangles.

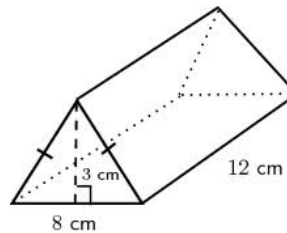
Bottom: $8 \cdot 12 = 96$

Front: $8 \cdot 12 = 96$

Back: $8 \cdot 12 = 96$

Step 3: Add all together.

$$24 + 96 + 96 + 96 = 312 \text{ cm}^2$$

**Example #2 of Finding the Surface Area of a Triangular Prism:**

Step 1: Find area of 2 triangles.

$$2 \cdot \frac{1}{2}bh \quad 2 \cdot 0.5 \cdot 8 \cdot 9 = 72$$

Step 2: Find area of 3 rectangles.

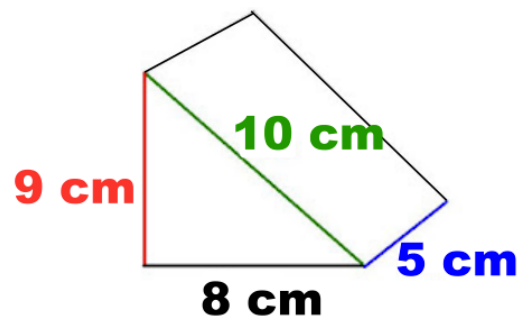
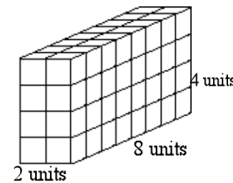
Bottom: $8 \cdot 5 = 40$

Front: $10 \cdot 5 = 50$

Back: $9 \cdot 5 = 45$

Step 3: Add all together.

$$72 + 40 + 50 + 45 = 207 \text{ cm}^2$$

**Volume:** The number of cubic units needed to fill a given space.Volume = 64 cubic units Or 64 units^3 **How to find the Volume of Prisms:**

$$\text{Volume} = Bh \quad [B = \text{Area of Base} \quad b = \text{base} \quad h = \text{height}]$$

If base is a triangle: $A = \frac{1}{2}bh$

If base is a triangle: $A = bh$

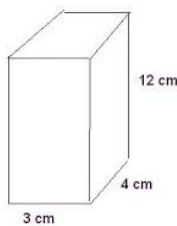
Examples of Finding Volume of Prisms:1.) $V = Bh$

$V = (bh) \cdot h$

$V = (3 \cdot 4) \cdot 12$

$V = 12 \cdot 12$

$V = 144 \text{ cm}^3$

2.) $V = Bh$

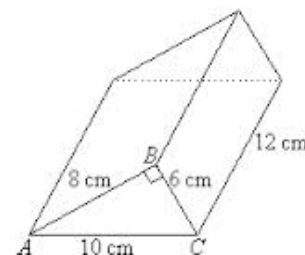
$V = \left(\frac{1}{2}bh\right) \cdot h$

$V = \left(\frac{1}{2} \cdot 8 \cdot 6\right) \cdot 12$

$V = \left(\frac{1}{2} \cdot 48\right) \cdot 12$

$V = 24 \cdot 12$

$V = 288 \text{ cm}^3$



Topic Fourteen: Probability

The **probability** of an event, written $P(\text{event})$, is the measure of how likely the event is to occur. Probability is a measure between 0 and 1. You can write probability as a fraction, a decimal, or a percent. $P(\text{heads})$ means “the probability that heads will be the outcome.”

Sample Space: Listing all the possible options of what you could get!

Outcome: Result of doing a probability experiment.

Examples of Finding Sample Space/Outcomes:

- 1.) What is the sample space of rolling a number cube?
Answer: 1, 2, 3, 4, 5, 6
- 2.) What are the possible outcomes of flipping a coin?
Answer: head, tail
- 3.) What are the possible outcomes of rolling a number cube AND flipping a coin?
Answer: 1head, 2head, 3head, 4head, 5head, 6head
1tail, 2tail, 3tail, 4tail, 5tail, 6tail

Theoretical Probability: How likely something will happen based on outcomes.

Theoretical Probability = $\frac{\text{Number of ways to get the outcome in question}}{\text{total possible outcomes}}$

Example: 12 purple blocks

24 total blocks in bag

$$P(\text{Purple}) = \frac{12}{24} = \frac{1}{2} = 0.5 = 50\%$$

Examples of Finding Theoretical Probability:

An experiment consists of rolling a number cube. Find the probability of each outcome.

- 1.) Rolling a 3 (answer as a fraction)
Number of 3s on a number cube = 1 Outcomes = 1, 2, 3, 4, 5, 6 = 6 outcomes
 $P(3) = \frac{1}{6}$
- 2.) Rolling a number greater than 3 (answer as a decimal)
Numbers greater than 3 = 4, 5, 6 = 3 numbers greater than 3 Outcomes = 6
 $P(\text{greater than 3}) = \frac{3}{6} = \frac{1}{2} = 0.5$
- 3.) Rolling an 8 (answer as a decimal and percent)
Number of 8s on a number cube = 0 Outcomes = 6
 $P(0) = \frac{0}{6} = 0 = 0\%$
- 4.) Rolling a number greater than or equal to 1 (answer as a fraction and percent)
Numbers greater than or equal to 1 = 2, 3, 4, 5, 6 = 5 Outcomes = 6
 $P(\text{greater than/equal to 1}) = \frac{5}{6} = 0.8\bar{3} = 83.\bar{3}\%$

Relative Frequency/Experimental Probability: Probability based on an experiment

$$\text{Experimental Probability} = \frac{\text{times an event occurred}}{\text{total number of trials}}$$

Example: 6 purple blocks picked
10 total picks from bag

$$P(\text{Purple}) = \frac{6}{10} = \frac{3}{5} = 0.6 = 60\%$$

Examples of Finding Relative Frequency/Experimental Probability:

Esmeralda did an experiment where she flipped two coins in the air repeatedly. Here is her data:

Outcome	# of Times
HH	4
TH	2
HT	3
TT	1

1.) What is her relative frequency for landing with both heads (as a percent)?

Number of times both heads (HH) = 4

Total number of trials = 4 + 2 + 3 + 1 = 10

$$P(\text{HH}) = \frac{4}{10} = \frac{2}{5} = 0.4 = 40\%$$

2.) What is her experimental probability for landing with one a head and the other a tail (as a fraction)?

Number of one a head and the other a tail (HT or TH) = 2 + 3 = 5

Total number of trials = 4 + 2 + 3 + 1 = 10

$$P(\text{HT or TH}) = \frac{5}{10} = \frac{1}{2}$$

Making Predictions with Probability:

Step 1: Find the Part/Whole.

Step 2: Set up and solve an equivalent fraction (see topic three).

Examples of Making Predictions with Probability:

1.) Mario flipped a coin 30 times. He got tails 18 times. How many times should he expect to get tails if he flips 60 times?

$$\text{Part} = 18 \qquad \frac{18}{30} = \frac{?}{60} \qquad (\text{Multiply top/bottom by 2})$$

$$\text{Whole} = 30 \qquad ? = 36$$

Answer: Mario should expect tails 36 times.

2.) Nate inspects Peeps at the candy factory. After checking 90 Peeps, he found that 3 of them were missing ears. How many Peeps of the next 360 would Nate expect to be missing ears?

$$\text{Part} = 3 \qquad \frac{3}{90} = \frac{?}{360} \qquad (\text{Multiply top/bottom by 4})$$

$$\text{Whole} = 90 \qquad ? = 12$$

Answer: Nate should expect 12 Peeps with missing ears.

Topic Fifteen: Graphing

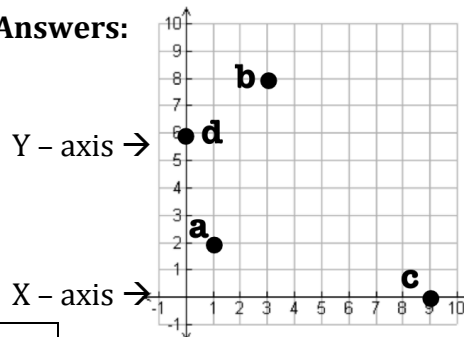
Ordered Pair: A pair of numbers that can be used to locate a point on a coordinate plane.

- (x, y) 1.) x –coordinate tells you how many spaces to go left or right (horizontally)
2.) y – coordinate tells you how many spaces up or down (vertically)

Examples of Plotting Points:

- a.) (1, 2) [Find 1 on x axis, go up 2]
b.) (3, 8) [Find 3 on x axis, go up 8]
c.) (9, 0) [Find 9 on x axis, go up 0]
d.) (0, 6) [Find 0 on x axis, go up 6]

Answers:



How to Make a Table from a Graph:

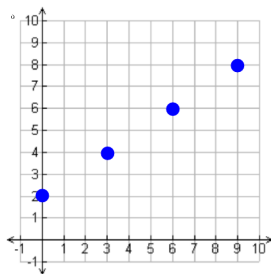
- Step 1: Find the x-axis value (look down)
Step 2: Find the y-axis value (look left)
Step 3: Write in table (see right)

x	y

x			
y			

Examples of Making a Table from a Graph:

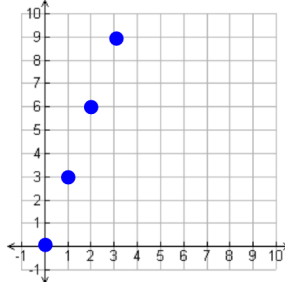
1.)



Answer:

x	y
0	2
3	4
6	6
9	8

2.)



Answer:

x	0	1	2	3
y	0	3	6	9

How to Change an Equation to a Table:

- Step 1: Evaluate x for at least three numbers.
Step 2: Put x and y values into a table.

Examples of Making a Table from an Equation:

For each equation, create a table.

1.) $y = 5x$

x	5x	y	(x, y)
0	5•0	0	(0, 0)
1	5•1	5	(1, 5)
2	5•2	10	(2, 10)

2.) $y = x + 6$

x	y
0	6
1	7
2	8
3	9

$0 + 6 = 6$
 $1 + 6 = 7$
 $2 + 6 = 8$
 $3 + 6 = 9$

3.) $y = 2x + 10$

x	y
0	10
1	12
2	14
3	16

$2 \cdot 0 + 10 = 10$
 $2 \cdot 1 + 10 = 12$
 $2 \cdot 2 + 10 = 14$
 $2 \cdot 3 + 10 = 16$

How to Make a Graph from an Equation:

Step 1: Make a table (with at least 3 points).

Step 2: Plot points on graph.

Step 3: Connect the dots (arrows at ends)!

Examples of Making a Graph from an Equation:

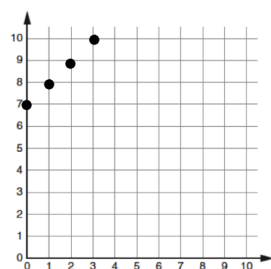
For each equation, create a graph.

1.) $y = x + 7$

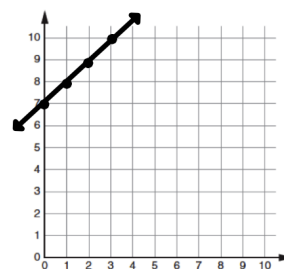
Step 1:

x	y
0	7
1	8
2	9
3	10

Step 2:



Step 3:

2.) $y = 10 - 3x$

Step 1:

$10 - 3 \cdot 0$

$10 - 0 = 10$

$10 - 3 \cdot 1$

$10 - 3 = 7$

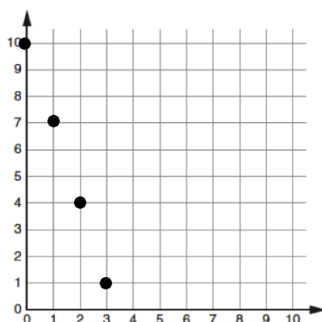
$10 - 3 \cdot 2$

$10 - 6 = 4$

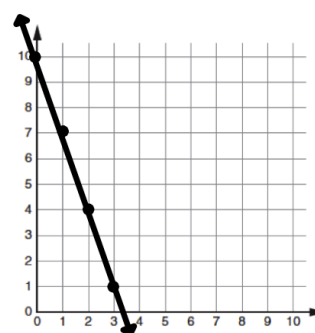
$10 - 3 \cdot 3 = 10 - 9 = 1$

x	y
0	10
1	7
2	4
3	1

Step 2:



Step 3:

**How to Make an Equation from a Table:**

Step 1: Look for patterns! (If increasing, try addition or multiplication) (If decreasing, try subtraction or division) (If that didn't work try two things, like multiplication and subtraction.)

Step 2: Write an equation from the rule. (Make sure to have x, y, and an equal sign).

Step 3: Check that your equation works for the ENTIRE table.

Examples of Making an Equation from a Table:

For each table, create an equation.

1.)

x	y
0	0
1	3
2	6
3	9

Step 1: $0 + 0 = 0$

$1 + 0 = 1$

Add 0 is

not the rule

$0 \cdot 3 = 0$

$1 \cdot 3 = 3$

$2 \cdot 3 = 6$

$3 \cdot 3 = 9$

Times 3 is the rule

Step 2: $x \cdot 3 = y$

OR $y = 3x$

Step 3: Yes, it works

for the entire
table

2.)

x	y
15	11
14	10
13	9
12	7

Step 1: $15 - 4 = 11$
 $14 - 4 = 10$
 $13 - 4 = 9$
 $12 - 4 = 8$
 Minus 4 is
 the rule

Step 2: $x - 4 = y$
 OR $y = x - 4$

Step 3: Yes, it works
 for the entire
 table

3.)

x	y
0	2
1	4
2	6
3	8

Step 1: $0 + 2 = 2$
 $1 + 2 = 3$
 Add 2 is
 not the rule

$0 \cdot 4 \neq 0$
 $1 \cdot 4 = 4$
 Multiply by
 4 is not the
 rule

$0 \cdot 2 + 2 = 2$
 $1 \cdot 2 + 2 = 4$
 $2 \cdot 2 + 2 = 6$
 $3 \cdot 2 + 2 = 8$
 Multiply by 2 then
 add 2 is the rule

Step 2: $x \cdot 2 + 2 = y$ OR $y = 2x + 2$

Step 3: Yes, it works for the entire table

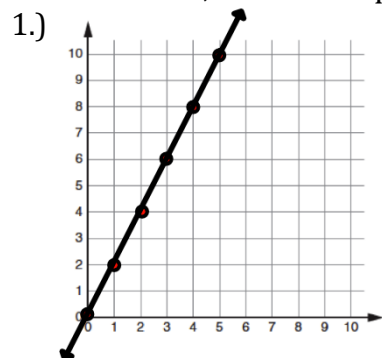
How to Make an Equation from a Graph:

Step 1: Make a table.

Step 2: Use table to make equation.

Examples of Making an Equation from a Graph:

For each table, create an equation.

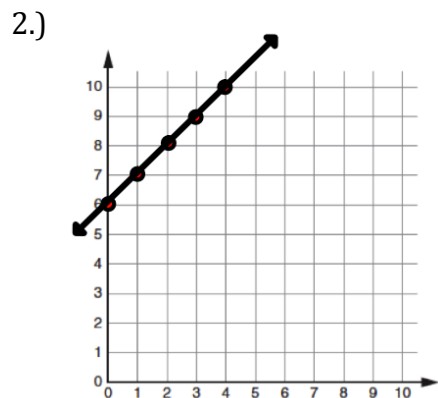


Step 1:

x	y
0	0
1	2
2	4
3	6

Step 2:
 Rule is multiply by 2

Answer: $x \cdot 2 = y$
 OR $y = 2x$



Step 1:

x	y
0	6
1	7
2	8
3	9

Step 2:
 Rule is add 6

Answer: $x + 6 = y$
 OR $y = x + 6$