Simple Solutions.

Minutes a Day–Mastery for a Lifetime!

Standards-Based Mathematics 6

Help Pages

Some material addressed in standards covered at earlier grade levels may not be available in these *Help Pages*, but you can access all grade levels of *Simple Solutions Standards-Based Mathematics Help Pages* at SimpleSolutions.org.

Help Pages

Vocabulary

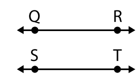
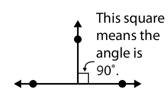
absolute deviation	a measure of variability; in a set of data, the absolute difference between a data point and another point, such as the mean or median. Example: if the median is 3 and a data point is 5, its absolute deviation from the median is 2 because the difference between 3 and 5 is 2. Absolute deviation is always positive (*see* **absolute value**).
absolute value	the distance between a number and zero on a number line. Example: the absolute value of negative seven is 7; it is written as $\lvert -7 \rvert$. Absolute value is never negative.
algebraic expression	a mathematical phrase written in symbols. Example: $2x + 5$
approximately symmetric	a distribution that appears to be a mirror reflection above and below the median; A bell curve is an example; the word *approximately* means "fairly close," so the distribution may not be perfectly symmetric but is close to symmetric.
area	the amount of space within a polygon; area is always measured in square units (feet^2, meters^2, etc.)
associative property	a math rule that says changing the grouping of addends or factors does not change the outcome of the equation. Example: $(a + b) + c = a + (b + c)$ or $(a \times b) \times c = a \times (b \times c)$
axis / axes	the lines that form the framework for a graph. The horizontal axis is called the x-axis; the vertical axis is called the y-axis.
box plot (box-and-whisker plot)	a graphic with five numbers that summarize a set of data
cluster	numbers that are bunched or grouped together around a certain point in a set of values
coefficient	the number in front of a variable in an algebraic term. Example: in the term $5x$, 5 is the coefficient.
commutative property	a math rule that says changing the order of addends or factors does not change the outcome of the equation. Example: $a + b = b + a$ and $a \times b = b \times a$
composite number	a number with more than 2 factors. Example: 10 is composite because it has factors of 1, 2, 5, and 10.
congruent	figures with the same shape and the same size
constant	a number that is not attached to a variable; a term that always has the same value in an algebraic expression. Example: in the expression, $3x + 4$, 4 is the constant.
coordinates	an ordered pair of numbers that give the location of a point on a coordinate grid
coordinate plane / grid	a grid in which the location is described by its distances from two intersecting, straight lines called axes
data	numeric information collected from a statistical question
decimal	a number that contains a decimal point; any whole number or fraction can be written as a decimal. Example: $\frac{1}{10} = 0.10$
dependent variable	a variable that is affected by the independent variable. Often, the dependent variable is y, as in $y = 3x$. The value of y depends on the value of x.
dot plot	a type of graph that uses dots over a number line to show a set of data. The placement of each dot tells the value of the data point.
edge	the line segment where two faces meet
equivalent fractions	fractions with different names but equal value
evaluate	to find the value of an expression
exponent	the number of times that a base is multiplied by itself. An exponent is written to the upper right of the base. Example: 5^3; the base is five; the exponent is three. $5^3 = 5 \times 5 \times 5$

Help Pages

Vocabulary	
exponential notation	an expression with an exponent. 4^3 is an example of an exponential notation.
face	a flat surface of a solid figure
frequency table	lists items and uses tally marks to record the number of times items occur
gap	a large space between data, or missing data from an established set of values
greatest common factor (GCF)	the highest factor that 2 numbers have in common. Example: the factors of 6 are 1, 2, 3, and 6. The factors of 9 are 1, 3, and 9. The GCF of 6 and 9 is 3.
histogram	a type of bar graph that displays the frequency of data within equal, non-overlapping intervals
independent variable	a variable that affects the dependent variable. Often, the independent variable is x, as in $y = 3x$. When x is 2, $y = 6$; when x is 0.5, $y = 1.5$
integers	the set of whole numbers, positive, negative, and zero. A set of integers that includes zero, the counting numbers, and their opposites.
interquartile range (IQR)	a measure of variability; the range of the middle 50% of a data set; IQR is the difference between the upper and lower quartiles (Q3 – Q1).
isosceles triangle	a triangle that has two sides that are the same length
least common multiple (LCM)	the smallest multiple that 2 numbers have in common. Example: the multiples of 3 are 3, 6, 9 12, 15 . . . the multiples of 4 are 4, 8, 12, 16, so the LCM of 3 and 4 is 12.
like terms	terms that have the same variable and are raised to the same power; like terms can be combined (added or subtracted), whereas unlike terms cannot.
maximum	the greatest number; the largest value in a set of data
mean	a measure of center; the average of a set of numbers
mean absolute deviation (MAD)	the average of the differences between data points in a data set, and the mean of the set; mean absolute deviation (MAD) indicates the degree of variability in a data set.
median	a measure of center; the data point that falls in the exact middle of a set of data
measure of center	mean, median, mode; a number that summarizes a set of data
measure of variability	a number that indicates the degree of variance (how clustered or spread out a set of data is). Examples are range, interquartile range, and mean absolute deviation.
minimum	the smallest number; the lowest value in a data set
mixed number	the sum of a whole number and a fraction; Example: $5\frac{3}{4}$
mode	a measure of center; in a data set, the value that occurs most often
negative numbers	all the numbers less than zero. (Zero is neither positive nor negative.) A negative number has a negative sign (–) in front of it.
net	an edge-to-edge drawing that shows all the surfaces of a polygon or geometric solid; a flat representation of a 3-dimensional figure
operation	the type of procedure to perform on numbers, whether addition, subtraction, multiplication, or division
order of operations	a rule that tells the order in which to perform operations in an equation. Solve whatever is in parentheses or brackets first (work from the innermost grouping outward); then calculate exponents. Next, multiply or divide from left to right, and finally, add or subtract from left to right.
ordered pair	a pair of numbers that gives the coordinates of a point on a grid

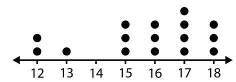
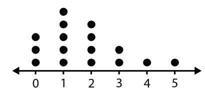
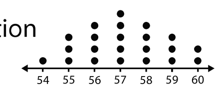
Help Pages

Vocabulary

origin	the point where the x-axis and y-axis intersect
opposite numbers	two numbers that are exactly the same distance from zero on a number line. Every positive number has an opposite that is negative, and every negative number has an opposite that is positive. Example: 5 and –5 are opposites.
opposite of opposite	the number itself. Examples: the opposite of the opposite of 4 is 4, and the opposite of the opposite of –3 is –3.
outlier	a number that is much smaller or much larger than the other numbers in a data set
parallel lines	two lines that never intersect and are always the same distance apart 
peak	the highest point in a set of data; the peak indicates the mode in the data set
percent	the ratio of any number to 100; the symbol for percent is % Example: 14% means 14 out of 100 or 14/100
perpendicular lines	lines that intersect and form a right angle (90°) 
positive numbers	all numbers greater than zero; sometimes a positive sign (+) is written in front of a positive number
prime number	a number with exactly 2 factors (the number itself and 1); the number 1 is neither prime nor composite, as it has only one factor. Example: seven is a prime number because 7 has exactly two factors, 1 and 7.
prime factorization	a number that is written as a product of its prime factors. Example: 140 can be written as $2 \times 2 \times 5 \times 7$ or $2^2 \times 5 \times 7$. (All of the factors are prime numbers.)
proportion	a statement that two ratios (or fractions) are equal. Example: $\frac{1}{2} = \frac{3}{6}$
Q1	the lower quartile; in a box plot, Q1 represents the median of the lower half of the data set.
Q2	the middle quartile; in a box plot, Q2 represents the median of the data set.
Q3	the upper quartile; in a box plot, Q3 represents the median of the upper half of the data set.
quartiles	points that divide a data set into four equal parts or quarters, Q1, Q2, and Q3. *see* **Interpreting Data — Box-and-Whisker Plots** section of the *Help Pages*
range	a measure of variability; in a set of data, the difference between the minimum and maximum values
ratio	a comparison of two numbers by division; a ratio looks like a fraction. Examples: $\frac{2}{5}$; 2:5; 2 to 5; all of these are pronounced "two to five."
relatively prime	a relationship between two numbers whose greatest common factor is 1. Example: the numbers 9 and 10 are relatively prime (or prime to each other) because their only common factor is 1.
right triangle	a triangle with one angle that measures exactly 90º
scalene triangle	a triangle whose side lengths are all different
shape of data	the appearance of a set of data on a dot plot; data is either symmetric or skewed
skewed	a data set that is not evenly balanced; values appear to be pulled toward the right or left; outliers cause data to be skewed

Help Pages

Vocabulary

skewed left	data points are more clustered on the right with a "tail" stretching left 
skewed right	data points are more clustered on the left with a "tail" stretching right 
surface area	the sum of the areas of the faces of a solid figure. Example: The surface area of a rectangular prism is the sum of the areas of its six faces.
symmetric	a distribution that is evenly balanced and appears to be a mirror reflection above and below the median; a bell curve is an example of this. 
term	a part of an algebraic expression; a number, variable, or combination of the two; terms are separated by signs such as +, =, or –; in $4x + 3 - 2y$, $4x$, $+3$, and $-2y$ are all terms.
unit rate	a ratio of two values; in a unit rate, the denominator is 1.
variability	the degree to which a set of data is spread out.
variable	an unknown or a symbol that stands for an unknown value; a variable can change. Variables need to be defined in an algebraic equation; that means choose a letter or symbol to stand for an unknown value.
vertex	the endpoint at which two sides meet on a polygon; the corner of two or more edges on a geometric solid
volume	the number of cubic units it takes to fill a solid; volume is expressed in cubic units (ft^3, m^3, $in.^3$)
whole numbers	the set of numbers that includes zero and all the counting numbers {0, 1, 2, 3, 4 . . . }

Properties of Addition and Multiplication

The **commutative property** states that the addends in addition or factors in multiplication can be placed in any order. The answer will be the same either way.

Example: $3 \times 9 = 9 \times 3$ Both are equal to 27.

The **associative property** states that the addends in addition or the factors in multiplication can be grouped differently. Either way results in the same solution.

Example: You can solve $3 \times 5 \times 2$ two ways.

$$(3 \times 5) \times 2 = 30 \qquad 15 \times 2 = 30$$

$$3 \times (5 \times 2) = 30 \qquad 3 \times 10 = 30$$

The **distributive property** is used when one term is multiplied by an expression that includes either addition or subtraction.

Example: $3(2x + 5)$

1. Since the 3 is multiplied by the expression $2x + 5$, the 3 must be multiplied by both terms in the expression.
2. Multiply 3 by $2x$ and then multiply 3 by +5
3. The result is $6x + 15$.

❶ $3(2x + 5) =$

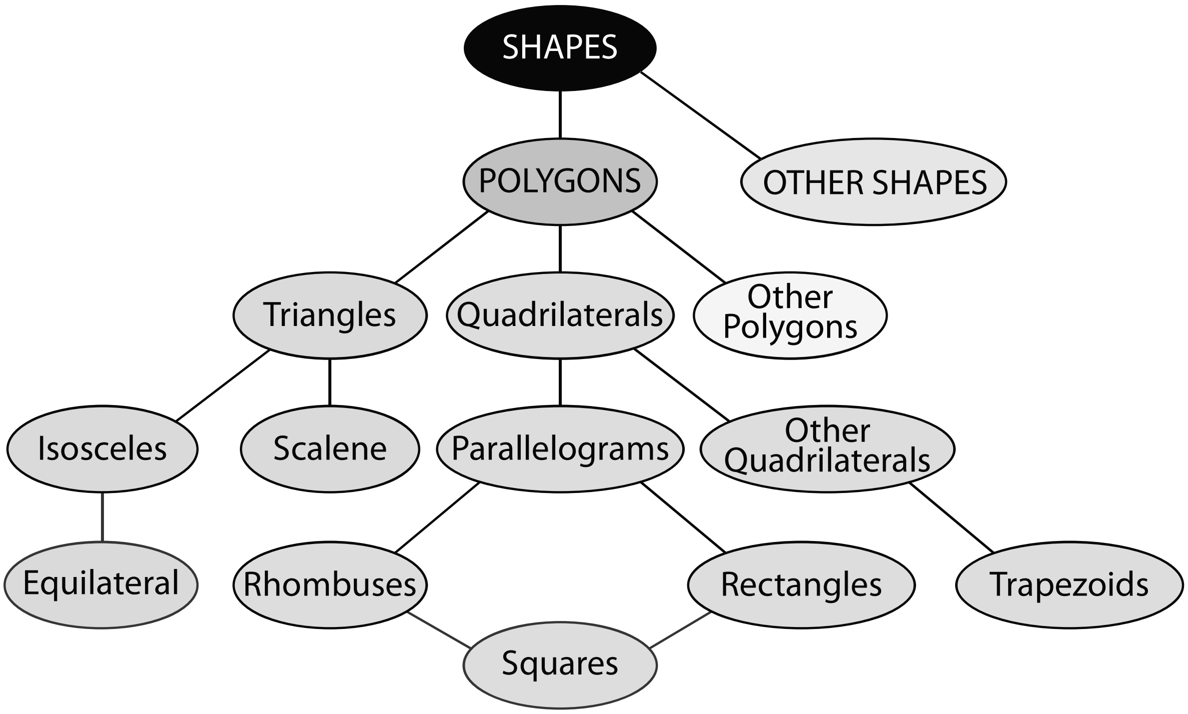
❷ → $3(2x) + 3(5) =$

❸ → $6x + 15$

Notice that simplifying an expression does not result in a single number answer, only a simpler expression.

Help Pages

Geometry — Classification of Polygons

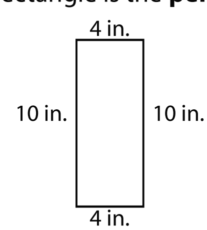


Geometry — Finding a Perimeter of a Rectangle

A rectangle has 2 pairs of parallel sides. The distance around the outside of a rectangle is the **perimeter**. To find the **perimeter of a rectangle, add the lengths of the sides**.

Examples:

$10 + 4 + 10 + 4 = 28$ in.
or
$2(10 + 4) = 2 \times 14 = 28$ in.
or
$(2 \times 10) + (2 \times 4) = 28$ in.

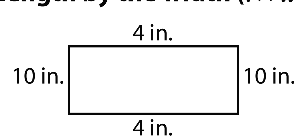


Geometry — Finding the Area of a Rectangle

Area is the number of square units within any two-dimensional shape. A rectangle has side lengths called length and width.

To find the area of a rectangle, multiply the length by the width ($l \times w$).

Example 1: In the example, $10 \times 4 = 40$ in.^{2}



If the area is known, but the length or width is missing, use division to find the missing measurement.

Example 2: The area of a rectangle is 70 square inches. The length of one of the sides is 10 inches. Find the width. Label the answer.
If $A = l \times w$, then $A \div w = l$ and $A \div l = w$. Show: $70 \div 10 = 7$. The width is 7 inches.

Remember to label your answer in square units.

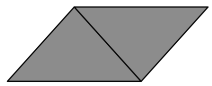
Examples:
- square inches: in.^{2}
- square feet: ft^2
- square yards: yd^2
- square miles: mi^2
- square centimeters: cm^2
- square meters: m^2

Help Pages

Geometry — Finding the Area of a Triangle

To find the area of a triangle, it is helpful to recognize that any triangle is exactly half of a paralleogram.

The whole figure is a parallelogram

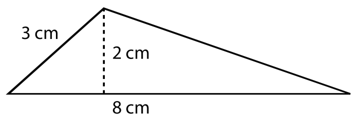


Half of the whole figure is a triangle.

So, the triangle's area is equal to half of the product of the base and the height.

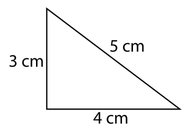
Area of triangle = $\frac{1}{2}$**(*base* × *height*) or *A* =** $\frac{1}{2}$***bh***

Examples: Find the area of the triangles below.



1. Find the length of the base. (8 cm)
2. Find the height. (It is 2 cm. The height is always straight up and down — never slanted.)
3. Multiply them together and divide by 2 to find the area. (8 cm^2)

A = 8 cm × 2 cm × $\frac{1}{2}$ = 8 cm^2



The base of this triangle is 4 cm long. Its height is 3 cm. (Remember, the height is always straight up and down!)

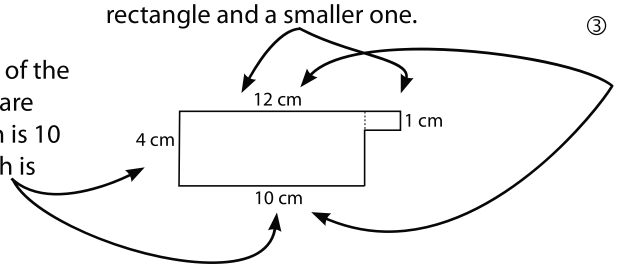
A = 4 cm × 3 cm × $\frac{1}{2}$ = 6 cm^2.

Geometry — Finding the Area and Perimeter of Irregular Shapes

Example: Find the area of the shape. The dotted line helps to show two different rectangles. Find the area of each rectangle, and then add them together for a total.

① This irregular shape is made of a large rectangle and a smaller one.

② The side lengths of the larger rectangle are clear. The length is 10 cm and the width is 4 cm.



③ The small rectangle has a side length of 1 cm, but the other side is not labeled. However, notice that the top side length is 12 cm and the bottom one is 10 cm. By subtracting 10 from 12, you can see that the missing length is 2 cm. Use that number to calculate the smaller area.

4 × 10 (large rectangle) + 2 × 1 (small rectangle) = 40 + 2 = 42 cm^2

The total area of the shape is 42 cm^2.

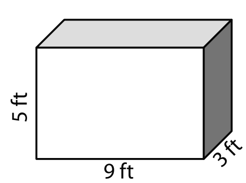
Geometry — Finding the Volume of a Rectangular Prism

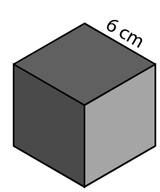
Volume is the measure of space inside of a solid figure. The volume of a rectangular prism is the product of its length, its width, and its height. Volume of a solid is expressed in cubic units (m^3, ft^3, etc.).

Volume = Length × Width × Height   or   V = L × W × H

Examples: Find the volume of the solids below.

Volume = Length × Width × Height
V = 9 ft × 3 ft × 5 ft
V = 135 ft^3 ; Say "135 cubic feet."



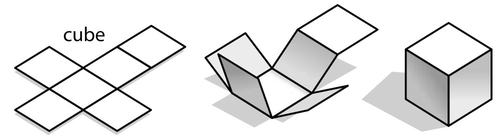


A cube has all equal sides, so its length, width, and height are all the same.
V = 6 cm × 6 cm × 6 cm
V = 216 cm^3

Help Pages

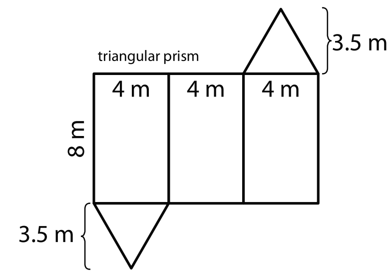
Geometry — Surface Area

A **net** is a flat pattern that can be folded to make a solid, such as a prism or a pyramid. A prism or pyramid may have several nets. A net is useful for finding surface area because a net shows the shapes of the faces, as well as the number of faces on a prism or pyramid.



Calculating the surface area of a prism or pyramid

1. First find the area of each face. If the face is a rectangle, multiply its length by its width ($A = l \times w$). If the face is a triangle, use the formula $\frac{1}{2} b \times h$.
2. Next, add the areas of all the faces. Give your answer in square units.



Example:

The triangular prism has two bases that are triangles and three faces that are rectangles. Each rectangle measures 8 m × 4 m, and each triangle has a base of 4 m and a height of 3.5 m.

Calculations:

Rectangles: $(8 \times 4) + (8 \times 4) + (8 \times 4) = 96\ m^2$

Triangles: $\frac{1}{2}(4 \times 3.5) + \frac{1}{2}(4 \times 3.5) = 14\ m^2$

Total Area: $96 + 14 = 110\ m^2$

Measurement — Equivalent Units

Volume	Distance
1 liter (L) = 1,000 milliliters (mL)	1 foot (ft) = 12 inches (in.)
1 pint (pt) = 2 cups (C)	1 yard (yd) = 3 feet (ft) = 36 inches (in.)
1 gallon (gal) = 4 quarts (qt)	1 meter (m) = 100 centimeters (cm)
1 tablespoon (tbsp) = 3 teaspoons (tsp)	1 kilometer (km) = 1,000 meters (m)
Weight	**Time**
1 kilogram (kg) = 1,000 grams (g)	1 hour (hr) = 60 minutes (min)
1 pound (lb) = 16 ounces (oz)	1 minute (min) = 60 seconds (sec)

Decimals — Place Value

1,	2	7	1,	4	0	5	.	6	4	9
millions	hundred thousands	ten thousands	thousands	hundreds	tens	ones	*decimal point* ⇧	tenths	hundredths	thousandths

The number above is read:
one million, two hundred seventy one thousand, four hundred five and six hundred forty-nine thousandths

Decimals — Expanded Notation

Base-Ten	Expanded Form	Word
0.45	$(4 \times \frac{1}{10}) + (5 \times \frac{1}{100})$	forty-five hundredths
15.137	$(1 \times 10) + (5 \times 1) + (1 \times \frac{1}{10}) + (3 \times \frac{1}{100}) + (7 \times \frac{1}{1{,}000})$	fifteen and one hundred thirty-seven thousandths
3.286	$(3 \times 1) + (2 \times \frac{1}{10}) + (8 \times \frac{1}{100}) + (6 \times \frac{1}{1{,}000})$	three and two hundred eighty-six thousandths
26.4	$(20 \times 10) + (6 \times 1) + (4 \times \frac{1}{10})$	twenty-six and four tenths
487.391	$(4 \times 100) + (8 \times 10) + (7 \times 1) + (3 \times \frac{1}{10}) + (9 \times \frac{1}{100}) + (1 \times \frac{1}{1{,}000})$	four hundred eighty-seven and three hundred ninety-one thousandths

Help Pages

Decimals – Rounding

When we round decimals, we are approximating them. This means we end the decimal at a certain place value and we decide if it's closer to the next higher number (round up) or to the next lower number (keep the same).

1. Identify the number in the rounding place.
2. Look at the digit to its right. If the digit is 5 or greater, increase the number in the rounding place by 1. If the digit is less than 5, keep the number in the rounding place the same.
3. Drop all digits to the right of the rounding place.

Example 1: Round 86.43 to the ones place.

1) There is a 6 in the rounding (ones) place.
2) Since four is less than 5, keep the rounding place the same.
3) Drop the digits to the right of the ones place.

❶
8<u>6</u>.43
8<u>6</u>.43 ❷
86
❸

Example 2: Round 0.574 to the tenths place.

1) There is a 5 in the rounding (tenths) place.
2) Since 7 is greater than 5, change the 5 to a 6.
3) Drop the digits to the right of the tenths place.

❶
0.<u>5</u>74
0.<u>5</u>74
0.6 ❷
❸

Example 3: Round 2.783 to the nearest hundredth.

1) There is an 8 in the rounding place.
2) Since 3 is less than 5, keep the rounding place the same.
3) Drop the digits to the right of the hundredths place.

❶
2.7<u>8</u>3
2.7<u>8</u>3
2.78 ❷
❸

Decimals – Addition

Example: Solve. 5.2 + 3.9 = _____

5.2 is close to 5.

3.9 is close to 4.

Since 5 + 4 = 9, the sum should be about 9.

$$\begin{array}{r} {}^{1} \\ 5.2 \\ +3.9 \\ \hline 9.1 \end{array}$$

Line up the numbers with the same place value, then add.

Decimals – Subtraction

Example: Solve. 8.3 – 2.7 = _____

When the numbers are estimated to the nearest whole number, the problem becomes 8 – 3.

Since 8 – 3 = 5, the sum should be about 5.

$$\begin{array}{r} {}^{7}\cancel{8}.{}^{1}3 \\ -2.7 \\ \hline 5.6 \end{array}$$

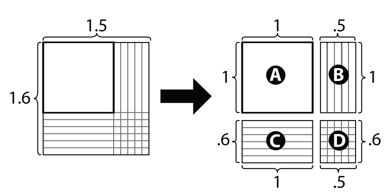
Line up the numbers with the same place value, then subtract.

Decimals – Multiplication

Example: Solve. 1.5 x 1.6 = _____

Think of this model as 4 separate rectangles.

Find the area of each, then add.



A) (1 × 1)	=	1.00
B) (1 × 0.6)	=	0.60
C) (1 × 0.5)	=	0.50
D) (0.5 × 0.6)	=	<u>0.30</u>
		2.40

Help Pages

Whole Numbers — Multiplication

When multiplying multidigit whole numbers, it is important to know your multiplication facts. Follow the steps and the examples below.

Here is a way to multiply a four-digit whole number by a one-digit whole number.

Use the **distributive property** to multiply 3,514 × 3.

Multiply 3 by all the values in 3,514 (3,000 + 500 + 10 + 4).

3 × 4 = 12 ones or 1 ten and 2 ones.

3 × 10 = 3 tens + 1 ten (regrouped) or 4 tens.

3 × 500 = 15 hundreds or 1 thousand and 5 hundreds.

3 × 3,000 = 9 thousands + 1 thousand (regrouped) or 10 thousands.

Add all the partial products to get one final product.

(3,000 × 3) + (500 × 3) + (10 × 3) + (4 × 3) = 9,000 + 1,500 + 30 + 12 = 10,542.

$$\begin{array}{r} {}^{1}\ \ {}^{1}\ \ \\ 3{,}514 \\ \times\quad 3 \\ \hline 10{,}542 \end{array}$$

Here are two ways to multiply two, two-digit numbers.

Use the **distributive property** to multiply 36 × 12.

Multiply the two addends of 36 (30 + 6) by the two addends of 12 (10 + 2).

2 × 6 = 12   2 × 30 = 60

10 × 6 = 60   10 × 30 = 300

Then, add all the partial products to get one final product.

(30 × 10) + (30 × 2) + (6 × 10) + (6 × 2) = 300 + 60 + 60 + 12 = 432

$$\begin{array}{r} 36 \\ \times\ 12 \\ \hline 432 \end{array}$$

Use the **matrix model** to multipy 48 × 31.

The model shows the four parts needed to arrive at the final product.
Place the expanded form of each two-digit number on the outside edge of the boxes as shown.
Write the partial products in each box. The sum of the four partial products is 1,488.
Notice the two different addition problems that serve as a way to check your accuracy.

	40	8	
30	1,200	240	1,440
1	40	8	+ 48
	1,240	+ 248	1,488

Whole Numbers — Division

This example involves **division using two-digit divisors with remainders**. You already know how to divide single digit numbers. This process, called "long division," helps you divide numbers with multiple digits.

Example: Divide 6,392 by 27.

1. There are 200 twenty-sevens in 6,392.
   The 2 is in the hundreds place.
2. 200 times twenty-seven equals 5,400.
   6,392 minus 5,400 equals 992.
3. There are 30 twenty-sevens in 992.
   The 3 is in the tens place.
4. 30 times twenty-seven equals 810.
   992 minus 810 equals 182.
5. There are 6 twenty-sevens in 182.
   The six is in the ones place.
6. 6 times twenty-seven equals 162.
   182 minus 162 equals 20.
   20 is less than 27, so the remainder is 20.
   The quotient is 236, R 20 or $236\frac{20}{27}$.

$$\begin{array}{r} 2 \\ 27\overline{)6{,}392} \end{array} \qquad \begin{array}{r} 2 \\ 27\overline{)\ 6{,}392} \\ -5{,}400 \\ \hline 992 \end{array}$$

$$\begin{array}{r} 23 \\ 27\overline{)\ 6{,}392} \\ -5{,}400 \\ \hline 992 \end{array} \qquad \begin{array}{r} 23 \\ 27\overline{)\ 6{,}392} \\ -5{,}400 \\ \hline 992 \\ -810 \\ \hline 182 \end{array}$$

$$\begin{array}{r} 236 \\ 27\overline{)\ 6{,}392} \\ -5{,}400 \\ \hline 992 \\ -810 \\ \hline 182 \end{array} \qquad \begin{array}{r} 236 \\ 27\overline{)\ 6{,}392} \\ -5{,}400 \\ \hline 992 \\ -810 \\ \hline 182 \\ -162 \\ \hline 20 \end{array}$$

Help Pages

Greatest Common Factor

The **greatest common factor (GCF)** is the largest factor that 2 numbers have in common.

Example: find the greatest common factor of 32 and 40.

1. First list the factors of each number.
   OR
   List the factor pairs for each number.
2. Find the largest number that is in both lists.

The GCF of 32 and 40 is 8.

Factor List

❶ The factors of 32 are 1, 2, 4, 8, 16, 32.
The factors of 40 are 1, 2, 4, 5, 8, 10, 20, 40

❷ 1, 2, 4, 8, 16, 32.
1, 2, 4, 5, 8, 10, 20, 40

Factor Pairs

❶

32	40
1, 32	1, 40
2, 16	2, 20
4, 8	4, 10
	5, 8

❷

32	40
1, 32	1, 40
2, 16	2, 20
4, 8	4, 10
	5, 8

Sometimes factoring is as easy as finding the GCF in each term and dividing all of the terms by that factor. You can think of this process as "undoing" the distributive property. First, check to see if there is a common factor that can easily be divided out.

Example: Using GCF and the distributive property, simplify the expression 25*x* + 15.

1. Find the GCF of 25*x* and 15.
   – The GCF of 25 and 15 is 5.
2. Factor out the GCF.
3. Rewrite the expression.
   – The expression becomes **5(5*x* + 3).**

Factor List

❶ The factors of 25 are 1, 5, 25.
The factors of 15 are 1, 3, 5, 15.

❷ 1, 5, 25
1, 3, 5, 15

25*x* + 15
The GCF of 25 and 15 is 5.
5(5*x* + 3)

Least Common Multiple

At other times you need to know the **least common multiple (LCM)** of an algebraic expression. The least common multiple is the smallest multiple that two numbers have in common. The prime factors of the number can be useful

Example: Find the LCM of 16 and 24.

1. If any of the numbers are even, factor out a 2.
2. Continue factoring out 2 until all numbers left are odd.
3. If the prime number cannot be divided evenly into the number, simply bring the number down.
4. Once you are left with all 1s at the bottom, you're finished!
5. Multiply all the prime numbers (on the left side of the bracket) together to find the least common multiple.
6. The least common multiple is $2 \times 2 \times 2 \times 2 \times 3$ or 48.

❶ → 2 | 16, 24
❷ → 2 | 8, 12
2 | 4, 6
2 | 2, 3
3 | 1, 3 ← ❸
1 1 ← ❹

Example: Find the LCM of 6 and 8.

1. List the first five multiples of 6. List the first five multiples of 8.
2. Circle any multiples that are in both lists.
3. The smallest circled number is the least common multiple (LCM) of 6 and 8.
4. The least common multiple of 6 and 8 is 24.

6: 6, 12, 18, 24, 30
8: 8, 16, 24, 32, 40

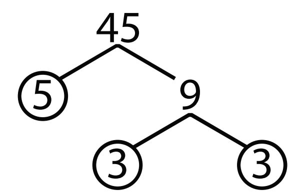
Help Pages

Factors and Multiples

The **prime factorization** of a number is a number written as a product of its prime factors. A factor tree is helpful in finding the prime factors of a number.

Example: Use a factor tree to find the prime factors of 45.

1. Find any two factors of 45 (5 and 9).
2. If a factor is prime, circle it. If a factor is not prime, find two factors of it.
3. Continue until all factors are prime.
4. In the final answer, the prime factors are listed in order from least to greatest, using exponents when needed.



The prime factorization of 45 is $3 \times 3 \times 5$ or $3^2 \times 5$

Fractions — Adding and Subtracting Mixed Numbers with Unlike Denominators

To add or subtract mixed numbers, the fractions must have a common denominator.
If the denominators are the same, simply add or subtract to find the sum or difference.

Example: $7\frac{2}{9} + 3\frac{1}{9} = 10\frac{3}{9}$

$7\frac{2}{9} + 3\frac{1}{9} = 10\frac{3}{9} \longrightarrow (7 + 3 = 10 \text{ and } \frac{2}{9} + \frac{1}{9} = \frac{3}{9})$

$6\frac{3}{5} - 2\frac{2}{5} = 4\frac{1}{5} \longrightarrow (6 - 2 = 4 \text{ and } \frac{3}{5} - \frac{2}{5} = \frac{1}{5})$

For mixed numbers with unlike denominators, follow these steps to find a common denominator.

Example: $42\frac{1}{3} + 4\frac{1}{4} = ?$

1. Add the whole numbers. $42 + 4 = 46$
2. Follow the steps to find a common denominator: $\frac{1}{3} \times \frac{4}{4} = \frac{4}{12}$ and $\frac{1}{4} \times \frac{3}{3} = \frac{3}{12}$.
3. Add the fractions. $\frac{4}{12} + \frac{3}{12} = \frac{7}{12}$, so the sum is $46\frac{7}{12}$.

Example: $19\frac{4}{5} - 12\frac{1}{8} = ?$

1. Follow the steps to find a common denominator: $\frac{4}{5} \times \frac{8}{8} = \frac{32}{40}$ and $\frac{1}{8} \times \frac{5}{5} = \frac{5}{40}$
2. Subtract the fractions. $\frac{32}{40} - \frac{5}{40} = \frac{27}{40}$; the difference is $\frac{27}{40}$.
3. Subtract the whole numbers. $19 - 12 = 7$, so the difference is $7\frac{27}{40}$.

Fractions — Subtracting Mixed Numbers with Regrouping

Sometimes, you have to regroup when you subtract.

Example: $21\frac{1}{5} - 3\frac{2}{3} = ?$

1. Find a common denominator for $\frac{1}{5}$ and $\frac{2}{3}$. $\frac{1}{5} \times \frac{3}{3} = \frac{3}{15}$ and $\frac{2}{3} \times \frac{5}{5} = \frac{10}{15}$
2. Set up the equation as shown below. You cannot subtract $\frac{10}{15}$ from $\frac{3}{15}$, so take 1 from 21 (make it 20) and then add 1 (in the form of $\frac{15}{15}$) to the fraction to get $\frac{18}{15}$. This works because you are not changing the value of the mixed number; you are only renaming it.

   $\longrightarrow \quad \longrightarrow \quad \longrightarrow$

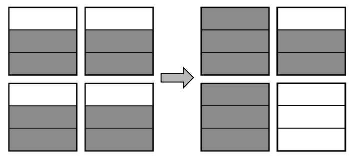
3. Subtract the whole numbers: $20 - 3 = 17$.
   Then subtract the fractions: $\frac{18}{15} - \frac{10}{15} = \frac{8}{15}$.
4. The difference is $17\frac{8}{15}$.

Help Pages

Fractions — Using a Model

Example: Use the fraction model to solve $4 \times \frac{2}{3}$.

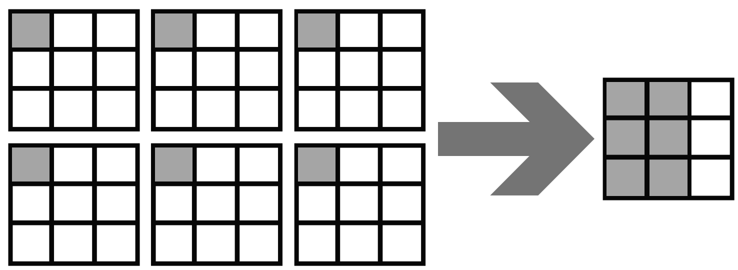
The first model shows that four groups of $\frac{2}{3}$ is $\frac{8}{3}$.



The second model shows that $\frac{8}{3}$ is equal to the mixed number $2\frac{2}{3}$.

Fractions — Multiplying a Fraction by a Whole Number

Example: What is $6 \times \frac{1}{9}$? Study the fraction model. It shows 6 one-ninths or $\frac{6}{9}$.



Every whole number can be written as itself over 1. For example, 6 is the same as $\frac{6}{1}$ because $\frac{6}{1}$ means $6 \div 1$ and that equals 6.

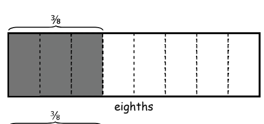
To multiply a fraction by a whole number, show the whole number in its fraction form and multiply the numerators and denominators. (Remember, any whole number can be expressed as a fraction; the whole number becomes the numerator, and 1 is the denominator. This works because any number divided by 1 is that number.)

Examples: $7 \times \frac{7}{1} = \frac{7}{1} \times \frac{7}{1} = \frac{49}{1} = 7$ $\quad 8 \times \frac{11}{12} = \frac{8}{1} \times \frac{11}{12} = \frac{88}{12} = 7\frac{4}{12} = 7\frac{1}{3}$ $\quad \frac{1}{3} \times 15 = \frac{1}{3} \times \frac{15}{1} = \frac{15}{3} = 5$

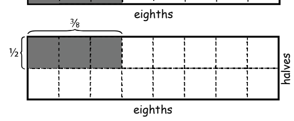
Fractions — Multiplying a Fraction by a Fraction

Example: What is $\frac{1}{2}$ of $\frac{3}{8}$? To find out, write a multiplication equation: $\frac{1}{2} \times \frac{3}{8} = ?$

This model shows $\frac{3}{8}$.



This model shows $\frac{1}{2}$ of $\frac{3}{8}$.



You can see that $\frac{1}{2}$ of $\frac{3}{8}$, or $\frac{1}{2}$ times $\frac{3}{8}$, is $\frac{3}{16}$. (When you see the word *of,* it usually means you will multiply.)

To find the product of two fractions, multiply the numerator by the numerator and the denominator by the denominator.

Examples: $\frac{4}{5} \times \frac{1}{3} = \frac{4}{15}$ $\quad \frac{2}{5} \times \frac{1}{2} = \frac{2}{10}$ $\quad \frac{3}{4} \times \frac{1}{9} = \frac{3}{36}$

Fractions — Converting a Mixed Number to an Improper Fraction

Example: Multiply $\frac{2}{5} \times 2\frac{1}{2}$. First, you must convert the mixed number $2\frac{1}{2}$ to an improper fraction.

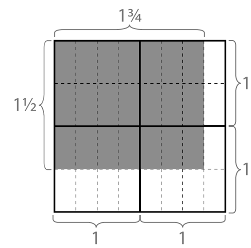
1. Multiply the whole number by the denominator. $2 \times 2 = 4$
2. Add the numerator. $4 + 1 = 5$
1. Use that sum as the new numerator and keep the denominator. The improper fraction is $\frac{5}{2}$.

$$\frac{2}{5} \times \frac{5}{2} = \frac{10}{10} = 1$$

Help Pages

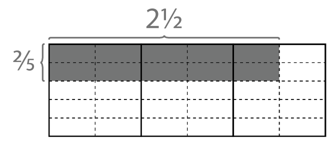
Fractions — Multiplying Mixed Numbers

Example: Study the fraction model. It shows $1\frac{1}{2}$ sets of $1\frac{3}{4}$. The model shows that $1\frac{1}{2}$ of $1\frac{3}{4}$ is $2\frac{5}{8}$. Every 8 subsections make one whole. So, count 8 subsections and 8 more. That makes 2 whole squares. There are 5 subsections left over, so that makes $2\frac{5}{8}$.



Example: What is $\frac{2}{5}$ of $2\frac{1}{2}$? Study the fraction model. This model shows that $2\frac{1}{2}$ is 5 halves.

2 of the 5 halves equal 1 whole rectangle, so $\frac{2}{5}$ of $2\frac{1}{2}$ is 1. To check this, study the previous section titled "Fractions - Converting a Mixed Number to an Improper Fraction."



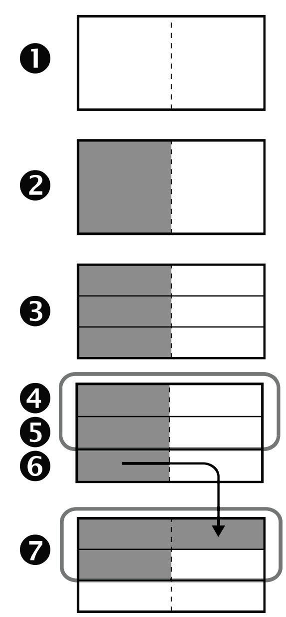
Fractions — Using a Fraction Model to Divide a Fraction by a Fraction

Example 1: How many $\frac{2}{3}$ are in $\frac{1}{2}$? Write an equation: $\frac{1}{2} \div \frac{2}{3} = ?$ Draw a model to solve the equation.

1. Draw a shape and divide it equally into the number of parts shown in the denominator of the dividend. The dividend is $\frac{1}{2}$ and has a denominator of 2, so divide the rectangle into 2 equal halves.
2. Shade the portion named by the dividend's numerator (1).
3. Use the denominator of the divisor to divide the shape again. The divisor is $\frac{2}{3}$ and has a denominator of 3, so divide the rectangle into 3 equal parts.
4. Circle the portion of the whole figure that represents the divisor. The divisor is $\frac{2}{3}$, so circle two-thirds of the whole figure.
5. Count all the shaded sections in the whole figure. This is the numerator of your quotient (3).
6. Count the sections in the portion that is circled. This is the denominator of your quotient (4). The quotient is $\frac{3}{4}$.
7. The arrow shows another way to visualize the answer. By moving all shaded areas inside of the circled portion, you can see $\frac{3}{4}$.

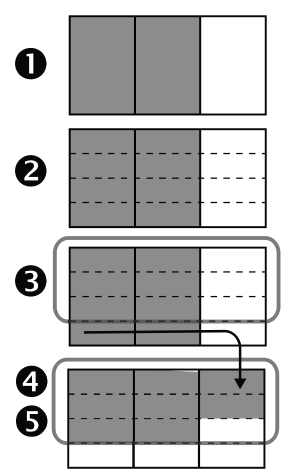
Interpreting the Quotient

8. To check your answer, multiply $\frac{3}{4}$ by $\frac{2}{3}$. $\frac{3}{4} \times \frac{2}{3} = \frac{6}{12} = \frac{1}{2}$



Example 2: $\frac{2}{3} \div \frac{3}{4} = ?$

1. Make a model; divide it into 3 parts, and shade $\frac{2}{3}$.
2. Divide the model into fourths.
3. Circle $\frac{3}{4}$.
4. Count all the shaded sections in the whole figure. This is the numerator of your quotient (8).
5. Count the sections in the portion that is circled. This is the denominator of your quotient (9). There are 8 portions shaded and 9 portions are in the circled part. The quotient is $\frac{8}{9}$.
6. Check: $\frac{3}{4} \times \frac{8}{9} = \frac{24}{36} = \frac{2}{3}$



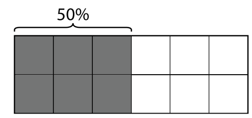
Help Pages

Ratio, Percent, and Proportion

Percent literally means "per hundred." To find 50% of a number, multiply the number by $\frac{50}{100}$. Study the model.

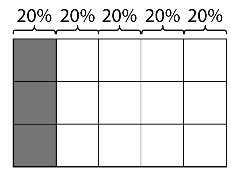
Example: Find 50% of 12.

1. The diagram shows 12 sections. Since 50% equals $\frac{1}{2}$, count half of the sections to find the answer of 6.
2. Multiply. $\frac{12}{1} \times \frac{50}{100} = \frac{600}{100} = 6$



Example: If 3 blocks (shaded part) are 20% of the value, what is 100% of the value?

1. The model helps show that 3 is 20% of unknown value.
2. Find out how many 20 percents are in 100%.
3. If 5 groups of 20% equal 100%, then 5 groups of 3 equals 15.
4. 100% of the value is 15 blocks.



A **ratio** is used to compare two numbers. There are three ways to write a ratio comparing 5 and 7.

1. Word form → 5 to 7
2. Ratio form → 5 : 7
3. Fraction form → $\frac{5}{7}$

All are read as "five to seven."

You must make sure that all ratios are written in simplest form. (Just like fractions!)

A **proportion** is a statement that two ratios are equal to each other. There are two ways to solve a proportion when a number is missing.

One way to solve a proportion is by using cross products. **Example**: $\frac{14}{20} = \frac{21}{n}$. Solve for n.

1. Multiply downward on each diagonal.
2. Make the product of each diagonal equal to each other.
3. Solve for the missing variable.

$$\frac{14}{20} = \frac{21}{n}$$
$$20 \times 21 = 14 \times n$$
$$420 = 14n$$
$$\frac{420}{14} = \frac{\cancel{14}n}{\cancel{14}}$$
$$30 = n$$
$$So, \frac{14}{20} = \frac{21}{30}.$$

Another way to solve a proportion is already familiar to you. You can use the equivalent fraction method.

Example: $\frac{5}{8} = \frac{n}{64}$. Solve for n.

1. To make $\frac{n}{64}$ equivalent to $\frac{5}{8}$, multiply both numerator and denominator by 8. Remember $\frac{8}{8}$ is another name for 1.
2. $\frac{5}{8} \times \frac{8}{8} = \frac{40}{64}$, $n = 40$

$$\overset{\times 8}{\frac{5}{8} = \frac{n}{64}}$$
$$\times 8$$
$$n = 40$$
$$\text{So, } \frac{5}{8} = \frac{40}{64}.$$

The equivalent fraction method can be used with percent problems, as well.

Example: 40 of 50 sixth graders went on a field trip. What percent of the sixth graders went on the trip?

1. Write the given information as a fraction.
2. Set up the proportion. *Percent* literally means "per hundred" so the denominator for the second fraction will be 100.
3. The ratio represents part to whole. 40 out of 50 sixth graders is equal to the unknown percent to 100 percent (or the whole).
4. $\frac{40}{50} \times \frac{2}{2} = \frac{80}{100}$; $\frac{80}{100}$ means 80 per 100 or 80%

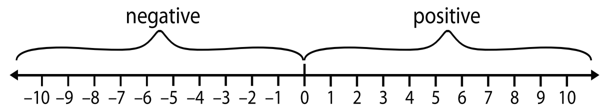
40 of 50 is $\frac{40}{50}$

$$\overset{\times 2}{\frac{40}{50} = \frac{n}{100}}$$
$$\times 2$$
$$n = 80$$
$$\text{So, } \frac{40}{50} = \frac{80}{100}$$
$$\frac{80}{100} = 80\%$$

Help Pages

Positive and Negative Numbers

Integers include the counting numbers, their opposites (negative numbers) and zero.



When **ordering integers**, arrange them either from least to greatest or from greatest to least. The further a number is to the right on the number line, the greater its value. For example, 9 is further to the right than 2, so 9 is greater than 2.

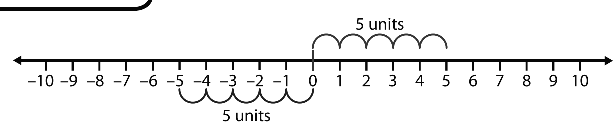
Example: Order these integers from **least to greatest**: −10, 9, −25, 36, 0

> Remember, the smallest number will be the one farthest to the left on the number line. −25, then −10, then 0. Next will be 9, and finally 36.
>
> Answer: −25, −10, 0, 9, 36

Example: Put these integers in order from greatest to least: −94, −6, −24, −70, −14

> Now the greatest value (farthest to the right) will come first and the smallest value (farthest to the left) will come last.
>
> Answer: −6, −14, −24, −70, −94

The **absolute value of a number** is its distance from zero on a number line. It is always positive.



The absolute value of both −5 and +5 is 5, because both are 5 units away from zero. The symbol for the absolute value of −5 is $|-5|$. Examples: $|-3| = 3$; $|8| = 8$

Exponents

An exponent is a small number to the upper right of another number (the **base**). Exponents are used to show that the base is a repeated factor.

Example: 2^4

> 2^4 is read "two to the fourth power."
>
> The base (2) is a factor many times.
>
> The exponent (4) tells how many times the base is a factor.
>
> $2^4 = 2 \times 2 \times 2 \times 2 = 16$

Example: 9^3

> 9^3 is read "nine to the third power" and means $9 \times 9 \times 9 = 729$

Help Pages

Evaluating Algebraic Expressions

An **expression** is a number, a variable, or any combination of these, along with operation signs and grouping symbols. An expression never includes an equal sign.

Five examples of expressions are 5, x, $(x + 5)$, $(3x + 5)$, and $(3x^2 + 5)$.

To **evaluate an expression** means to calculate its value using specific variable values.

1. To evaluate, put the values of x and y into the expression.
2. Use the rules for integers to calculate the value of the expression.

Example: Evaluate $2x + 3y + 5$ when $x = 2$ and $y = 3$.

$2(2) + 3(3) + 5 = ?$
$4 + 9 + 5 = ?$
$13 + 5 = 18$

The expression has a value of 18.

Example: Find the value of $\frac{xy}{3}+2$ when $x = 6$ and $y = 4$.

$\frac{6(4)}{3}+2=?$
$\frac{24}{3}+2=?$
$8+2=10$

The expression has a value of 10.

Algebraic Expressions and Equations

Often a relationship is described using verbal (English) phrases. In order to work with the relationship, you must first **translate it into an algebraic expression or equation**. In most cases, word clues will be helpful. Some examples of verbal phrases and their corresponding algebraic expressions or equation are written below.

Verbal Phrase	Algebraic Expression/Equation
Ten more than a number	$x + 10$
The sum of a number and five	$x + 5$
A number increased by seven	$x + 7$
Six less than a number	$x - 6$
A number decreased by nine	$x - 9$
The difference between a number and four	$x - 4$
The difference between four and a number	$4 - x$
Five times a number	$5x$
Eight times a number, increased by one	$8x + 1$
The product of a number and six is twelve.	$6x = 12$
The quotient of a number and 10	$\frac{x}{10}$
The quotient of a number and two, decreased by five	$\frac{x}{2}-5$

In most problems, the word "is" tells you to put in an equal sign. When working with fractions and percents, the word "of" generally means multiply. Look at the example below.

Example: One half <u>of</u> a number is fifteen.

- You can think of it as "one half <u>times</u> a number <u>equals</u> fifteen."
- When written as an algebraic equation, it is $\frac{1}{2}x=15$.

Help Pages

Order of Operations

When evaluating a numerical expression containing multiple operations, use a set of rules called the order of operations. The **order of operations** determines the order in which operations should be performed.

The Order of Operations is as follows:

Step 1: Parentheses
Step 2: Exponents
Step 3: Multiplication/Division (left to right in the order that they occur)
Step 4: Addition/Subtraction (left to right in the order that they occur)

If parentheses are enclosed within other parentheses, work from the inside out.

To remember the order, use the mnemonic device **"Please Excuse My Dear Aunt Sally."**

Use the following examples to help you understand how to use the order of operations.

Example: $2^2 + 6 - 5$

To evaluate this expression, work through the steps using the order of operations.

- Since there are no parentheses skip Step 1.
- According to Step 2, do exponents next.
- Step 3 is multiplication and division.
- Next, Step 4 says to do addition and subtraction.

$2^2 + 6 \times 5$ ⟵ Step ❷ Exponents
$4 + 6 \times 5$ ⟵ Step ❸ Multiplication and Division
$4 + 30$ ⟵ Step ❹ Addition and Subtraction
34

Example: $42 \div 6 - 3 + 4 - 16 \div 2$

- Do multiplication and division first (in the order they occur).
- Do addition and subtraction next (in the order they occur).

$42 \div 6 - 3 + 4 - 16 \div 2$ ⟵ Step ❸ Multiply and Divide (In the order they occur.)
$7 - 3 + 4 - 8$ ⟵ Step ❹ Add and Subtract (In the order they occur.)
0

Example: $5(2 + 4) + 15 \div (9 - 6)$

- Do operations inside of parentheses first.
- Do multiplication and division first (in the order they occur).
- Do addition and subtraction next (in the order they occur).

$5(2+4)+15 \div (9-6)$ ⟵ Step ❶ Parentheses (Do operations inside first)
$5(6)+15 \div (3)$ ⟵ Step ❸ Multiply and Divide (In the order they occur.)
$30+5$ ⟵ Step ❹ Multiply and Divide (In the order they occur.)
35

Example: $4[3 + 2(7 + 5) - 7]$

- Brackets are treated as parentheses. Start from the innermost parentheses first.
- Then work inside the brackets.

$4[3+2(7+5)-7]$ ⟵ Step ❶ Parentheses (including brackets) Do inside innermost parentheses first. Then work inside the brackets.
$4[3+2(12)-7]$
$4[3+24-7]$
$4[20]$
80

Example: Place grouping symbols to make this equation true. $36 \div 4 + 5 = 4$

	Without Grouping Symbols	With Grouping Symbols	
Without parentheses the first step is 36÷4. ⟶	$36 \div 4 + 5 = ?$	$36 \div (4 + 5) = ?$	⟵ With parentheses the first step is 4 + 5.
	$36 \div 4 + 5 = ?$	$36 \div 9 = ?$	
	$9 + 5 = 14$	$36 \div 9 = 4$	

Help Pages

Simplifying Algebraic Expressions

Expressions which contain like terms can also be simplified. **Like terms** are those that contain the same variable to the same power. $2x$ and $-4x$ are like terms; $3n^2$ and $8n^2$ are like terms; $5y$ and y are like terms; the numbers 3 and 7 are like terms. An expression sometimes begins with like terms. This process for **simplifying expressions** is called **combining like terms**. When combining like terms, first identify the like terms. Then, simply add the like terms to each other and write the results together to form a new expression.

Example: Simplify $2x + 5y + 9 + 5x + 3y + 2$.

> The like terms are $2x$ and $5x$, $5y$ and $3y$, and 9 and 2.
> $2x + 5x = 7x$, $5y + 3y = 8y$, and $9 + 2 = 11$.
> The result is $7x + 8y + 11$.

Example: Use the distributive property, and then simplify $2(4a + 2b + 6) + 2a$.

> Distribute: $8a + 4b + 12 + 2a$
> Simplify: $8a + 2a + 4b + 12$
> $10a + 4b + 12$

Inequalities

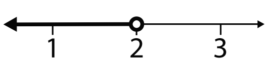
An inequality is a statement that one quantity is different than another (usually larger or smaller). The symbols showing inequality are <, >, ≤, and ≥ (less than, greater than, less than or equal to, and greater than or equal to.) An inequality is formed by placing one of the inequality symbols between two expressions. The solution of an inequality is the set of numbers that can be substituted for the variable to make the statement true.

Example: A simple inequality is $x \le 4$. The solution set, {..., 2, 3, 4}, includes all numbers that are either less than four or equal to four.

> Inequalities can be graphed on a number line. For < and >, use an open circle; for ≤ and ≥, use a closed circle.

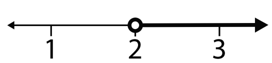
Example 1

$x < 2$



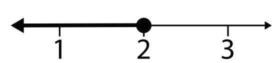
Example 2

$x > 2$



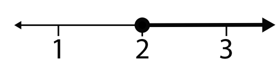
Example 3

$x \le 2$



Example 4

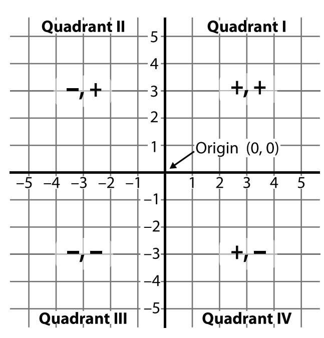
$x \ge 2$

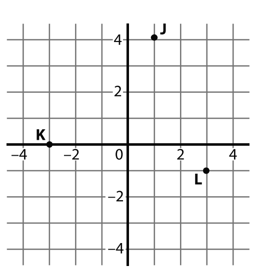


Graphing on a Coordinate Plane

A **coordinate plane** is formed by the intersection of a horizontal number line, called the ***x*-axis**, and a vertical number line, called the ***y*-axis.** The axes meet at the point (0, 0), called the **origin**, and divide the coordinate plane into four **quadrants**.

Points are represented by ordered pairs of numbers, (x, y). The first number in an **ordered pair** is the x-coordinate; the second number is the y-coordinate. In the point **(–4, 1)**, –4 is the x-coordinate and 1 is the y-coordinate.





When graphing on a coordinate plane, always move on the x-axis first (right or left), and then move on the y-axis (up or down).

- The coordinates of point J are (1, 4).
- The coordinates of point K are (–3, 0).
- The coordinates of point L are (3, –1).

Help Pages

Finding the Mean Absolute Deviation

The **mean absolute deviation** (MAD) is the mean (average) of the differences between each data point and the mean of all the data points. To find the mean absolute deviation of a set of data, follow these steps.

Use this data set: 3 4 4 4 5 6 6 8

1. Find the mean of the data set. Add all the numbers and divide by the number of data points.

   $3 + 4 + 4 + 4 + 5 + 6 + 6 + 8 = 40$ $40 \div 8 = 5$ Mean = 5

2. List each data point and its deviation (absolute value of its difference from the mean). For example, the mean is 5, so the data point 8 has a deviation of 3 because 8 is 3 points from 5.

Data Point	3	4	4	4	5	6	6	8
Deviation	2	1	1	1	0	1	1	3

3. Add the deviations, or differences. $2 + 1 + 1 + 1 + 0 + 1 + 1 + 3 = 10$
4. Divide by the number of data points. This is the average. $10 \div 8 = 1.25$ MAD = 1.25

Interpreting Data — Box-and-Whisker Plots

A **box-and-whisker plot**, or **box plot**, is a way of showing the distribution of data. The data is ordered from least to greatest. The median separates the data into an upper and lower half. Then, the data is divided into fourths using the median and lower and upper quartiles. The lower quartile is the median of the lower half of the data set. The upper quartile is the median of the upper half of the data set. A box extends from the lower quartile to the upper quartile and includes the median. The minimum and maximum values are represented by horizontal lines called "whiskers."

Steps for Making a Box Plot

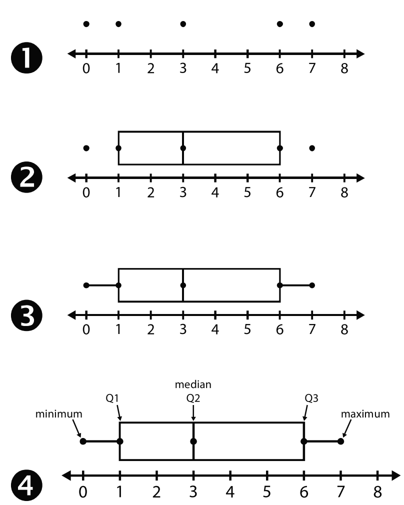
Example: Make a box plot for this set of data: 0 3 2 7 6 3 1

1. Order the data set and find the median (Q2) and the other two quartiles (Q1 and Q3).

   0 1 2 3 3 6 7

2. Draw a number line. Above the number line, plot the median, the two quartiles, and the minimum and maximum values.
3. Draw a box from the lower quartile to the upper quartile. The median is marked by a vertical line within the box.
4. Draw a horizontal line, or whisker, from the box to the maximum value and another line from the box to the minimum value.

The data is now divided into four parts. The length of the parts may differ, but each contains 25%, or ¼ of the data. The box represents the middle 50% of the set of data.

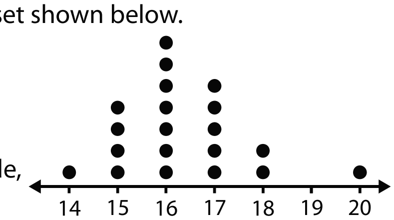


Interpreting Data — Dot Plots

A dot plot is a graphic that summarizes a set of data. **Example**: Consider the data set shown below.

20 16 18 15 17 17 16 16 18 16
17 15 16 17 16 16 15 14 15 17

In the list, the data is in an unorganized form. When the same data is organized as a dot plot, it is easier to see a few things. For example, you can see that 16 is the mode, the data is clustered around the mode, and there is a gap between 18 and 20.



In a dot plot, there is always a number line across the bottom. Above each number, there are dots and each dot represents an observation or data point. For example, the dot plot shown above may represent a class of 20 sixth graders. Each student scored between 14 and 20 points on a science fair project. The dot plot would show that only one student received a score of 20 and only one received a score of 14, while most students received a score of 15, 16, or 17.

Help Pages

Interpreting Data — Histograms

To make a **histogram**, start with data. The data may be organized into a frequency table.

Example:

Twenty students took a math pretest. There were 25 items on the test, and the test scores (the number correct) are shown below. A frequency table summarizes the data.

3	1	24	13	4
7	16	19	12	25
11	6	9	15	5
12	7	21	8	13

Intervals	Tally Marks	Frequency
1 – 5	////	4
6 – 10	~~////~~	5
11 – 15	~~////~~ /	6
16 – 20	//	2
21 – 25	///	3

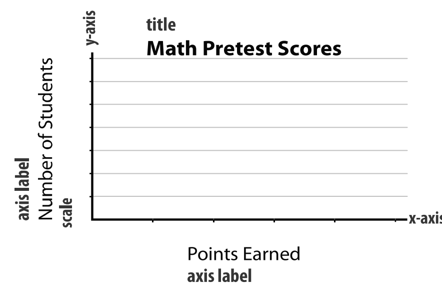
Here are the steps for drawing a histogram:

1. Give the histogram a title.
2. Draw a horizontal axis and a vertical axis. Label each axis.
3. Choose a scale of measure that suits the data. Mark equal intervals, or groupings, along the *x*-axis (horizontal axis). In this example, the data points range from 1 to 25, so these intervals are used: 1–5, 6–10, 11–15, 16–20, and 20–25.
4. Choose a scale of measure that suits the data and mark equal intervals along the *y*-axis (vertical axis). For example, there are 25 students, but the highest frequency for any interval was 6, so the *y*-axis is divided into equal sections from 0 to 6.
5. For each interval, draw a bar that reflects the value for that interval. For example, if there are 4 data points for the interval 0–5, draw the bar for 0–5 up to line 4 on the *y*-axis (vertical axis). No spaces are left between the bars.

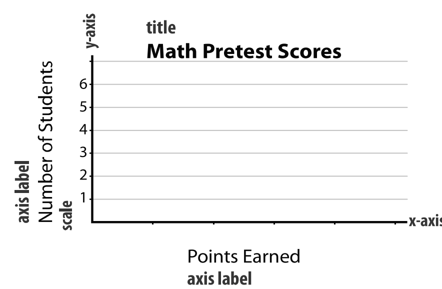
❶

title
Math Pretest Scores

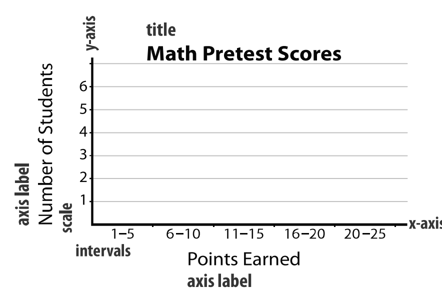
❷



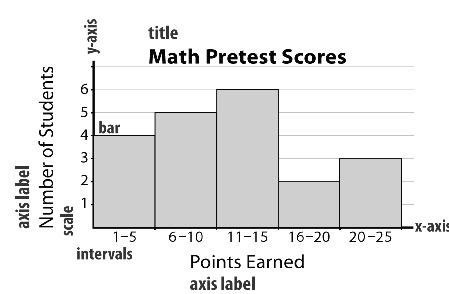
❸



❹



❺



Appendix and Help Pages Index

Appendix and Help Pages Index