Name ______________________________ Date ______________

# Measures of Center

A **measure of center** is a measure that represents the center, or typical value, of a data set. The *mean*, *median*, and *mode* are measures of center.

| Mean | Median | Mode |
|---|---|---|
| The **mean** of a numerical data set is the sum of the data divided by the number of data values.<br>The symbol $\bar{x}$ represents the mean. It is read as "$x$-bar." | The **median** of a numerical data set is the middle number when the values are written in numerical order. When a data set has an even number of values, the median is the mean of the two middle values. | The **mode** of a data set is the value or values that occur most often. There may be one mode, no mode, or more than one mode.<br>Mode is the only measure of center that can represent a nonnumerical data set. |

**Example 1** **The table shows the sizes (in kilobytes) of emails in your inbox.**

| Email Sizes (kilobytes) | | | | |
|---|---|---|---|---|
| 1.5 | 13 | 1.8 | 1.9 | 9.1 |
| 2.4 | 2.8 | 9.2 | 2 | 11 |
| 5.6 | 5 | 4.9 | 5.5 | 11 |

**a.** Find the mean, median, and model of the email sizes.

**b.** Which measure of center best represent the data? Explain.

**a. Mean** $\bar{x} = \dfrac{1.5 + 13 + 1.8 + \cdots + 5.5 + 11}{15} = 5.78$

**Median** 1.5, 1.8, 1.9, 2, 2.4, 2.8, 4.9, 5, 5.5, 5.6, 9.1, 9.2, 11, 11, 13 Order the data.

middle value

**Mode** 1.5, 1.8, 1.9, 2, 2.4, 2.8, 4.9, 5, 5.5, 5.6, 9.1, 9.2, 11, 11, 13 11 occurs most often.

▶ The mean is 5.78 kilobytes, the median is 5 kilobytes, and the mode is 11 kilobytes.

**b.** The median best represents the data. The mean and mode are both greater than most of the data.

## Practice

*Check your answers at BigIdeasMath.com.*

### Find the mean, median, and mode of the data set.

**1.** 35, 44, 40, 35, 54, 50

**2.** 14, 8, 10, 12, 13, 18, 6, 11, 16

**3.** 834, 654, 711, 590, 578, 861, 525

**4.** 4, 8, 5, 6, 4, 5, 4, 2, 6, 5, 4, 3, 5, 4, 6, 5

**5.** 0.6, 1.4, 0.7, 2, 1.5, 1.2, 1.4, 0.9, 0.7, 1.8

**6.** $7\frac{3}{4}, 8\frac{1}{2}, 8, 6\frac{3}{4}, 7\frac{3}{4}, 8, 8\frac{1}{4}, 8$

**7.** **APARTMENTS** The table shows the monthly rental prices for apartments in a city. Find the mean, median, and mode of the prices. Which measure of center best represents the data? Explain.

| Monthly Rental Prices | | | |
|---|---|---|---|
| \$535 | \$625 | \$850 | \$480 |
| \$895 | \$420 | \$500 | \$485 |
| \$1175 | \$490 | \$510 | \$550 |

Name ______________________________ Date ______________

# Rewriting Literal Equations

An equation that has two or more variables is called a **literal equation**. To rewrite a literal equation, solve for one variable in terms of the other variable(s).

**Example 1** **Solve each literal equation for $y$.**

**a.** $3x + 5y = 45$

$3x - 3x + 5y = 45 - 3x$ Subtract $3x$ from each side.

$5y = 45 - 3x$ Simplify.

$\dfrac{5y}{5} = \dfrac{45 - 3x}{5}$ Divide each side by 5.

$y = 9 - \dfrac{3}{5}x$ Simplify.

The rewritten literal equation is $y = 9 - \frac{3}{5}x$.

**b.** $2xy + 5y = 7$

$y(2x + 5) = 7$ Distributive Property

$\dfrac{y(2x + 5)}{2x + 5} = \dfrac{7}{2x + 5}$ Divide each side by $2x + 5$.

$y = \dfrac{7}{2x + 5}$ Simplify.

The rewritten literal equation is $y = \dfrac{7}{2x + 5}$.

**c.** $2x = \dfrac{3 + y}{y}$

$2x \cdot y = \dfrac{3 + y}{y} \cdot y$ Multiply each side by $y$.

$2xy = 3 + y$ Simplify.

$2xy - y = 3 + y - y$ Subtract $y$ from each side.

$2xy - y = 3$ Simplify.

$y(2x - 1) = 3$ Distributive Property

$\dfrac{y(2x - 1)}{2x - 1} = \dfrac{3}{2x - 1}$ Divide each side by $2x - 1$.

$y = \dfrac{3}{2x - 1}$ Simplify.

The rewritten literal equation is $y = \dfrac{3}{2x - 1}$.

## Practice

*Check your answers at BigIdeasMath.com.*

**Solve the literal equation for $y$.**

**1.** $x + 3y = 9$

**2.** $4x - 2y = 16$

**3.** $2x + 7y = 5$

**4.** $2x + 3y = 6$

**5.** $5x - 4y = 10$

**6.** $x - 2y = 8$

**7.** $2xy - 6 = 8x$

**8.** $4x = 9y + xy$

**9.** $4yz = 3y - 8x$

**10.** $2xy = 3z + 4y$

**11.** $\dfrac{2 + 7y}{y} = x$

**12.** $3x = \dfrac{5 + y}{y}$

Name ______________________________ Date ______________

# Properties of Exponents

| Product of Powers | Power of a Product | Power of a Power | |
|---|---|---|---|
| $a^m \cdot a^n = a^{m+n}$ Add exponents. | $(ab)^m = a^m b^m$ Find the power of each factor. | $(a^m)^n = a^{mn}$ Multiply exponents. | |
| **Quotient of Powers** | **Power of a Quotient** | **Negative Exponent** | **Zero Exponent** |
| $\frac{a^m}{a^n} = a^{m-n}, a \neq 0$ Subtract exponents. | $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}, b \neq 0$ Find the power of the numerator and the power of the denominator. | $a^{-n} = \frac{1}{a^n}, a \neq 0$ | $a^0 = 1, a \neq 0$ |

**Example 1** Evaluate (a) $4.9^0$ and (b) $(-3)^{-4}$.

**a.** $4.9^0 = 1$ Definition of zero exponent

**b.** $(-3)^{-4} = \frac{1}{(-3)^4}$ Definition of negative exponent

$= \frac{1}{81}$ Evaluate power.

**Example 2** Simplify each expression. Write your answer using only positive exponents.

**a.** $2^3 \cdot 2^4 = 2^7 = 128$

**b.** $\frac{5^9}{5^6} = 5^{9-6} = 5^3 = 125$

**c.** $\frac{12y^0}{x^{-7}} = 12y^0x^7 = 12x^7$

**d.** $\frac{x^6 \cdot x^2}{x^5} = \frac{x^{6+2}}{x^5} = x^{8-5} = x^3$

**e.** $(z^4)^2 = z^{4 \cdot 2} = z^8$

**f.** $(6mn)^3 = 6^3 \cdot m^3 \cdot n^3 = 216m^3n^3$

**g.** $\left(\frac{y}{3}\right)^4 = \frac{y^4}{3^4} = \frac{y^4}{81}$

**h.** $\frac{10x^6y^{-2}}{5x^3y} = \frac{10}{5}x^{(6-3)}y^{(-2-1)} = 2x^3y^{-3} = \frac{2x^3}{y^3}$

## Practice

*Check your answers at BigIdeasMath.com.*

### Evaluate the expression.

**1.** $(-9)^0$

**2.** $-8^{-1}$

**3.** $4^{-3}$

**4.** $\frac{-5^0}{3^{-2}}$

### Simplify the expression. Write your answer using only positive exponents.

**5.** $2^9 \cdot 2^{-6}$

**6.** $-\frac{10^8}{10^{12}}$

**7.** $y \cdot y^{-5}$

**8.** $\frac{x^7}{x^{-7}}$

**9.** $-5x^7 \cdot x^{-11} \cdot 2x^4$

**10.** $\frac{x^{-2}}{5z^0}$

**11.** $(w^2)^{-3}$

**12.** $(8xy)^2$

**13.** $3x^5 \cdot (-2x)^4$

**14.** $(-5m^2n^{-1})^3$

**15.** $\frac{z^8}{z^{-2} \cdot z^9}$

**16.** $\frac{(x^5)^3}{x^6}$

**17.** $\left(\frac{3x}{2}\right)^3$

**18.** $\left(\frac{6x^4}{5y}\right)^{-2}$

**19.** $\frac{xy^{-2}}{x^4y^{-3}}$

**20.** $\frac{8xy}{6x^5yz^{-2}}$

**21.** **METRIC SYSTEM** There are $10^6$ micrometers in a meter and $10^3$ meters in a kilometer. How many micrometers are there in $10^6$ kilometers?

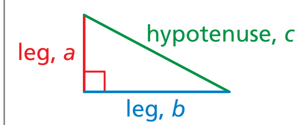
Name ______________________________ Date ______________

# The Pythagorean Theorem

In a right triangle, the **hypotenuse** is the side opposite the right angle. The **legs** are the two sides that form the right angle.

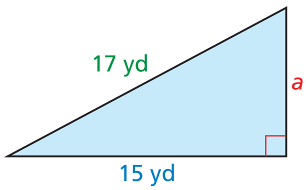
The **Pythagorean Theorem** states that in any right triangle, the sum of the squares of the lengths of the legs is equal to the square of the length of the hypotenuse.

**Pythagorean Theorem**




$$a^2 + b^2 = c^2$$

**Example 1** **Find the missing length of the triangle.**

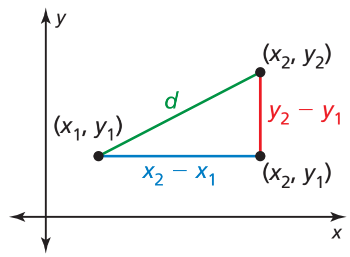



| | |
|---|---|
| $a^2 + b^2 = c^2$ | Write the Pythagorean Theorem. |
| $a^2 + 15^2 = 17^2$ | Substitute 15 for *b* and 17 for *c*. |
| $a^2 + 225 = 289$ | Evaluate powers. |
| $a^2 = 64$ | Subtract 225 from each side. |
| $a = 8$ | Take positive square root of each side. |

▶ The missing length is 8 yards.

You can use the Pythagorean Theorem to develop the *Distance Formula*. You can use the **Distance Formula** to find the distance $d$ between any two points $(x_1, y_1)$ and $(x_2, y_2)$ in a coordinate plane.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$




**Example 2** **Find the distance between the two points.**

**a.** $(3, 6), (-2, 4)$

Let $(x_1, y_1) = (3, 6)$ and $(x_2, y_2) = (-2, 4)$.

$$\begin{aligned} d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(-2 - 3)^2 + (4 - 6)^2} \\ &= \sqrt{25 + 4} \\ &= \sqrt{29} \end{aligned}$$

**b.** $(0, 5), (4, -1)$

Let $(x_1, y_1) = (0, 5)$ and $(x_2, y_2) = (4, -1)$.

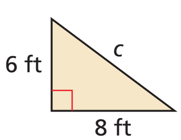
$$\begin{aligned} d &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\ &= \sqrt{(4 - 0)^2 + (-1 - 5)^2} \\ &= \sqrt{16 + 36} \\ &= 2\sqrt{13} \end{aligned}$$

## Practice

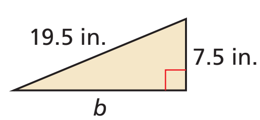
*Check your answers at BigIdeasMath.com.*

### Find the missing length of the triangle.

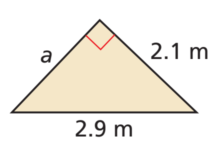
**1.**




**2.**




**3.**




### Find the distance between the two points.

**4.** $(0, 0), (4, 3)$

**5.** $(0, -7), (5, 5)$

**6.** $(4, 2), (-1, 5)$

**7.** $(-5, 6), (-7, -2)$

**8.** $(-1, -3), (9, 0)$

**9.** $(-4, -4), (-1, -1)$

# GEOMETRY REFERENCE SHEET

## COORDINATE FORMULAS

Given Points: $A(x_1, y_1)$, $B(x_2, y_2)$

Distance: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Slope: $m = \dfrac{rise}{run} = \dfrac{y_2 - y_1}{x_2 - x_1}$

Midpoint: $M = \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$

## SYMBOLS + MEANINGS

| | | | |
|---|---|---|---|
| $\angle$ | Angle | $\cong$ | Congruent |
| $\overset{\frown}{AB}$ | Arc *AB* | $^\circ$ | Degree |
| $m\overset{\frown}{AB}$ | Measure of arc *AB* | $\parallel$ | Parallel |
| $\overleftrightarrow{AB}$ | Line *AB* | $\perp$ | Perpendicular |
| $\overrightarrow{AB}$ | Ray *AB* | $\sim$ | Similar |
| $\overline{AB}$ | Line segment *AB* | $\triangle$ | Triangle |
| $AB$ | Length of line segment *AB* | | |

## VOLUME FORMULAS

pyramid: $V = \frac{1}{3}\pi r^2 h$

cone: $V = \frac{1}{3}Bh$

sphere: $V = \frac{4}{3} r^3$

cylinder: $V = \pi r^2 h$

prism: $V = Bh$

## AREA FORMULAS

triangle: $A = \frac{1}{2}bh$

rectangle: $A = lw$

trapezoid: $A = \frac{1}{2}h(b_1 + b_2)$

parallelogram: $A = bh$

circle: $A = \pi r^2$

## TRIANGLE CONGRUENCE

SSS SAS ASA AAS HL

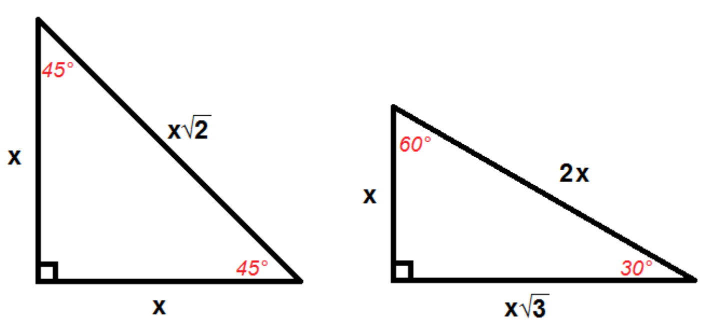
## TRIANGLE SIMILARITY

SSS SAS AA

| |
|---|
| $1^3 = 1$ |
| $2^3 = 8$ |
| $3^3 = 27$ |
| $4^3 = 64$ |
| $5^3 = 125$ |
| $6^3 = 216$ |
| $7^3 = 343$ |
| $8^3 = 512$ |
| $9^3 = 729$ |
| $10^3 = 1000$ |
| $11^3 = 1331$ |
| $12^3 = 1728$ |

| |
|---|
| $\sqrt{4} = 2$ |
| $\sqrt{9} = 3$ |
| $\sqrt{16} = 4$ |
| $\sqrt{25} = 5$ |
| $\sqrt{36} = 6$ |
| $\sqrt{49} = 7$ |
| $\sqrt{64} = 8$ |
| $\sqrt{81} = 9$ |
| $\sqrt{100} = 10$ |
| $\sqrt{121} = 11$ |
| $\sqrt{144} = 12$ |
| $\sqrt{169} = 13$ |
| $\sqrt{196} = 14$ |
| $\sqrt{225} = 15$ |
| $\sqrt{256} = 16$ |
| $\sqrt{289} = 17$ |
| $\sqrt{324} = 18$ |
| $\sqrt{361} = 19$ |

## SPECIAL RIGHT TRIANGLES

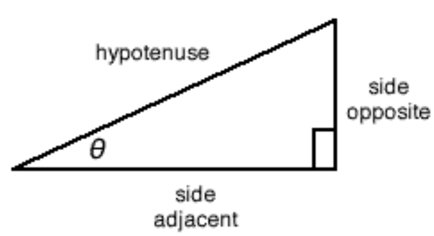



## TRIGONOMETRIC RATIOS

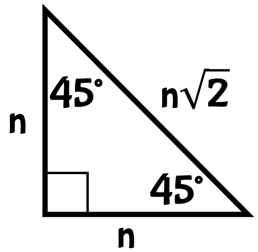
sin $\dfrac{opposite}{hypotenuse}$ $s = \dfrac{o}{h}$ SOH

cos $\dfrac{adjacent}{hypotenuse}$ $c = \dfrac{a}{h}$ CAH

tan $\dfrac{opposite}{adjacent}$ $t = \dfrac{o}{a}$ TOA




| | | |
|---|---|---|
| 75% | 3/4 | 0.75 |
| 66.66% | 2/3 | 0.66 |
| 50% | 1/2 | 0.50 |
| 33.33% | 1/3 | 0.33 |
| 25% | 1/4 | 0.25 |
| 20% | 1/5 | 0.20 |
| 12.5% | 1/8 | 0.125 |
| 10% | 1/10 | 0.10 |
| 5% | 1/20 | 0.05 |




# Special Right Triangle Maze

Start at the "Start Here" box. <u>Solve for x</u>, then follow the path with the correct answer. You have completed the maze when you reach the "Finished" box.