Ratio

a comparison of any two quantities

SET A | **SET B**
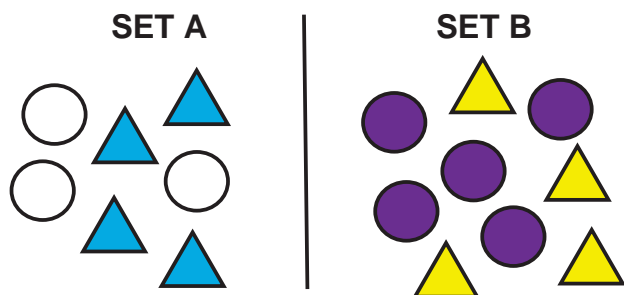
▲ to ◯	**4 to 3**
▲ to all of set A	$\frac{4}{7}$
◯ to ●	**3:5**
set B to set A	**9 to 7 or 9:7**

Absolute Value

$$|5| = 5 \qquad |-5| = 5$$

5 units   5 units

-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6
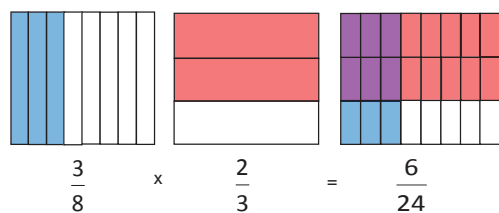
distance a number is from zero

Fraction Multiplication

How much is $\frac{3}{8}$ of $\frac{2}{3}$?

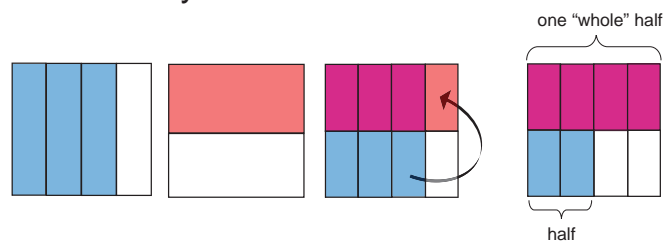$\frac{3}{8}$ x $\frac{2}{3}$ = $\frac{6}{24}$

$$\frac{3}{8} \times \frac{2}{3} = \frac{6}{24} = \frac{1}{4}$$

Fraction Division

$$\frac{3}{4} \div \frac{1}{2}$$

How many halves are in three-fourths?
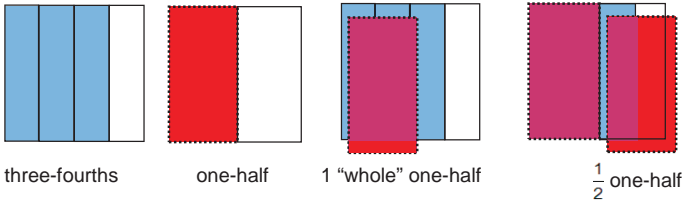
one "whole" half

half

There are $1\frac{1}{2}$ halves in three-fourths.

$$\frac{3}{4} \div \frac{1}{2} = 1\frac{1}{2}$$

Fraction Division

$$\frac{3}{4} \div \frac{1}{2}$$

How many halves are in three-fourths?

three-fourths   one-half   1 "whole" one-half $\frac{1}{2}$ one-half

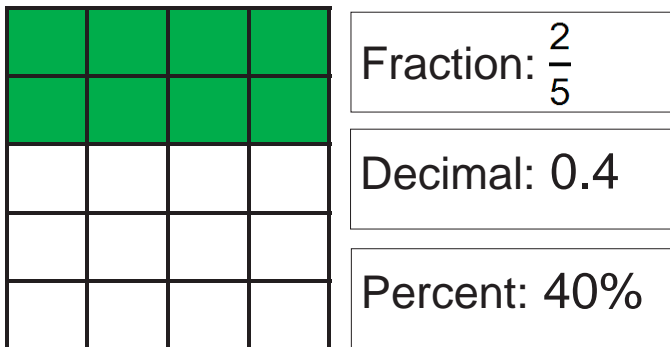There are $1\frac{1}{2}$ halves in three-fourths.

$$\frac{3}{4} \div \frac{1}{2} = 1\frac{1}{2}$$

Percent

Per hundred

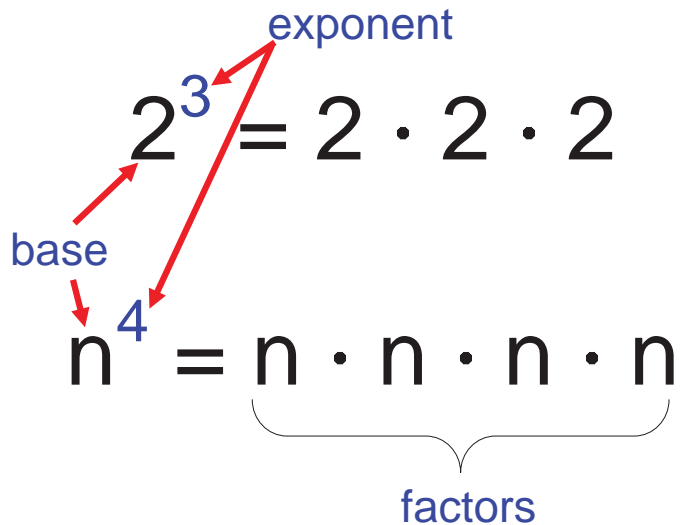$$56\% = \frac{56}{100} = \frac{14}{25} = 0.56$$

Equivalent Relationships

| Fraction: $\frac{2}{5}$ |
| Decimal: 0.4 |
| Percent: 40% |

Exponential Form

exponent

$$2^3 = 2 \cdot 2 \cdot 2$$

base

$$n^4 = n \cdot n \cdot n \cdot n$$

factors

Perfect Squares

$$0^2 = 0 \cdot 0 = \mathbf{0}$$
$$1^2 = 1 \cdot 1 = \mathbf{1}$$
$$2^2 = 2 \cdot 2 = \mathbf{4}$$
$$3^2 = 3 \cdot 3 = \mathbf{9}$$
$$4^2 = 4 \cdot 4 = \mathbf{16}$$
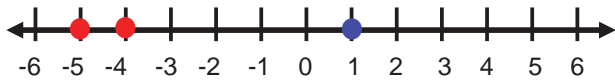$$5^2 = 5 \cdot 5 = \mathbf{25}$$

$$\sqrt{16} = \sqrt{4 \cdot 4} = 4$$

perfect square

Powers of Ten

	Meaning	Value
10^4	$10 \cdot 10 \cdot 10 \cdot 10$	10,000
10^3	$10 \cdot 10 \cdot 10$	1000
10^2	$10 \cdot 10$	100
10^1	10	10
10^0	1	1
10^{-1}	$\frac{1}{10}$	0.1
10^{-2}	$\frac{1}{10} \cdot \frac{1}{10}$	$\frac{1}{100} = 0.01$
10^{-3}	$\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}$	$\frac{1}{1000} = 0.001$
10^{-4}	$\frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10} \cdot \frac{1}{10}$	$\frac{1}{10,000} = 0.0001$

Comparing Integers

-6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6

-5 < 1 or 1 > -5

-4 > -5 or -5 < -4

Order of Operations

Grouping Symbols
$$\begin{cases} (\ ) \\ \{\ \} \\ [\ ] \\ |abs| \\ \text{Fraction bar} \end{cases}$$

Exponents

Multiplication
Division
} Left to right

Addition
Subtraction
} Left to right

Square Root

radical symbol

$$\sqrt{36} = 6$$

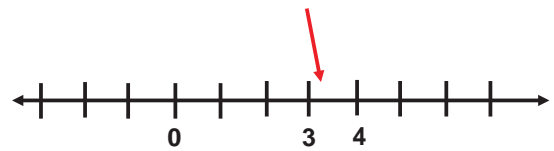$$\sqrt{36} = \sqrt{6 \cdot 6} = \sqrt{6^2} = 6$$

Squaring a number and taking a square root are inverse operations.

$$-\sqrt{36} = -6$$
$$(-6)^2 = -6 \cdot -6 = 36$$

Square Root
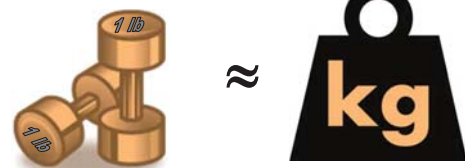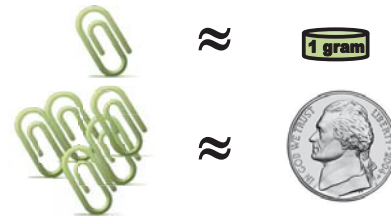
$$\sqrt{10}$$

between $\sqrt{9}$ and $\sqrt{16}$

Ballpark Comparisons
Length

1 inch or
2.5 centimeter

Meter stick

Yardstick

1 yard < 1 meter

Ballpark Comparisons
Weight/Mass

$\approx$ 1 gram

$\approx$

$\approx$ kg

Ballpark Comparisons
Volume

1 quart MILK ≈ 1 liter

Ballpark Comparisons
Temperature

	Fahrenheit	Celsius
Water freezes	32°F	0°C
Water boils	212°F	100°C
Body Temperature	98°F	37°C
Room Temperature	70°F	20°C

Perimeter

the measure of the distance around a figure

$P = a + b + c + d$

$P = r + s + t + u$ $P = e + f + g$
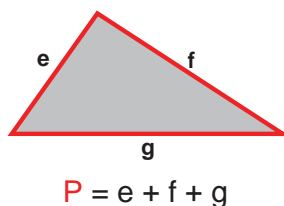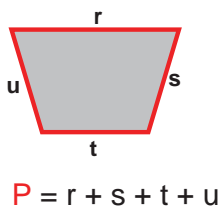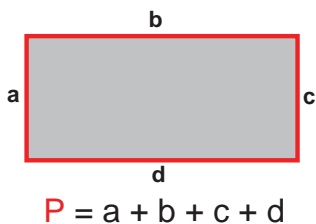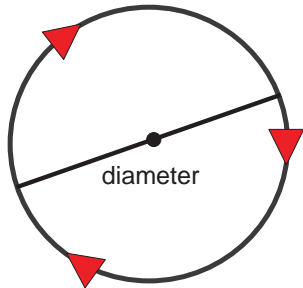
Area

the number of square units needed to cover a surface or figure
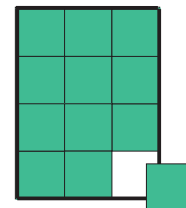
Area = 12 Square Units

Pi

$\pi \approx 3.14159\ldots$

diameter

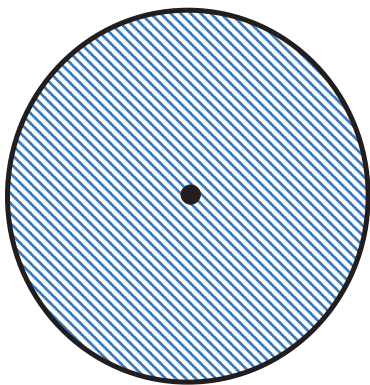$$\pi = \frac{\text{circumference}}{\text{diameter}}$$
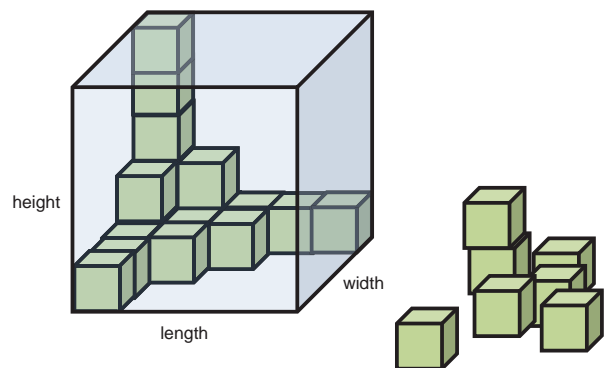
Circumference

radius
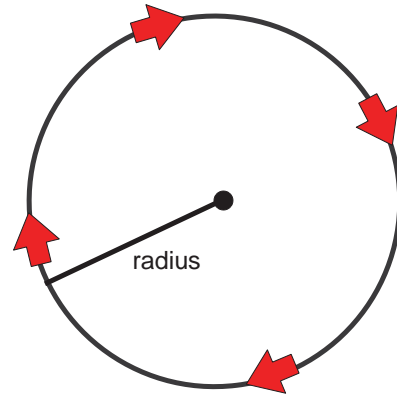
$$C = 2\pi r$$

C = perimeter of a circle
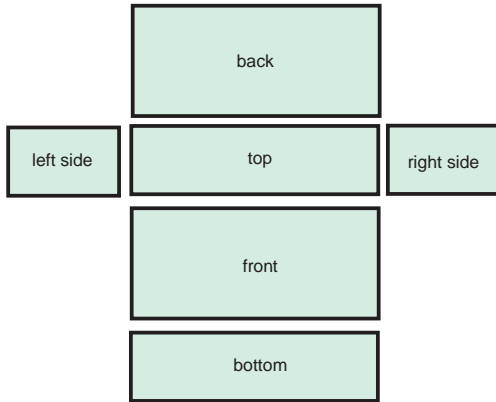
Area of a Circle

$$A = \pi r^2$$

Volume of a Prism

height

width

length

Volume = length x width x height

V = lwh

measured in cubic units

Surface Area

h

l

w

	back	
left side	top	right side
	front	
	bottom	
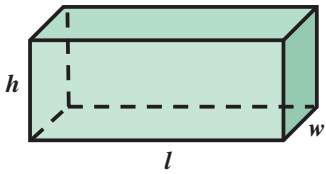
Surface Area (*S.A.*) = sum of areas of faces

Vertex

vertex

vertices

Face and Base

Face

Face

Base   Face
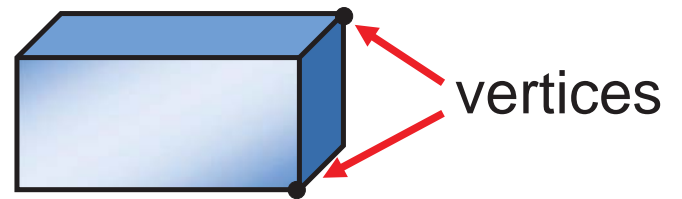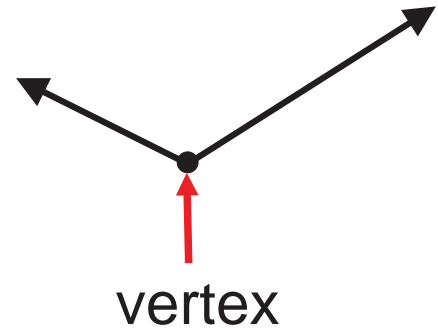
Base
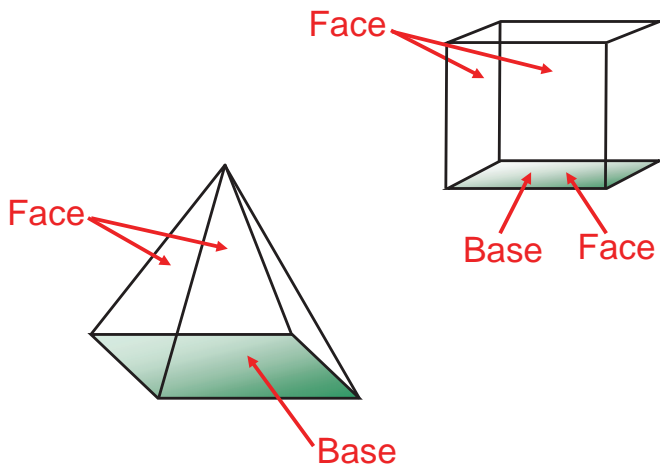
Congruent Figures

have exactly the same shape and size

B

P

Q

A

$\overline{AB} \cong \overline{CD}$

B

A

C

P

R

Q

$\angle BAC \cong \angle PQR$

H   G

B   C

F

A   D

E

▱ABCD ≅ ▱HGFE

Triangles

Quadrilaterals

rhombus
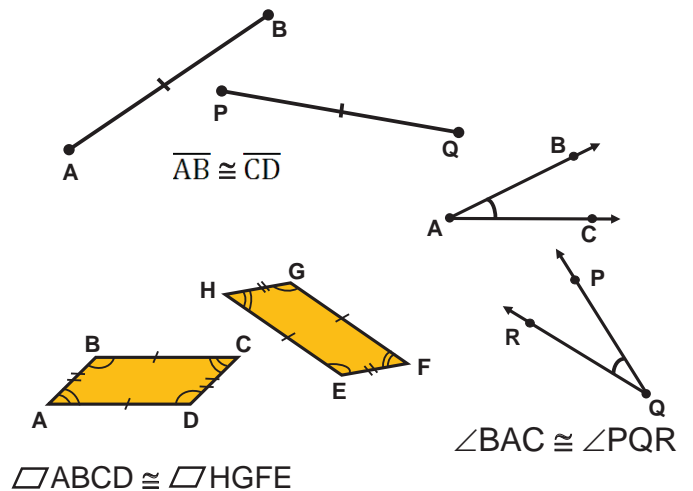
parallelogram

rectangle

kite

square

trapezoid
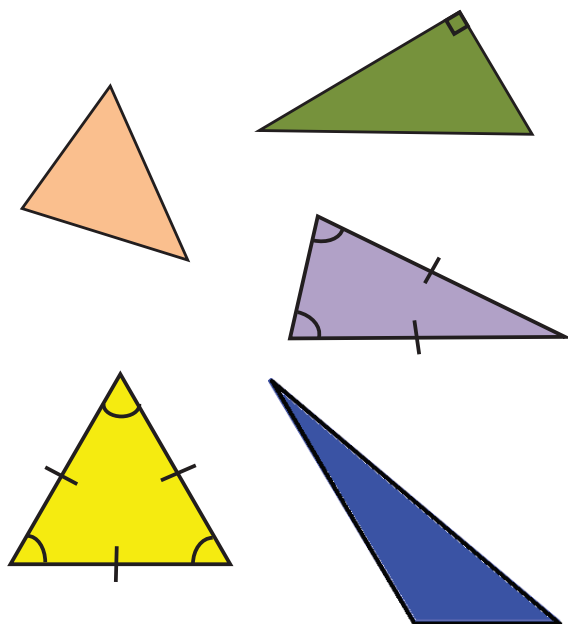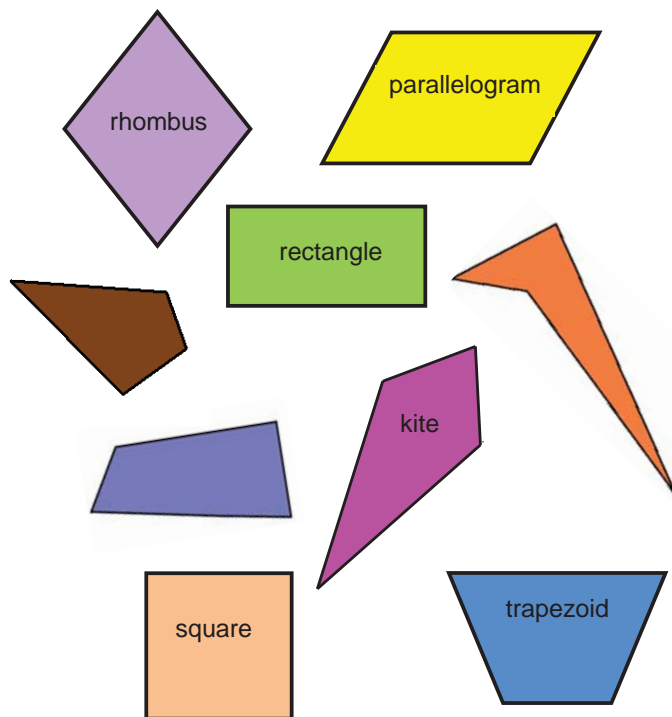
Quadrilaterals Relationships
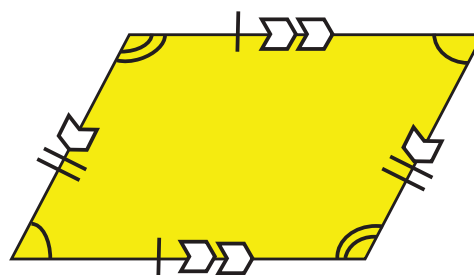
Quadrilateral

Kite

Parallelogram

Trapezoid

Rhombus

Rectangle

Square

Parallelogram

- opposite angles are congruent
- 2 pairs of parallel sides
- 2 pairs of opposite sides congruent

Rhombus
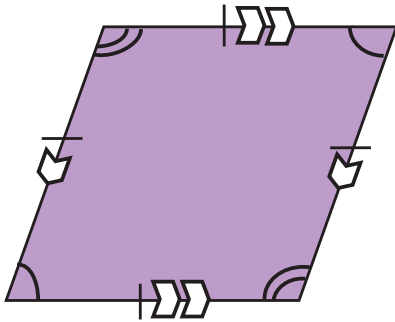
- opposite angles are congruent
- 2 pairs of parallel sides
- 4 congruent sides

Rectangle
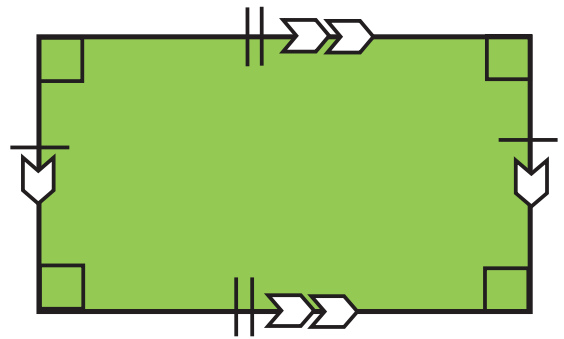
- 4 right angles
- 2 pairs of parallel sides
- 2 pairs of opposite sides congruent

Square

- 4 right angles
- 2 pairs of parallel sides
- 4 congruent sides

Trapezoid
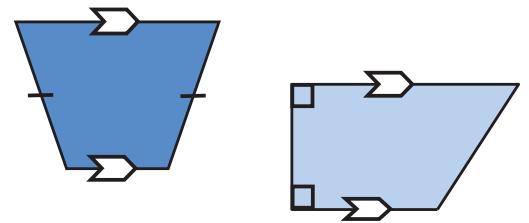
- may have zero or two right angles
- exactly one pair of parallel sides
- may have one pair of congruent sides

Kite
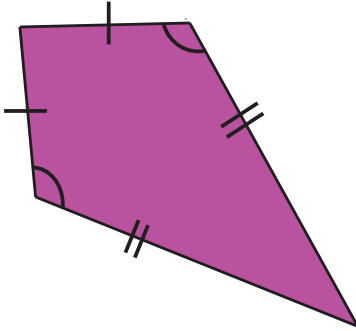
- one pair of opposite congruent angles
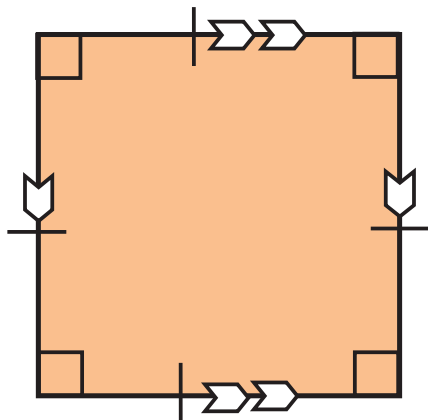- 2 pairs of adjacent congruent sides

Three Dimensional Models

front   side   top

front   side   top

Coordinate Plane

y axis

Quadrant II   Quadrant I

(4,3)

x axis

(-2,-1)

(0,-3)

Quadrant III   Quadrant IV
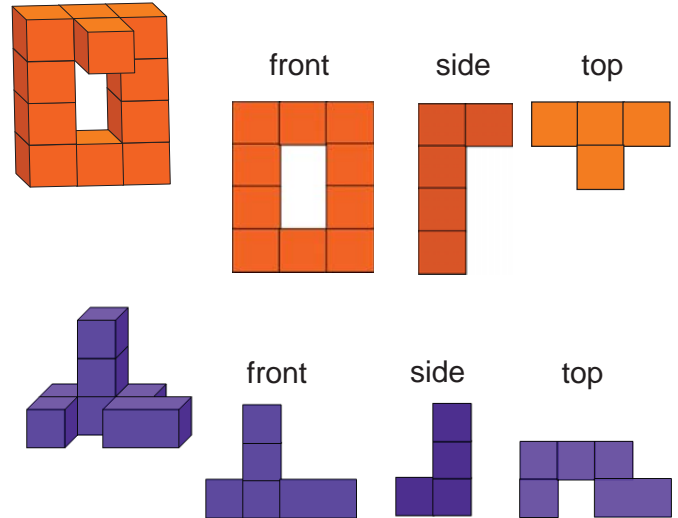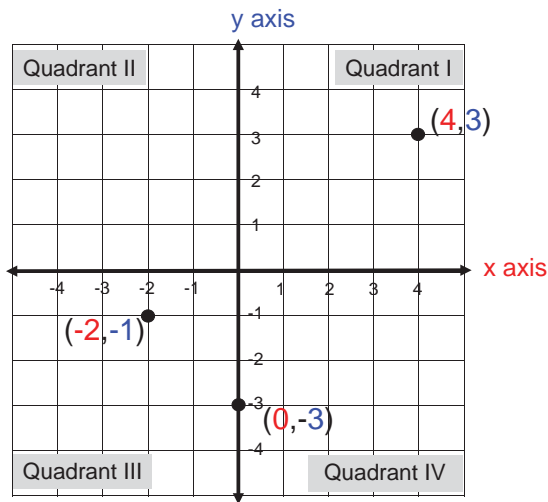
ordered pair (x,y)

Probability

A B A B
A C C

$$P(A) = \frac{3}{7}$$

unlikely   likely

$\frac{3}{7}$ $\frac{1}{2}$

0   1

impossible   certain
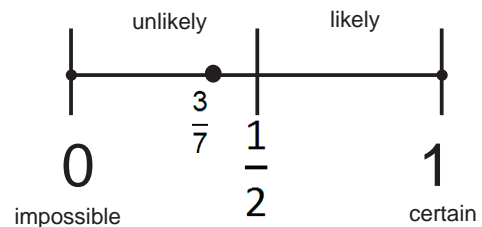
Probability of Independent Events
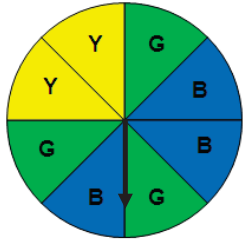
What is the probability of landing on green on the first spin and then landing on yellow on the second spin?

P(green and yellow) =

$P(\text{green}) \cdot P(\text{yellow}) = \dfrac{3}{8} \cdot \dfrac{1}{4} = \dfrac{3}{32}$

Probability of Dependent Events

What is the probability of getting a red jelly bean on first pick and then without replacing it, getting a green jelly bean on the second pick?
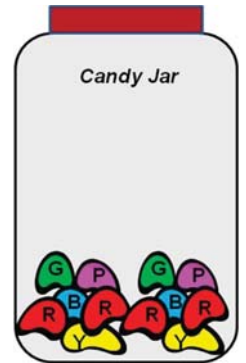
P(red) · P(green after red) =

$\dfrac{4}{12} \cdot \dfrac{2}{11} = \dfrac{8}{132} = \dfrac{2}{33}$

Mean

a measure of central tendency

2, 3, 4, 7

Balance Point

-1 0 1 2 3 ④ 5 6 7

Numerical Average

$$\dfrac{2+3+4+7}{4} = \dfrac{16}{4} = ④$$

Median

a measure of central tendency

6, 7, 8, 9, 9

8 = median

5, 6, 8, 9, 11, 12

8.5 = median

Mode

a measure of central tendency

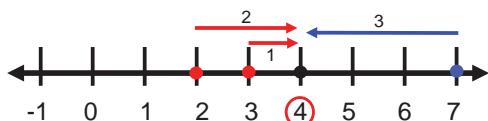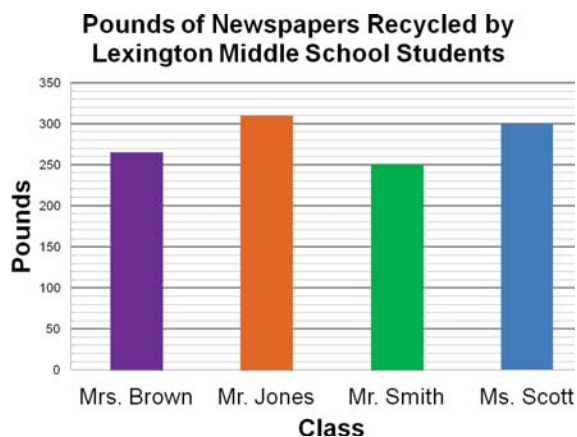| Data Sets	Mode
2, 3, 3, 3, 5, 5, 9, 10	3
5.2, 5.4, 5.5, 5.6, 5.8, 5.9, 6.0	none
1, 1, 2, 5, 6, 7, 7, 9, 11, 12	1, 7

bimodal

Range

Data set

$2\frac{1}{2}$, 3, $3\frac{3}{4}$, $3\frac{7}{8}$, 5, $5\frac{1}{2}$, $9\frac{1}{6}$, $10\frac{4}{5}$, $15\frac{1}{2}$, 20

$$20 - 2\frac{1}{2} = 17\frac{1}{2}$$

$$\text{Range} = 17\frac{1}{2}$$

Bar Graph

Pounds of Newspapers Recycled by Lexington Middle School Students

Line Graph

Value of Sarah's Car
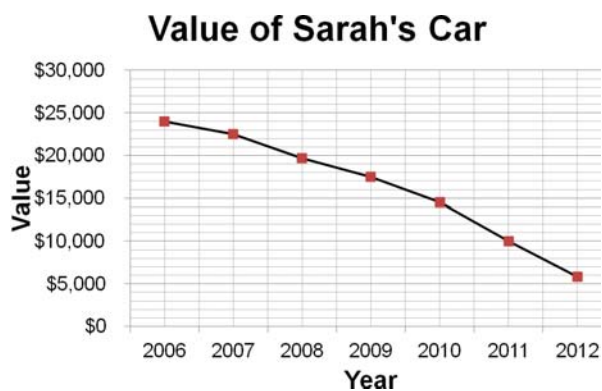
Stem-and-Leaf Plot

Math Test Scores
56, 65, 98, 82, 64, 71, 78, 86, 95, 91,
59, 70, 80, 92, 76, 82, 85, 91, 92, 73

STEM	LEAF
5	6 9
6	4 5
7	0 1 3 6 8
8	0 2 2 5 6
9	1 1 2 2 5 8

Key: 5|6 means 56

Circle Graph

Favorite Ice Cream

Butter Pecan 1/15 ≈ 7%
Chocolate Chip 1/30 ≈ 3%
Chocolate 1/5 = 20%
Strawberry 1/5 = 20%
Vanilla 1/2 = 50%

Histogram

Exam Scores of Students
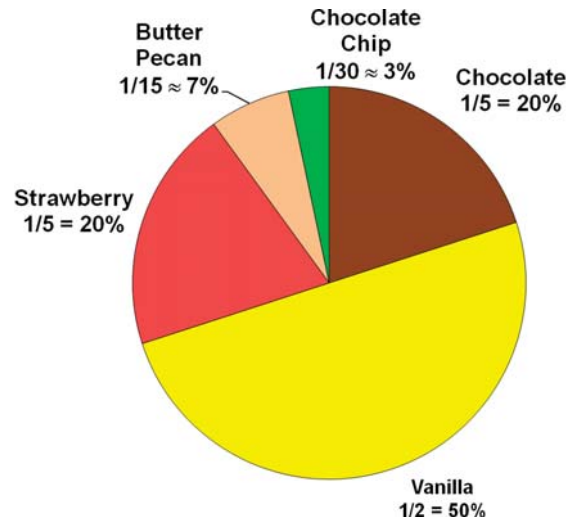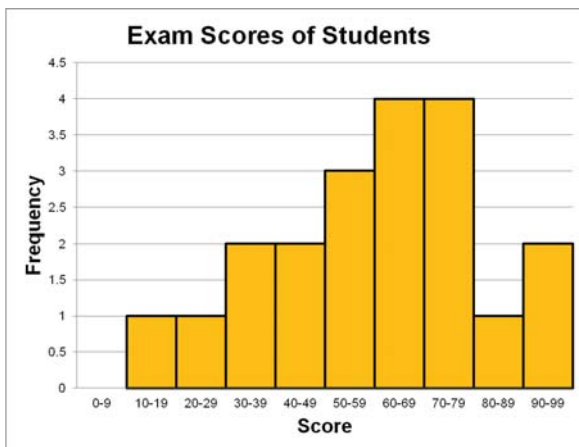
Scatterplot

illustrates the relationship between two sets of data.
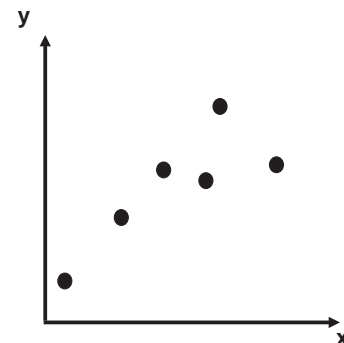
Arithmetic Sequences

What is the next term?

$+6$ $+6$ $+6$

4, 10, 16, 22 ...

common difference

$+\frac{1}{2}$ $+\frac{1}{2}$ $+\frac{1}{2}$ $+\frac{1}{2}$

3, $3\frac{1}{2}$, 4, $4\frac{1}{2}$, 5 …
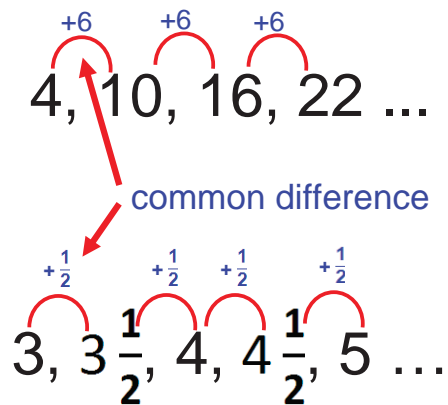
Geometric Sequences

What is the next term?

x3   x3   x3

9, 27, 81, 243 …

common ratio

$x\frac{1}{10}$ $x\frac{1}{10}$ $x\frac{1}{10}$ $x\frac{1}{10}$

7, 0.7, 0.07, 0.007, 0.0007 …
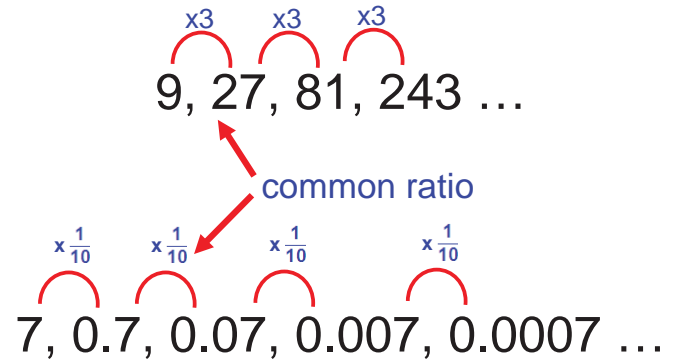
Additive Identity Property

$$0.3 + 0 = 0.3$$

$$0 + (-7) = -7$$

$$\frac{4}{7} = 0 + \frac{4}{7}$$

$$w + 0 = w$$

Additive Inverse Property

$$1.4 + (-1.4) = 0$$

$$(-9) + 9 = 0$$

$$0 = \frac{4}{7} + (-\frac{4}{7})$$

$$x + (-x) = 0$$

Associative Property

Addition:

$(4 + 2) + 8 = 4 + (2 + 8)$

$x + (3x + \frac{1}{2}) = (x + 3x) + \frac{1}{2}$

Multiplication:

$(3 \cdot 1.5) \cdot 6 = 3 \cdot (1.5 \cdot 6)$

$2(3x) = (2 \cdot 3)x$

Commutative Property

Addition:

$2.76 + 3 = 3 + 2.76$

$(a + 5) + 7 = (5 + a) + 7$

Multiplication:

$-8 \cdot \frac{2}{3} = \frac{2}{3} \cdot (-8)$

$y \cdot 9 = 9y$

Multiplicative Identity Property

$9 \cdot 1 = 9$

$1 \cdot (-10) = -10$

$\frac{3}{2} = \frac{3}{2} \cdot 1$

Multiplicative Inverse Property

$2 \cdot \frac{1}{2} = 1$

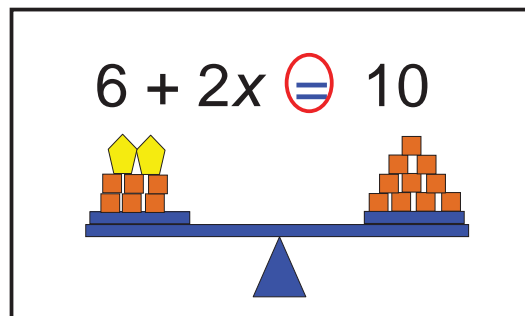$1 = (-\frac{1}{9}) \cdot -9$

$x \cdot \frac{1}{x} = 1 \ (x \neq 0)$

Multiplicative Property of Zero

$$0 = 8 \cdot 0$$

$$0(\text{-}13) = 0$$

$$\frac{5}{6} x \cdot 0 = 0$$

Equation

$$6 + 2x = 10$$

A mathematical sentence stating that two expressions are equal.

$$2.76 + 3 = 3 + 2.76$$

$$3x = 6.9$$

Expression

$$x$$

$$\text{-}\sqrt{26}$$

$$2x + 3^4$$

$$3(y + 3.9) - \frac{8}{9}$$

Variable

$$2(y + 3)$$

$$3 + x = 2.08$$

$$A = \pi r^2$$

Coefficient

$(-4) + \boxed{2}x$

$\boxed{-7}y^2$

$\boxed{\dfrac{2}{3}}ab - \dfrac{1}{2}$

Term

$3x + 2y - 8$

3 terms

$-5x^2 + (-2x)$

2 terms

$\dfrac{2}{3}ab$

1 term

Constant

$4x - 12 \quad \rightarrow \boxed{-12}$

$\boxed{7} - 2y + x - 6x^2$

$3(x + \boxed{3.9}) + \boxed{\dfrac{8}{9}}$

Inequality

$y < 4$

$3r \geq -7.5$

$-3(n - 4) < 0$