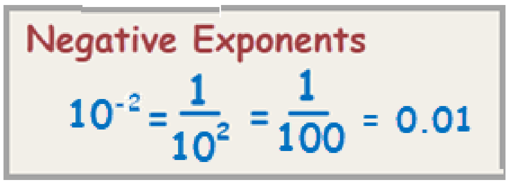
MATH 7 Review (2023 standards)

7.NS.1 EXPONENTS AND SCIENTIFIC NOTATION

Negative exponents represent numbers between 0 and 1. $10^{-3} = \frac{1}{10^3} = 0.001$ = one thousandths



What does 10^{-2} represent? Answer: 0.01 or 1% (Percent is another name for hundredths)

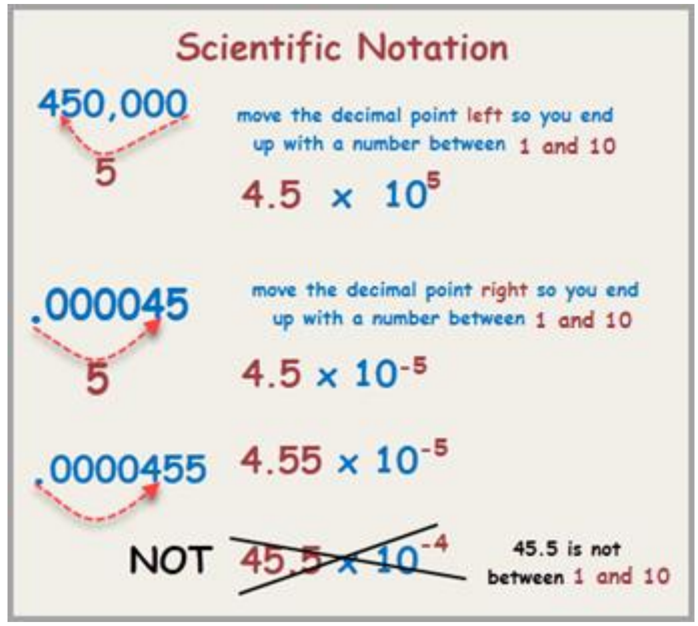
What is 10^{-1} in decimal form? Answer 0.1

What is 10^{-4} in decimal form? Answer 0.0001

What is 10^{-6} in decimal form? Answer 0.000001

Scientific notation used for **very large** and **very small** numbers.

Scientific notation has two parts – a **decimal between 1 and 10** (examples: 1.0, 1.456, 6.4, 9.99) and a **power of ten** **(**10^5, 10^{-3})



To write 145,600 in scientific notation, move the decimal point over until you have a decimal between 1 and 10.

145,600 = 145600.00 = 1.456×10^5 (the decimal point was moved 5 places to the left)

Write 0.000345 in scientific notation – move the **decimal point right** until you have a number between 1 and 10.

Answer: 3.45×10^{-4} (the decimal point was moved right 4 places to get 3.45)

7.NS.2 COMPARE AND ORDER RATIONAL NUMBERS

Integers are positive and negative whole numbers (and zero) {…-2, -1, 0, 1, 2, …}.

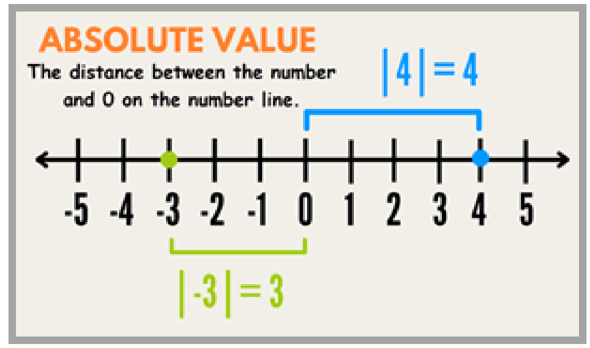
Rational numbers – all numbers that can be written as fractions with denominators not zero. Examples $\sqrt{25}$, $\frac{1}{4}$, -2.3, 82, 75%, $4.\overline{59}$.

Proper fraction – numerator less that denominator - 1/2 , 7/8

Improper fraction – numerator equal or greater than denominator – 12/7, 4/4.

Improper fractions can be written as **mixed numbers -** $3\frac{5}{8}$, $2\frac{1}{4}$

Percent means "per 100" or how many "out of 100"; percent is another name for hundredths. A percent is a ratio in which the denominator is 100. $\frac{2}{5} = \frac{40}{100} = 0.40 = 40\%$



The **absolute value** of a number is the distance of that number from zero on the number line.

Put these numbers in ascending order: -0.005, -2.4, $-2.\overline{4}$, $-1\frac{1}{2}$

Answer: $-2.\overline{4}$, -2.4, $-1\frac{1}{2}$, -0.005

7.NS.3 SQUARE ROOTS AND PERFECT SQUARES

A **perfect square** is a whole number whose square root is an integer: 0, 1, 4, 9, 16, 25, 36 etc

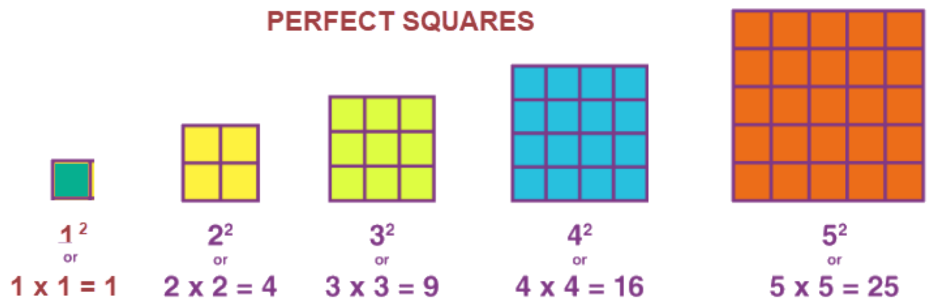
The symbol $\sqrt{}$ represents a square root.

$\sqrt{36} = 6$ means the square root of 36 = 6 (6 x 6 = 36)

$\sqrt{81} = ?$ Answer: 9 (9 x 9 = 81)

Square the number 4 - Answer: 16

Find the **square root** of 4 - Answer: 2



7.CE.1 SOLVE PRACTICAL PROBLEMS USING RATIONAL NUMBERS

Rational numbers - All numbers that can be expressed as fractions in the form $\frac{a}{b}$ where *a* and *b* are integers and *b* does not equal zero. A rational number can be written as a decimal or as a repeating decimal (line over repeating digits).

Proper fraction – numerator less than denominator. example $\frac{3}{4}$.

Improper fraction - numerator is equal to or greater than the denominator. example $\frac{4}{3}$

Mixed number – improper fraction can be written as a mixed number. example $\frac{4}{3} = 1\frac{1}{3}$

Students will solve addition, subtraction, multiplication, and division problems with rational numbers.

7.CE.2 PROBLEMS USING PROPORTIONAL REASONING

A **proportion** (introduced in grade 6) is an equation which states that two ratios are equal. A proportion can be written as $\frac{a}{b} = \frac{c}{d}$ a : b = c : d *a* is to *b* as *c* is to *d*.

Equivalent ratios – multiply each value in ratio by same number. 5 : 4 is equivalent to 10 : 8 and 20 : 16.

To solve a proportion with a missing value (y), $\frac{2}{3} = \frac{y}{9}$, **cross multiply** like this: 2 x 9 = 3*y, so* 18 = 3*y* so **6** **= *y***

A recipe calls for 3 eggs for every 6 cups of flour. How many eggs would you need with 2 cups of flour?

$\frac{3}{6} = \frac{y}{2}$ 3 x 2 = 6*y* 6 = 6*y* ***y* = 1 egg**

Rate - ratio that compares two quantities measured in **different units**.

Unit rate – has 1 as denominator. example miles/hour A bike might travel 10 miles/one hour. Rate is $\frac{10}{1}$.

How far would the car travel in 4 hours? $\frac{10}{1} = \frac{y}{4}$ Cross multiply to solve. 10 x 4 = 1*y* ***y = 40 miles***

Proportions can be used to convert **length, weight (mass), and volume (capacity)** within and between **measurement systems**.

-**Length**: between feet and miles; miles and kilometers example approx. 1 mile = 1.6km

In miles, how long is a 10km race? $\frac{1}{1.6} = \frac{y}{10}$ -> 1 x 10 = 1.6*y* -> *10 = 1.6y* -> *10 ÷1.6 = y* -> ***10 km = 6.25 mi.***

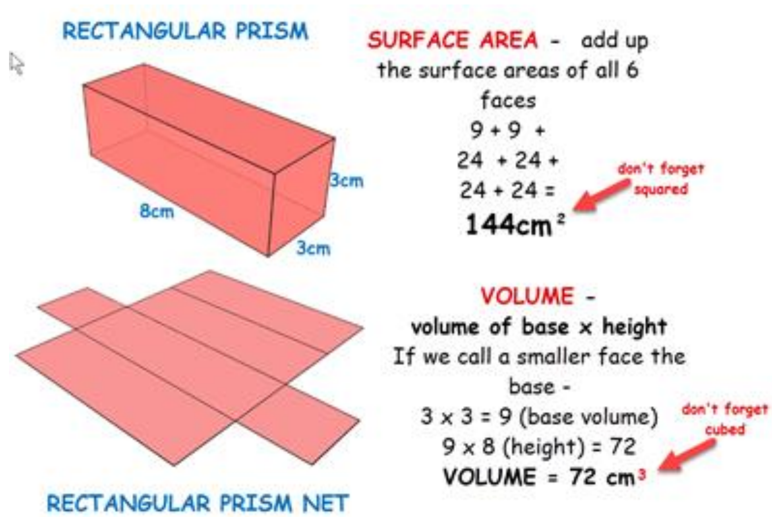
-**Weight**: between ounces and pounds; pounds and kilograms

-**Volume**: between cups and fluid ounces; gallons and liters

- Percent – ratio in which denominator is 100. To turn a **fraction into a percent** use this: $\frac{percent}{100} = \frac{part}{whole}$

Turn ¾ into a percent: $¾ = \frac{y}{100}$ -> 3 x 100 = 4y -> 300 = 4y -> y = 300 ÷ 4 -> y = 75 -> **¾ = 75%**

7.MG.1 VOLUME AND SURFACE AREA OF RECTANGULAR PRISMS AND CYLINDERS



Polyhedron is a solid figure whose **faces are all polygons**.

Rectangular prism is a polyhedron in which all **six faces** are **rectangles** - 8 vertices and 12 edges

A **face** is any flat surface of a solid figure.

The **surface area** of a prism is the sum of the areas of **all 6 faces** and is measured in **square units**

The **volume** of a three-dimensional figure is a measure of **capacity** and is measured in **cubic units**.

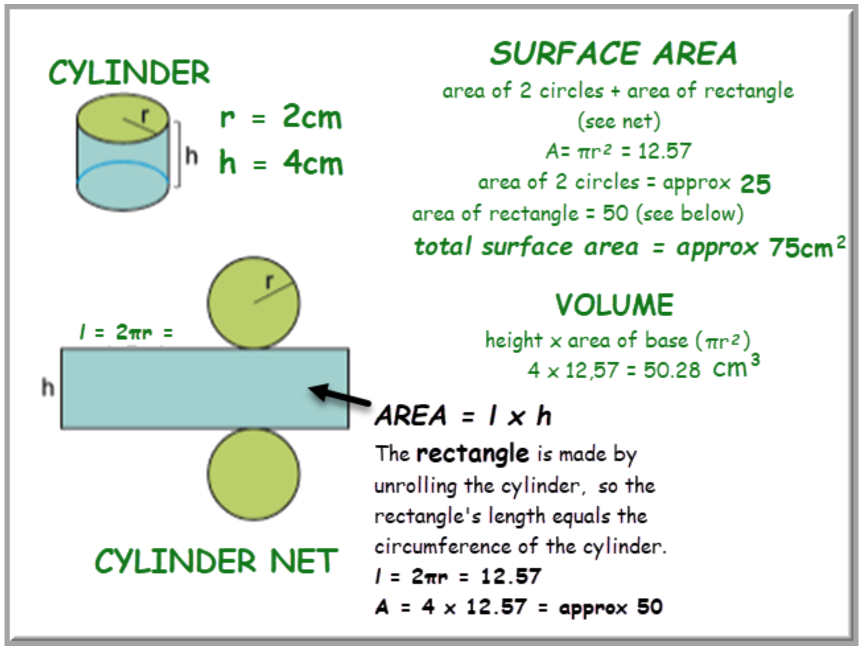
The volume of the rectangular prism to the right is 3 x 3 x 8 = 72 cm^3. If the length of one side doubles, what happens to the volume? Answer; it doubles.

Cylinder - bases joined by a curved surface

Know how to find surface area and volume of cylinders and rectangular prisms.

Find the **surface area** and **volume** of a 3 x 3 x 8 rectangular prism (see previous page)

Find the **volume** and **surface area** of a the **cylinder** with a radius of 2cm and height of 4cm. (see above) pi = 3.14



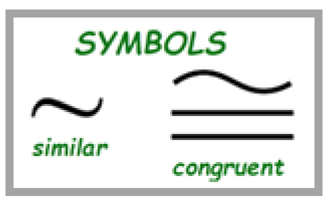
7.MG.2 CORRESPONDING SIDES AND ANGLES OF SIMILAR QUADRILATERALS AND TRIANGLES

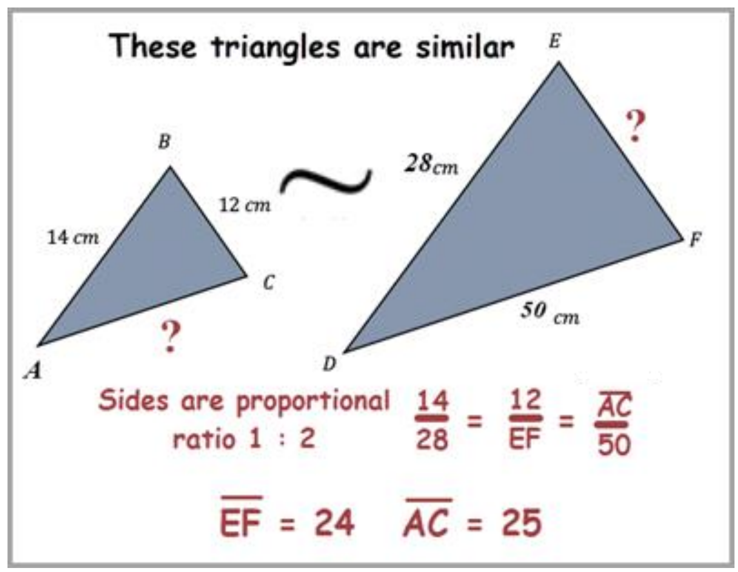
Similar polygons – angles are congruent, sides are proportional but not necessarily congruent.

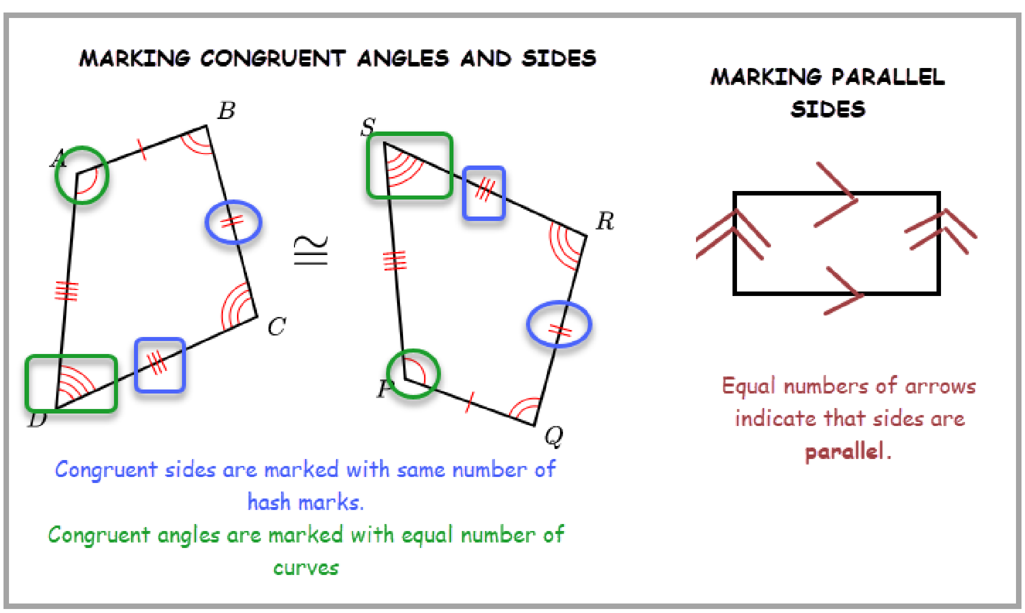
Conguent polygons – angles and sides are congruent, same size and shape.

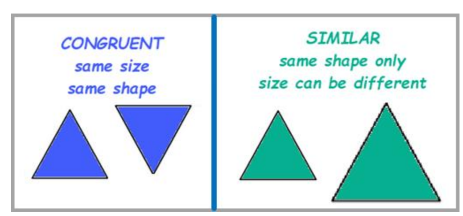
Congruent polygons are similar, but the reverse is not necessarily true.

In the similar triangles to the right, what length are the missing sides, EF and AC (use the ratio of ½)

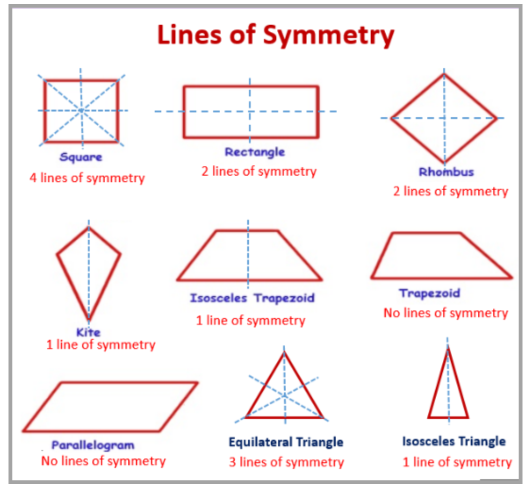








7.MG.3 WORKING WITH QUADRILATERALS



Polygon – a closed plane figure with at least 3 sides that don't cross

Quadrilateral -a polygon with four sides.

Bisect – divide into two equal parts.

Line of symmetry – divides a figure into two congruent parts, each a mirror image of the other.

Parallelogram -a quadrilateral with both pairs of opposite sides parallel.

Rectangle - a quadrilateral with four right angles.

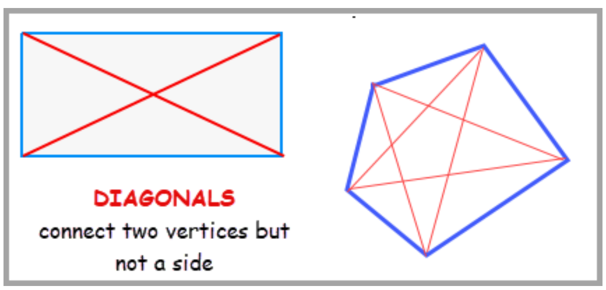
Square – polygon with four congruent sides and four right angels.

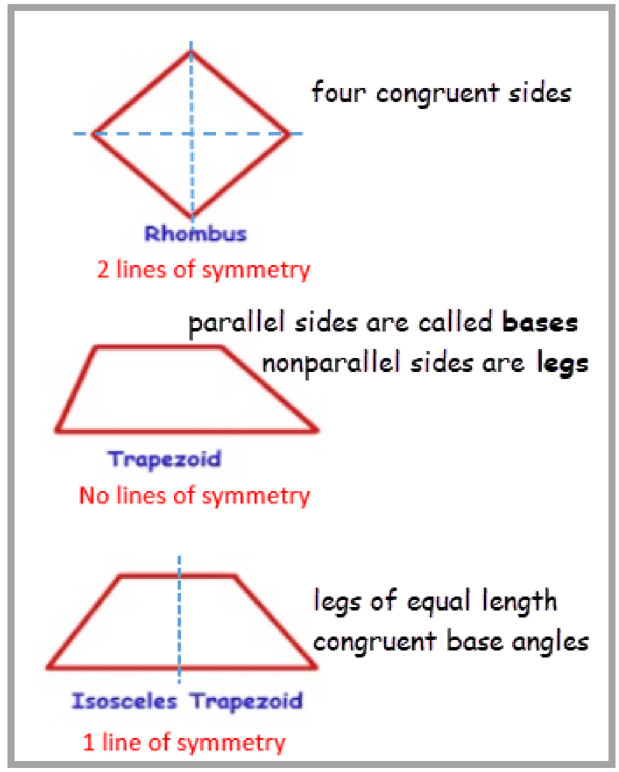
Rhombus - a quadrilateral with four congruent sides.

Trapezoid - a quadrilateral with exactly one pair of parallel sides. Parallel sides are called **bases**. Nonparallel sides are called **legs**.

Isosceles trapezoid - has legs of equal length and congruent base angles.

The sum of the measures of the **interior angles of a quadrilateral is 360°.**



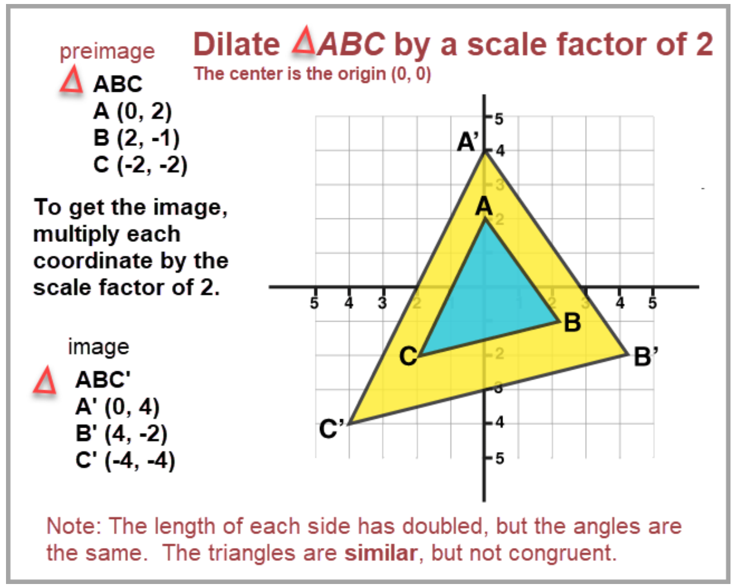


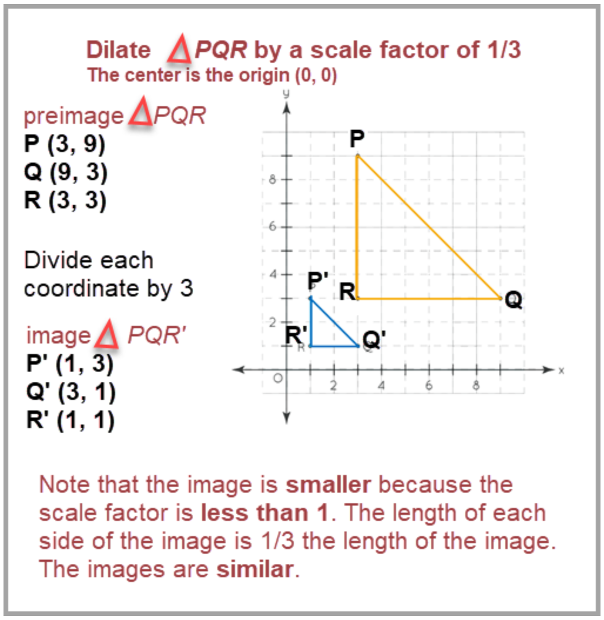
7.MG.4 DILATIONS OF POLYGONS IN THE COORDINATE PLANE

Transformation – changes the **preimage** in **size**, **shape** or **position**. New figure called **image**. Preimage point *A* transforms to image point *A'* (A prime)

Dilation – a kind of transformation that in which the image is formed by **reducing** or **enlarging** the preimage proportionally by a **scale factor** from the center of the dilation (for now the center will be the origin (0, 0)).

The preimage and the dilated image will be **similar** (side lengths will be longer or shorter, but angles will be the same).





When the **scale factor** is less than one, the image will be **reduced** in size. When the scale factor is **greater than 1**, the image will be **enlarged**.

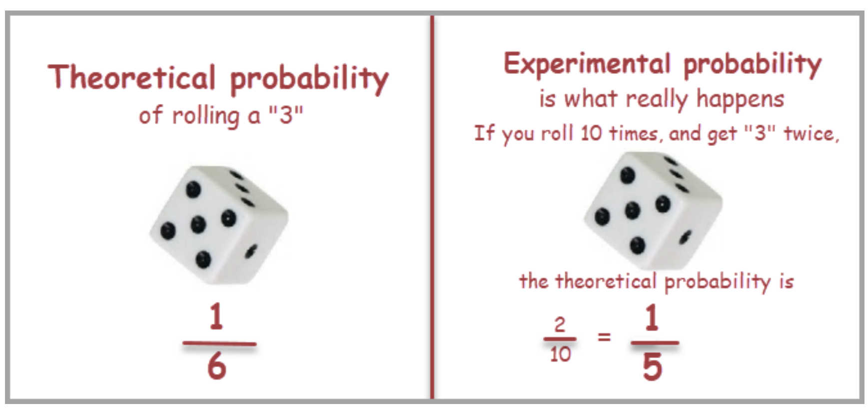
For now, the **center** will be at the origin (0,0), but the center can be part of the image or outside/inside the image.

The **scale factor** determines the **size** of the dilated image, but the **center** point determines **where** on the coordinate plane the image will be located.

7.PS.1 THEORETICAL AND EXPERIMENTAL PROBABILITIES OF AN EVENT

The **probability** of an event occurring is a **ratio between 0 and 1**.

- A probability of 0 means the event will never occur.
- A probability of 1 means the event will always occur.



The **theoretical probability** of an event is the **expected probability** and can be determined with a **ratio**.

The **experimental probability** of an event is determined by carrying out a simulation or an **experiment**.

The **more trials,** the closer the **experimental** probability will be to the **theoretical**. In the example above, if the die was rolled 100 times, the experimental probably would likely be nearer to 1/6.

7.PS.2 FOCUS ON HISTOGRAMS

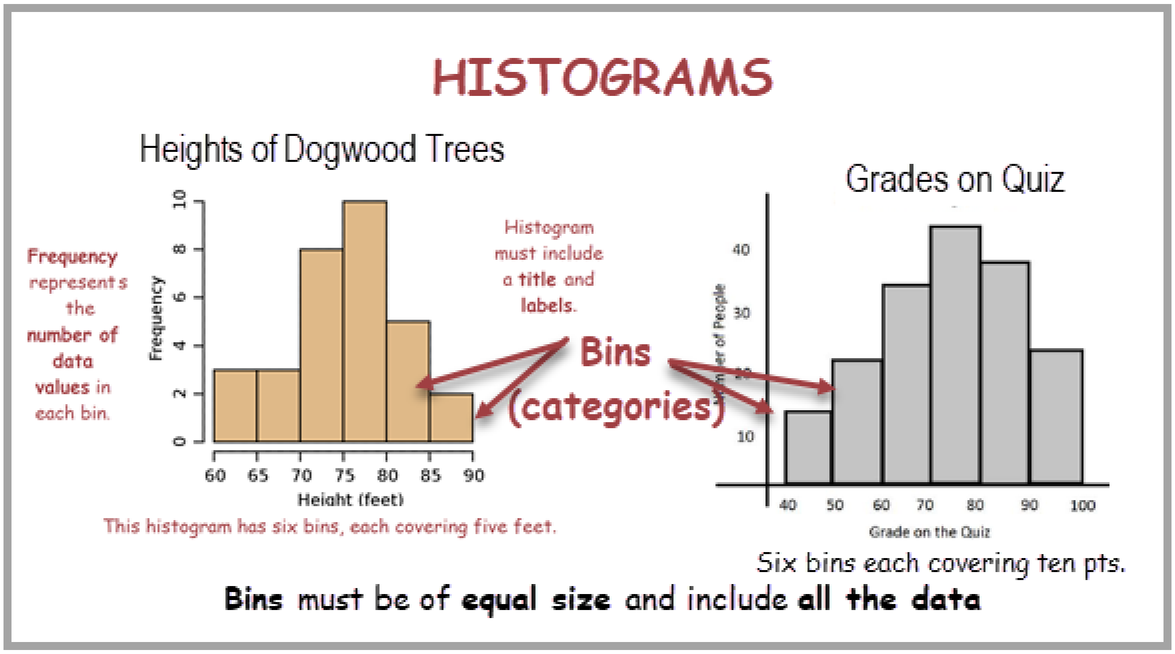
A histogram is a form of **bar graph** in which the **categories** are **consecutive** and **equal intervals**. The length or **height** of each bar is determined by the **number of data elements** (frequency) falling into a particular interval.

Bins (categories) on x-axis must be of **equal size** and must include **all the data.**

The **frequency** (**number** of data points) on y-axis.

x-axis and y-axis can be switched so that bars are **horizontal**.

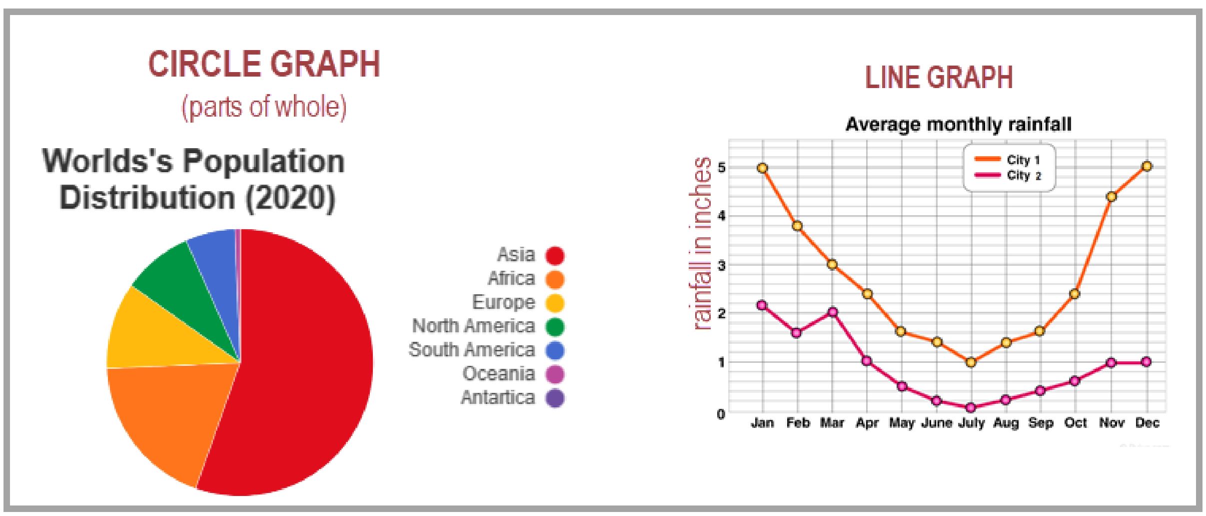
Can be used with **categorical** data or **numerical** data.



The type of graph used depends on the data and what the graph is intended to show.

Line plots are good for showing the **spread of data** and might be more useful when there are **extreme** high or low values.

Circle graphs are used to show a relationship between the **parts and the whole**.



7.PFA.1 PROPORTIONAL VS. ADDITIVE RELATIONSHIPS, GRAPHS OF LINES, SLOPES

Slope may also represent the **unit rate** of a **proportional relationship** between two quantities, also referred to as the **constant of proportionality** or the **constant ratio** of **y to x.**

Relationship represented as ***y = mx,*** where ***m*** is the **slope.**

$$\frac{y}{x} = \frac{2}{4} = \frac{3}{6} = \frac{1}{2} = 0.5$$

The equation representing this proportional relationship of *y* to *x* is ***y = ½ x*** or ***y = 0.5x***

The **slope** of a line representing this relationship is **½** or **.5**

Slope represents the rate of change of a line. $\frac{\text{change in y (vertical change)}}{\text{change in x (horizontal change)}}$

The graph of the line representing a **proportional relationship** will include the **origin (0, 0).**

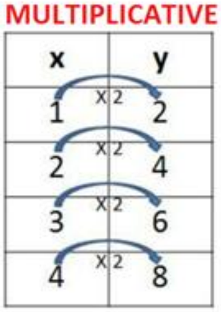
Practical Problem: John runs 1 mile every 6 minutes. In this example, he never tires. This table represents the relationship.

x (miles)	1	2	3	4	5
y (minutes)	6	12	18	24	30

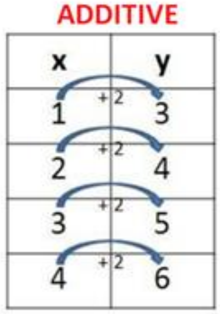
$$\frac{y}{x} = \frac{6}{1} = \frac{12}{2} = \frac{18}{3} = \frac{24}{4} = \frac{30}{5} = 6$$

This proportional relationship can be represented by the equation ***y = 6x.***

MULTIPLICATIVE



ADDITIVE

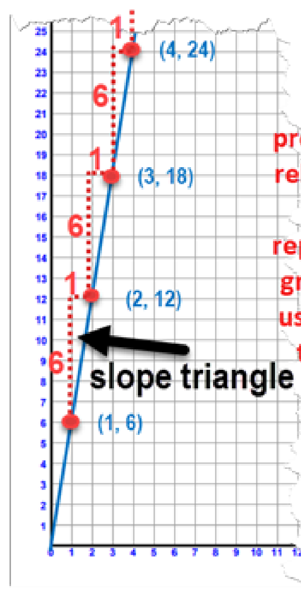


The relationships above were **multiplicative**, but relationships can also be **additive**.

An **additive** relationship is **not proportional** and its graph does **not pass through (0, 0).**

The equation for the additive relationship is ***y = x + 2***

The **slope** of this line is **1**. If this relationship was proportional, it would pass through the origin (0, 0). Instead, note that it passes through (0, 2) which is called the **y-intercept.**



This proportional relationship can be represented graphically using slope triangles

7.PFA.2 EVALUATING ALGEBRAIC EXPRESSIONS

Evaluate an algebraic expression ***4a – (2 + 3)b*** given values a = 2 b = 3

1) Replace the variables with given numbers 4(2) – (2 + 3)(3)

2) simplify using order of operations **8 – 5 x 3; 8 – 15;** **-7**

Review of **Order of Operations**

Grouping symbols (), [], etc innermost first

Exponents

Multiply and/or **divide**, left to right

Add and/or **subtract**, left to right

Review of **Properties**

- **Commutative** property of **addition**: $a + b = b + a$.
- **Commutative** property of **multiplication**: $a \cdot b = b \cdot a$.
- **Associative** property of **addition**: $(a + b) + c = a + (b + c)$.
- **Associative** property of **multiplication**: $(a \cdot b) \cdot c = a \cdot (b \cdot c)$.

Subtraction and division are neither commutative nor associative.

- **Distributive** property (over addition/subtraction): $a \cdot (b + c) = a \cdot b + a \cdot c \; and \; a \cdot (b - c) = a \cdot b - a \cdot c$.
- **Identity** property of **addition** (additive identity property): $a + 0 = a \; and \; 0 + a = a$.
- **Identity** property of **multiplication** (multiplicative identity property): $a \cdot 1 = a \; and \; 1 \cdot a = a$.
- **Inverse** property of **addition** (additive inverse property): $a + (-a) = 0 \; and \; (-a) + a = 0$.
- **Inverse** property of **multiplication** (multiplicative inverse property): $a \cdot \frac{1}{a} = 1 \; and \; \frac{1}{a} \cdot a = 1$.
- **Multiplicative** property of **zero**: $a \cdot 0 = 0 \; and \; 0 \cdot a = 0$.

Division by zero is not a possible mathematical operation. It is undefined.

- **Substitution** property: If $a = b$, then *b* can be substituted for *a* in any expression, equation, or inequality.

7.PFA.3 SOLVING TWO-STEP LINEAR EQUATIONS IN ONE VARIABLE

An **equation:** states that the mathematical expression on the left of the equal sign is equal to the expression on the right so **expression = expression** **$2x = 4^2$**

The Solution to an equation is what makes it true - **$2x = 4^2$** Solution: **$x = 8$**

An **expression** itself does not include an equal sign

A **variable expression** contains a variable: ***5y ;***

An algebraic expression is a variable contains a variable: ***5y + 3***

More review of properties included here – see 7.12

7.PFA.4 ONE- AND TWO-STEP LINEAR INEQUALITIES IN ONE VARIABLE

When both expressions of an inequality are multiplied or divided by a **negative number**, the inequality **symbol reverses** (e.g.**, $-2x < 6$ is equivalent to $x > -3$**).