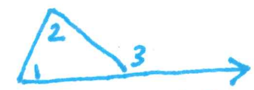
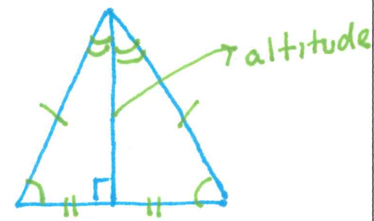
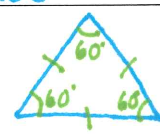
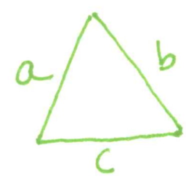
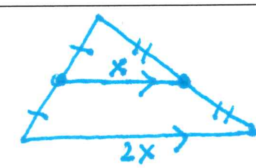
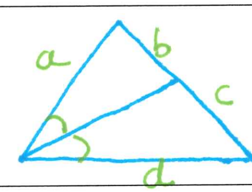
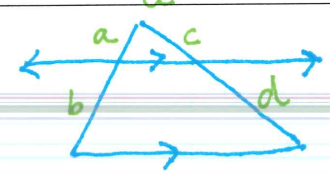
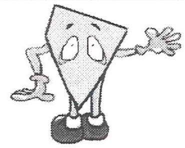
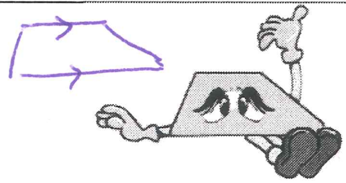
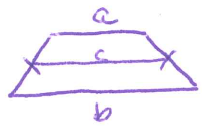
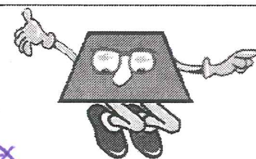
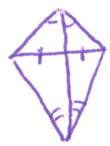
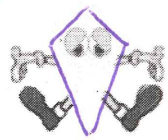
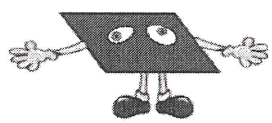
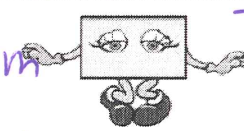
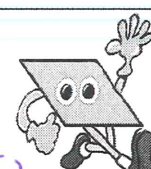
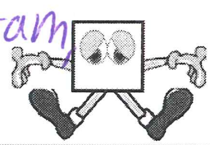
Properties of Triangles

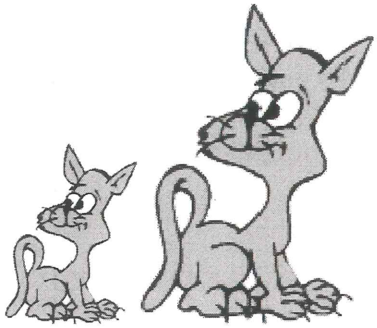
There are 180° in a Δ!

Theorem/ Property	Description
Exterior Angle Theorem	The sum of the 2 remote interior ∡s equal the exterior ∡.  $\angle 1 + \angle 2 = \angle 3$
Properties of Isosceles Triangles	1. 2 ≅ sides 2. 2 ≅ ∡s (opposite the ≅ sides) 3. The altitude to the base bisects the vertex ∡ and the base 
Equilateral Triangles	- 3 ≅ sides - each ∡ = 60° 
Inequalities in Triangles	1. The sum of any 2 sides must exceed the third side 2. The largest ∡ is opposite the largest side 3. The largest side is opposite the largest ∡.  $a+b>c$ $b+c>a$ $a+c>b$
Triangle Midsegment Theorem	The segment connecting the midpoints of the sides is parallel to the base and 1/2 of the base 
Triangle Angle-Bisector Theorem	The ∡ bisector of an ∡ cuts the opposite side to create proportional side lengths  $\frac{a}{b} = \frac{d}{c}$
Side-Splitter Theorem	If a line cuts through 2 sides of a Δ so that it's ∥ to the base, the side lengths are proportional.  $\frac{a}{b} = \frac{c}{d}$
INSIDE Points of Concurrency INSIDE Right = on Obtuse = outside Acute = inside	Perpendicular Bisectors = CIRCUMCENTER (this point is equidistant to all 3 vertices) * used to circumscribe a circle about a Δ. Angle Bisectors = INCENTER (this point is equidistant to all 3 side lengths) * used to inscribe a circle in a Δ Medians = CENTROID (cuts each median in such a way so the distance from the vertex to the centroid is double the distance from the centroid to the midpoint) Altitudes = ORTHOCENTER

Properties of Quadrilaterals

QUADRILATERAL Any 4 sided figure 	A quadrilateral is any four sided figure. Do not assume any additional properties for a quadrilateral unless you are given additional information.
TRAPEZOID A quadrilateral w/ one pair of parallel sides 	A trapezoid has ONLY ONE set of parallel sides. When proving a figure is a trapezoid, it is necessary to prove that two sides are parallel and two sides are not parallel.
ISOSCELES TRAPEZOID -Non parallel sides are $\cong$ - midsegment = $\frac{1}{2}$ the sum of the bases  $\frac{1}{2}(a+b)=c$ 	Never assume that a trapezoid is isosceles unless you are given (or can prove) that information.
KITE -diagonals are $\perp$ -diagonal bisects vertex $\measuredangle$s -diagonal connecting non-vertex $\measuredangle$s is bisected by other diagonal  	The vertex angles are where the two congruent sides meet. The non-vertex angles are where the non-congruent sides meet. * Non-vertex $\measuredangle$s are $\cong$
PARALLELOGRAM -opposite sides are $\parallel$ - opposite sides are $\cong$ - diagonals bisect each other - opposite $\measuredangle$s are $\cong$ - consecutive $\measuredangle$s are supplementary 	Notice how the properties of a parallelogram come in sets of twos: two properties about the sides; two properties about the angles; two properties about the diagonals. Use this fact to help you remember the properties.
RECTANGLE - everything a parallelogram has PLUS - 4 right $\measuredangle$s - diagonals are $\cong$ 	If you know the properties of a parallelogram, you only need to add 2 additional properties to describe a rectangle.
RHOMBUS -everything a parallelogram has PLUS -4 $\cong$ sides, diagonals are $\perp$, diagonals bisect $\measuredangle$s 	A rhombus is a slanted square. It has all of the properties of a parallelogram plus three additional properties.
SQUARE -everything a parallelogram rectangle, and rhombus have 	The square is the most specific member of the quadrilateral family. It has the largest number of properties.

SIMILARITY



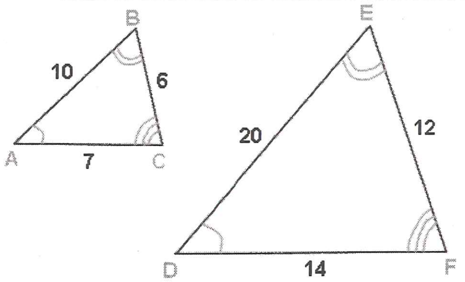
The cat on the right is an enlargement of the cat on the left. They are exactly the same shape, but they are **NOT** the same size.

These cats are **similar** figures.

SIMILARITY SYMBOL

$\sim$

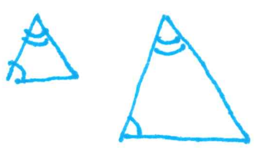
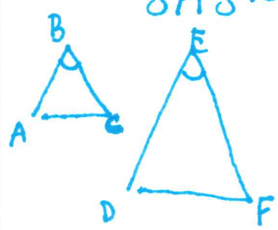
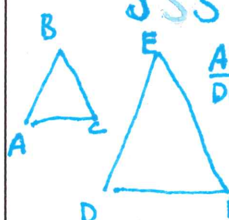
SIMILAR = the same shape but different sizes



$\triangle ABC \sim \triangle DEF$

FACTS ABOUT SIMILAR TRIANGLES	
$\angle A \cong \angle D$	$\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$
$\angle B \cong \angle E$	$\downarrow \quad \downarrow \quad \downarrow$
$\angle C \cong \angle F$	$\frac{10}{20} = \frac{6}{12} = \frac{7}{14}$

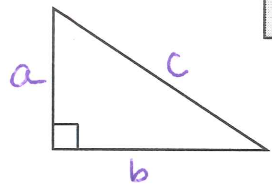
all $= \frac{1}{2}$ which is the similarity ratio

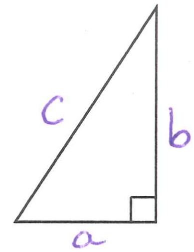
PROVING TRIANGLES ARE SIMILAR		
AA~ 	SAS~  $\frac{AB}{DE} = \frac{BC}{EF}$	SSS~  $\frac{AB}{DE} = \frac{BC}{EF} = \frac{AC}{DF}$

The SIMILARITY RATIO is the ratio of the corresponding sides of two similar figures or solids. If the similarity ratio is a:b, then...		
the ratio of their perimeter (and corresponding side lengths) is $a:b$	the ratio of their areas (or surface areas) is $a^2:b^2$	the ratio of their volumes is $a^3:b^3$

REMEMBER! In similar figures, the ratio of the angle measures is always 1 : 1 ! * $\angle$s are $\cong$!

Pythagorean Theorem

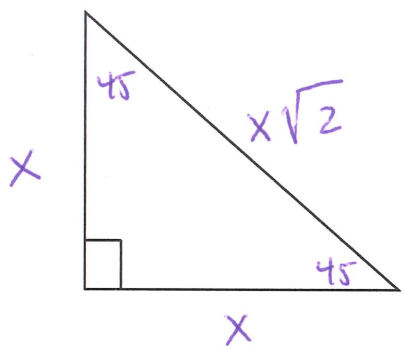


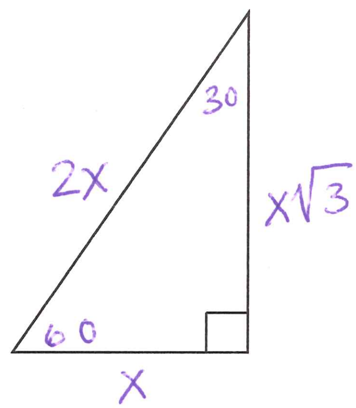


Acute Triangles	Right Triangles	Obtuse Triangles
$a^2+b^2>c^2$	$a^2+b^2=c^2$	$a^2+b^2<c^2$

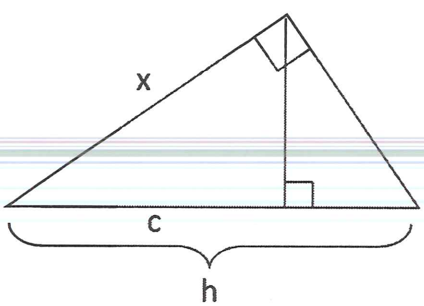
	COMMON PYTHAGOREAN TRIPLES	
3, 4, 5	5, 12, 13	8, 15, 17

Special Right Triangles



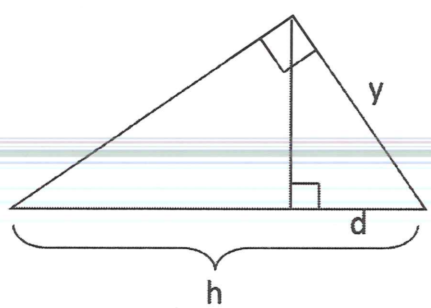


Similarity in Right Triangles



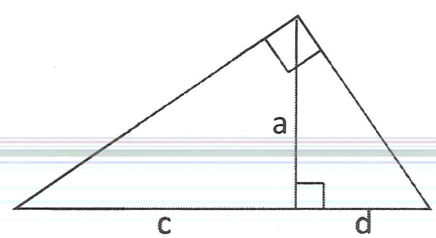
Leg Rule

$$\frac{c}{x}=\frac{x}{h}$$



Leg Rule

$$\frac{d}{y}=\frac{y}{h}$$



Altitude Rule

$$\frac{c}{a}=\frac{a}{d}$$