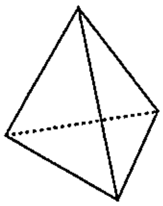
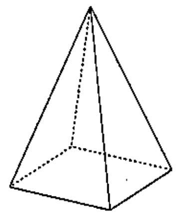
1 Formula: Area of a Trapezoid	2 Formula (given): Volume of a Pyramid V = 1/3 BH What does B represent?
3 Centroid	4 Midsegment of a triangle
5 Slope formula	6 Point Slope Form of Linear Equation *can be used to write equation of a line
7 Slope-Intercept Form of linear equation	8 Midsegment of a Trapezoid
9 Quadrilateral Family Tree	10 3 Methods of Proving Triangles SIMILAR

Area of the base.

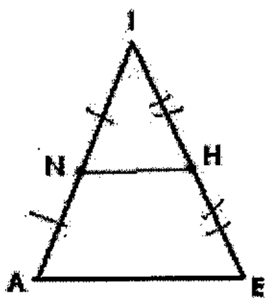
B = triangle ½ bh



B = Rectangle lw



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

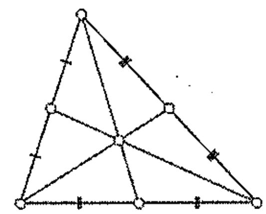


NH = (1/2) AE

and

$\overline{NH} \parallel \overline{AE}$

Where the medians of a triangle intersect.
Each median is divided into a 2:1 ratio.
The segment closest to vertex is twice as long!



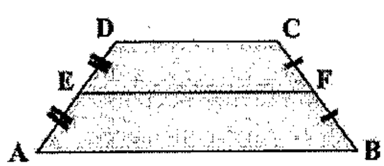
$y - y_1 = m(x - x_1)$

y_1 = y-coordinate x_1 = x-coordinate

m = slope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$\frac{\text{Rise}}{\text{Run}}$ $\frac{\Delta y}{\Delta x}$

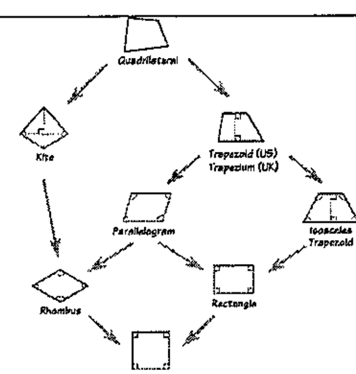


$\overline{EF} \parallel \overline{DC}$; $\overline{EF} \parallel \overline{AB}$

$$EF = \frac{1}{2}(DC + AB)$$

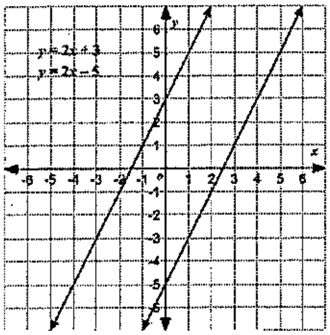
y = mx + b
m = slope
b = y-intercept

AA:
2 sets of corresponsing angles are CONGRUENT
SAS:
2 sets of corresponding sides are PROPORTIONAL
and
corresponding included angles are CONGRUENT
SSS:
3 sets of corresponding sides are PROPORTIONAL



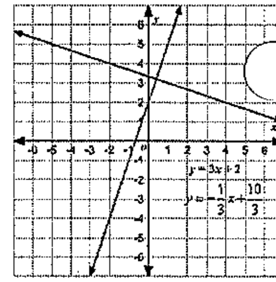
11 Perpendicular Lines	12 Parallel Lines
13 Parallelogram Properties	14 Rectangle Properties
15 Square Properties	16 Rhombus Properties
17 Kite Properties	18 Trapezoid Properties
19 Isosceles Trapezoid	20 Quadrilaterals

Same Slopes

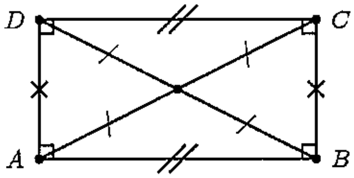


Negative Reciprocal Slopes (Opposite Signs and Flipped)

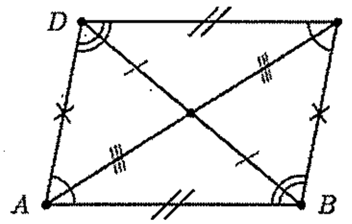
Example: $\frac{2}{3}$ and $\frac{-3}{2}$



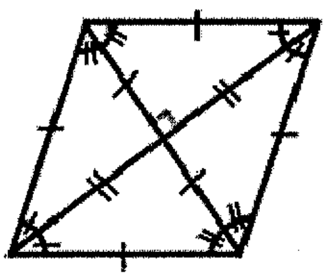
all of the properties of the parallelogram PLUS
- 4 right angles
- diagonals congruent



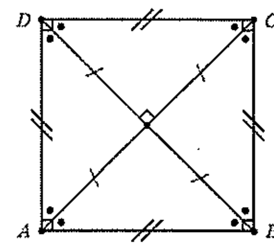
- 2 sets of parallel sides
- 2 sets of congruent sides
- opposite angles congruent
- consecutive angles supplementary
- diagonals bisect each other
- diagonals form 2 congruent triangles



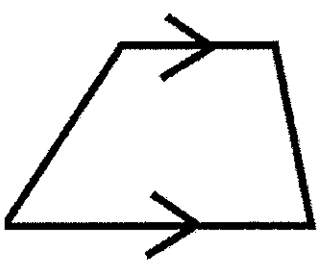
all of the properties of the parallelogram PLUS
- 4 congruent sides
- diagonals bisect angles
- diagonals perpendicular

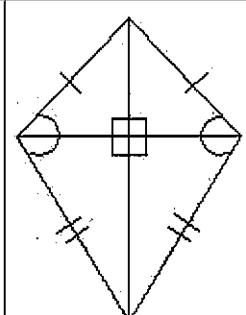


all of the properties of the parallelogram AND the rectangle AND the rhombus.



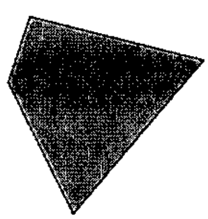
At least 1 pair of parallel sides



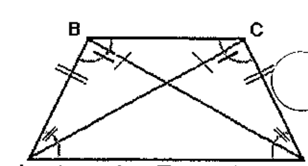


- Two pairs of equal in length adjacent sides.
- Diagonals intersect at right angles.
- One pair of equal opposite angles.
- One diagonal is bisected by the other.
- Two pairs of congruent triangles formed.

have exactly four sides
The sum of the interior angles of all quadrilaterals is 360°

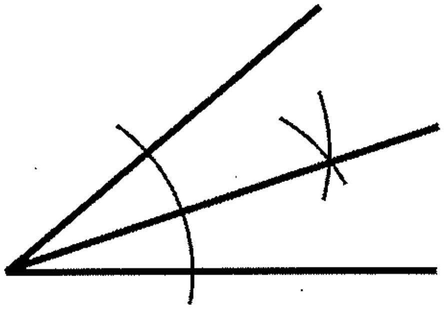


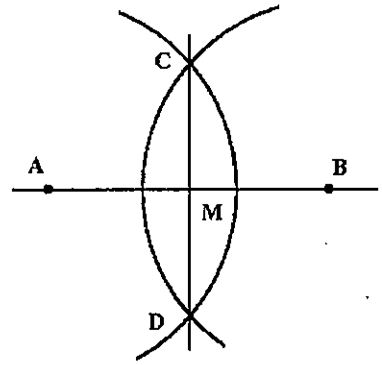
- only one set of parallel sides
- base angles congruent
- legs congruent
- diagonals congruent
- opposite angles supplementary

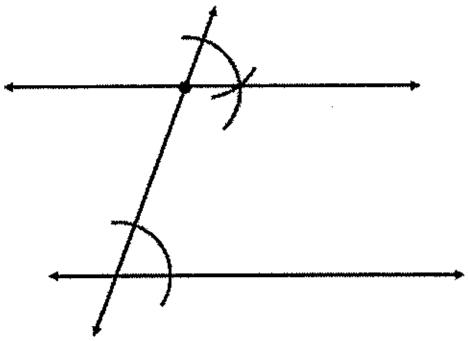


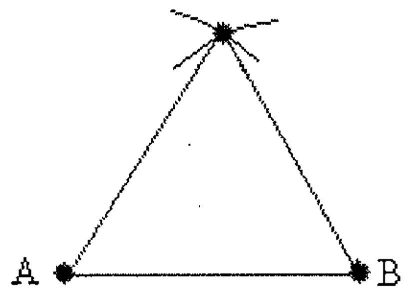
Isosceles Trapezoid

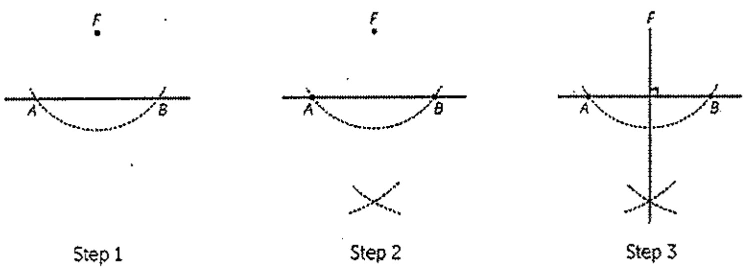
21 Constructing: Perpendicular Bisector Midpoint	22 Constructing: Angle Bisector
23 Constructing: Equilateral Triangle 60° angle	24 Constructing: Parallel Lines
25 Constructing: Perpendicular from a Point on the line	26 Constructing: Perpendicular from a point NOT on the line
27 Reflection in x-axis (x, y)	28 Reflection in y-axis (x, y)
29 Reflection in line y = x (x, y)	30 Reflection in line y = -x (x, y)

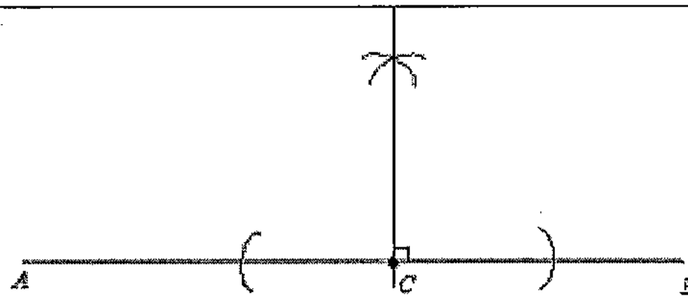












(- x, y)

(x, - y)

(-y, -x)

(y, x)

31 Point reflection through the Origin (same as Rotation 180° CC) (x, y)	32 R_{90}
33 R_{270}	34 Rigid Motion
35 What transformations are rigid motions?	36 **Formula for partitioning a directed line segment**
37 Sufficient properties for proving a quadrilateral is a PARALLELOGRAM	38 Composition of Transformations
39 Orthocenter	40 Incenter

(-y, x)

(-x, -y)

Produces a congruent image. They preserve:

1. distance
2. angle measure
3. parallelism
4. colinearity
5. midpoint

(y, -x)

$$\left(x_1 + \left(\frac{a}{a+b}\right)\cdot(x_2 \overset{run}{-} x_1),\ \ y_1 + \left(\frac{a}{a+b}\right)\cdot(y_2 \overset{rise}{-} y_1)\right)$$

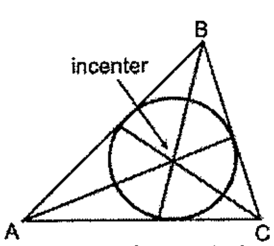
Reflections, rotations, translations, and glide reflections are all examples of rigid motions. (NOT DILATIONS)

$r_{x\text{-}axis} \circ T_{3,4}$

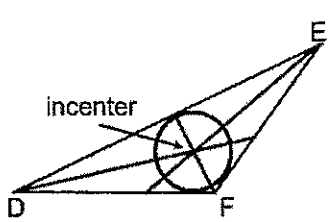
Do SECOND!! ↗ ↖ **Do FIRST!!!**

1. Both pairs of opposite sides are parallel.
2. Both pairs of opposite sides are congruent.
3. Both pairs of opposite angles are congruent.
4. Consecutive angles are supplementary.
5. Diagonals bisect each other.
6. One pair of opposite sides is both congruent and parallel.

Intersection of Angle Bisectors

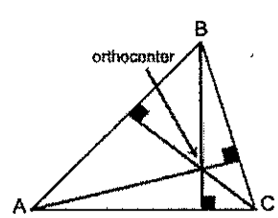


Angle Bisectors of an acute triangle.

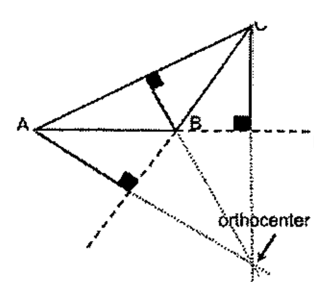


Angle Bisectors of an obtuse triangle.

Intersection of Altitudes

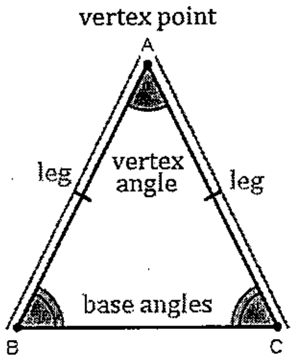


Altitudes of an acute triangle.

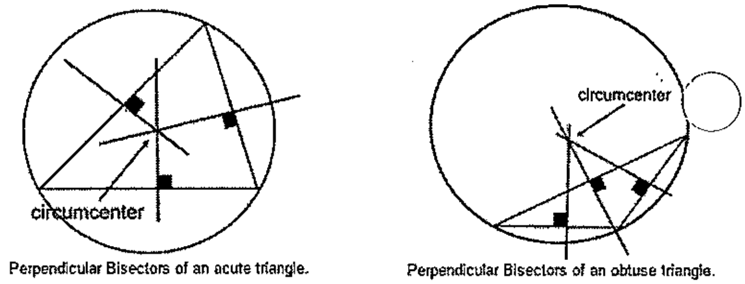


Altitudes of an obtuse triangle.

41 Circumcenter	42 Isosceles Triangle
43 Special Right Triangle 30°-60°-90°	44 Special Right Triangle 45°-45°-90°
45 How do you determine the longest side of a triangle?	46 Triangle Exterior Angle Theorem
47 Altitude to Hypotenuse	48 Distance Formula
49 Slope Formula	50 Midpoint Formula

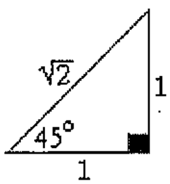


Intersection of Perpendicular Bisectors



45°-45°-90°

x x $x\sqrt{2}$

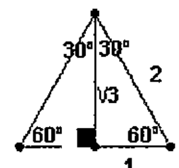


Hidden in Square w/diagonal

If side opposite 90° is a whole #, ÷ $\sqrt{2}$ then rationalize to get side opposite 45°.

30°-60°-90°

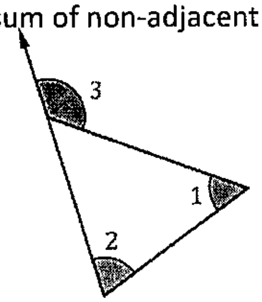
x $x\sqrt{3}$ 2x



Hidden in Equilateral Triangle with altitude.

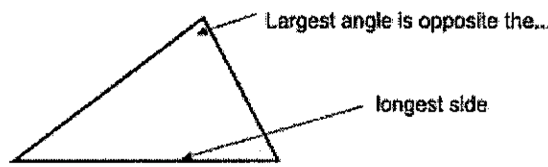
If side opposite 60° is a whole #, ÷ $\sqrt{3}$ then rationalize to get side opposite 30°.

Exterior angle = The sum of non-adjacent interior angles



$m\angle 1 + m\angle 2 = m\angle 3$

Opposite the largest angle

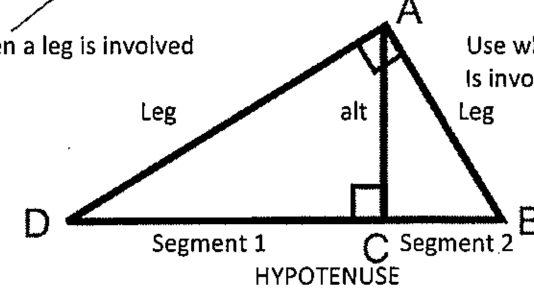


$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$\frac{H}{L} = \frac{L}{S} \qquad \frac{S_1}{A} = \frac{A}{S_2}$$

Use when a leg is involved

Use when altitude is involved

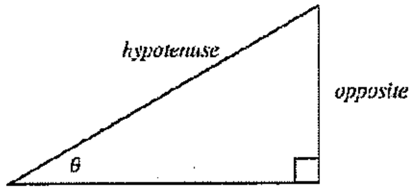


$$midpoint = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

$$\text{Slope} = m = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$$

51 Cofunctions	52 Sine
53 Cosine	54 Tangent
55 Pythagorean Theorem	56 When do you use Trig?
57 When do you use the Pythagorean Theorem?	58 How to determine possible length of 3rd side of a triangle.
59 What is density? What is formula? What are the keywords in a problem?	60 Converting in the metric system

$\text{Sin} \angle = \frac{Opp}{Hyp}$



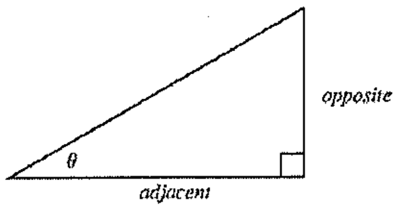
If trying to find angle use $\sin^{-1}$

Sine and Cosine

They are = when angles are complementary.

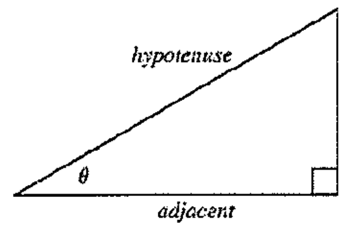
- Sin (10°) = cos (80°)
- Find value of x: sin (x) = cos (x + 5)
  Add angles and set to 90.

$\tan \angle = \frac{opp}{adj}$



If trying to find angle use $\tan^{-1}$

$\cos \angle = \frac{adj}{Hyp}$



If trying to find angle use $\cos^{-1}$

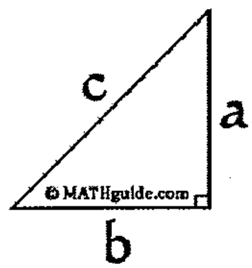
Use when **angle** is involved in RIGHT triangle

$$S\frac{O}{H}C\frac{A}{H}T\frac{O}{A}$$

Given side, angle…Find other side

Given 2 sides…find angle

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



Triples:

3, 4, 5

5, 12, 13

7, 24, 25

8, 15, 17

Given 2 sides of a triangle

Subtract them

Add them

3rd side must be between those lengths

Ex. 5 and 7

3rd side must be between 2 and 12 (not 2 or 12)

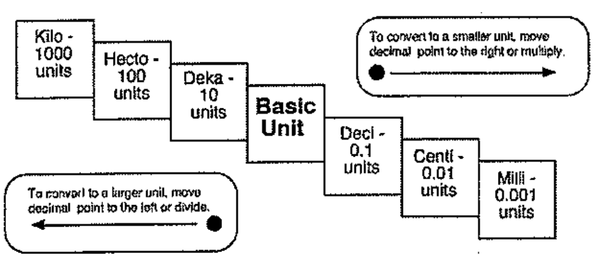
Use when only sides of a right triangle are involved.

Know 2 sides of a right triangle

Asked to find the third side

Kids Hate Doing Math During Class Movies

Metric Conversion Chart



Basic unit: Meters, Grams, Liters

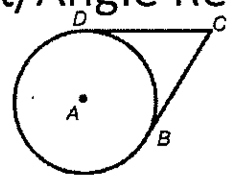
- The amount of something (quantity) per space available (area/volume)
- $Density = \frac{mass}{volume}$
- ___ per ___

Mass: g, oz, lbs, etc

Volume: in^3, cm^3, etc

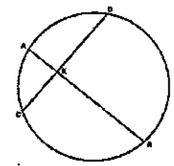
61

2 tangents to a circle
(Segment/Angle Relationship)



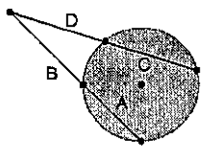
62

2 chords in a circle
(Segment/Angle Relationship)



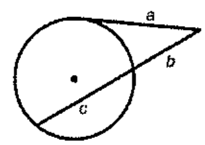
63

2 secants to a circle
(Segment relationship)



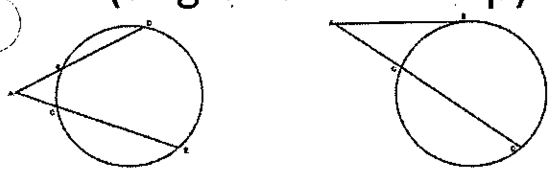
64

Tangent /Secant
(Segment Relationship)



65

Angle formed Outside the Circle
(angle relationship)

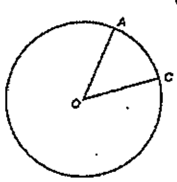


66

Equation of a circle
(center at the origin)

67

Central Angle

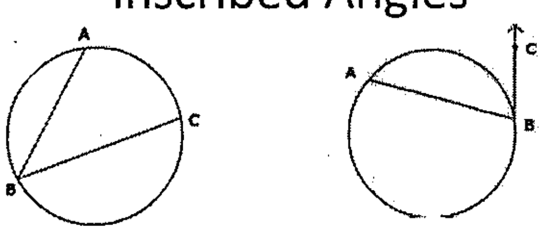


68

Equation of a Circle
(center shifted)

69

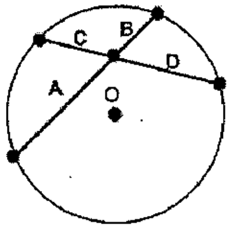
Inscribed Angles



70

Relationship between
a radius and a
tangent (at point of tangency)

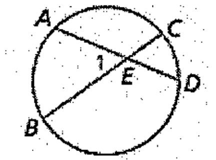
Segments



$P \bullet P = P \bullet P$

$A \bullet B = C \bullet D$

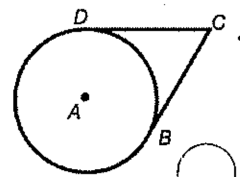
Angles

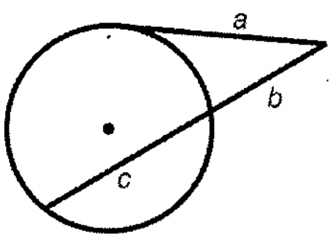


Chords $\overline{AD}$ and $\overline{BC}$ intersect at *E*.

$m\angle 1 = \frac{1}{2}(m\widehat{AB} + m\widehat{CD})$

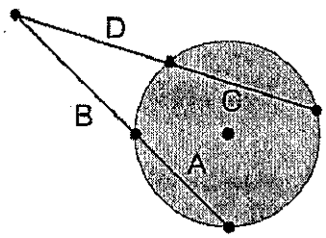
- tan = tan
- minor arc is supplementary to angle formed by 2 tangents





$w \bullet e = t^2$

$(b+c)\, b = a^2$



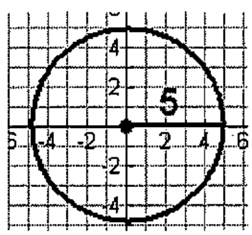
we=we

$(a+b) \bullet b = (c+d) \bullet d$

Circle with Center at Origin (0,0)

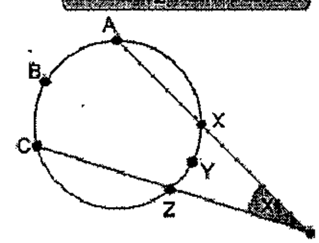
$$x^2 + y^2 = r^2$$

where the center is (0,0) and the radius is *r*.

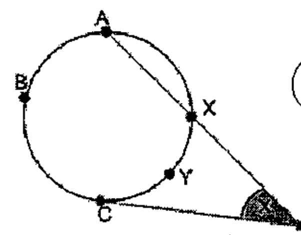


$$x^2 + y^2 = 25$$

I $m\angle X = \frac{1}{2}(\widehat{ABC} - \widehat{XYZ})$



II $m\angle X = \frac{1}{2}(\widehat{ABC} - \widehat{XYC})$

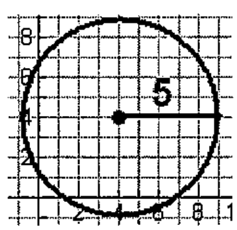


Circle with Center at Point (*h*,*k*)

$$(x-h)^2 + (y-k)^2 = r^2$$

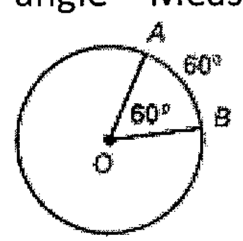
where the center is (*h*,*k*) and the radius is *r*

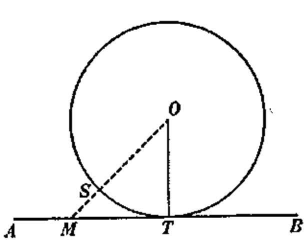
- opp signs of center!



$$(x-4)^2 + (y-4)^2 = 25$$

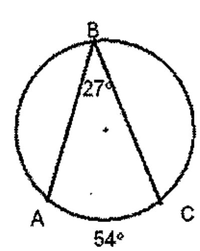
Measure of angle = Measure of arc





Always ⊥ at point of tangency. Look for right triangles!

Measure of angle = ½ arc



71

Points of Concurrency

72

Which point of concurrency locates the point equidistant from all 3 vertices of a triangle?

73

Cross Sections

74

Length of an Arc
(degrees)

75

Area of a Sector of a Circle

76

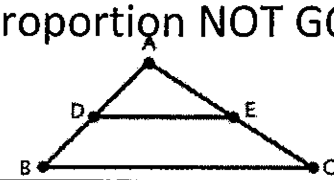
Length of an Arc
(Radians)

77

Converting between degrees and radians

78

SIDE SPLITTER
4 proportions GOOD
1 proportion NOT GOOD!



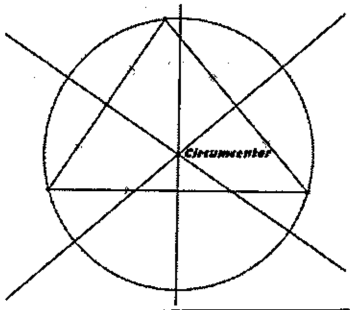
79

Similar Triangle Proofs
(last 3 steps)

80

Inscribed Angle
that intercepts the diameter

Perpendicuar Bisectors- Circumcenter

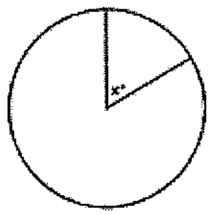


All Of My Children Are Bringing In Peanut Butter Cookies

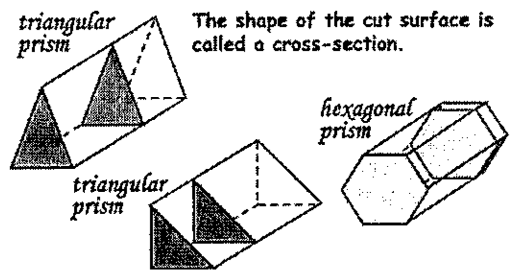
Altitudes-Orthocenter
Medians- Centroid
Angle Bisectors- Incenter
Perpendicuar Bisectors- Circumcenter

Portion of the Circumference

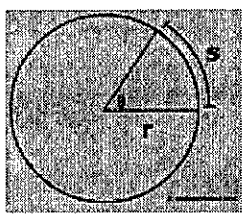
$$L = \frac{n^\circ}{360} \cdot \pi d$$



Parallel to base: SAME shape as base.

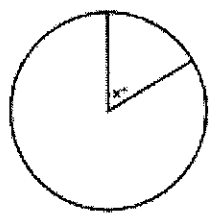


$$S = \theta r$$



θ *is central angle in RADIANS*

Portion of the Area



$$L = \frac{n^\circ}{360} \cdot \pi r^2$$

GOOD

- $\frac{AD}{DB} = \frac{AE}{EC}$ PIECE/PIECE
- $\frac{AD}{AB} = \frac{AE}{AC}$ PIECE/WHOLE
- $\frac{DB}{AB} = \frac{EC}{AC}$ PIECE/WHOLE
- $\frac{AD}{DE} = \frac{AB}{BC}$ WHOLE/WHOLE

NOT GOOD

$\frac{AD}{DE} = \frac{DB}{BC}$

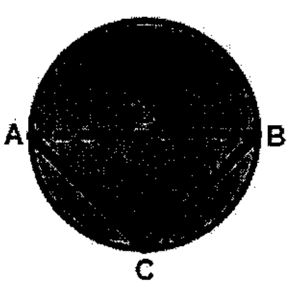
Parallel sides involved...

Must use WHOLE SIDES

degrees $\xrightarrow{\times \frac{\pi}{180}}$ radians

degrees $\xleftarrow{\times \frac{180}{\pi}}$ radians

Is a right angle!

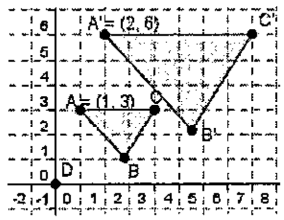


Δ ~ Δ	AA
— = —	CSSTP
( )( ) = ( )( )	In a proportion, the product of the means = product of the extremes.

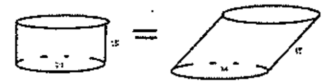
81 Cavalieri's Principle	82 Dilation with Respect to the ORIGIN
83 Dilation with Respect to a POINT	84 Segment Perpendicular to a chord
85 What does CPCTC stand for?	86 What does CSSTP stand for?
87 What congruence criteria can be used to prove 2 triangles are congruent?	88 When do you use law of sines in a TRIG problem?
89 Dilating a LINE With respect to origin	90 Angle of Elevation/Depression

Multiply pre-image points by scale factor.

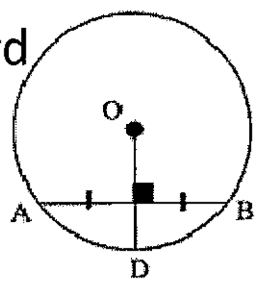
$D_{K,O}(x, y) = (kx, ky)$



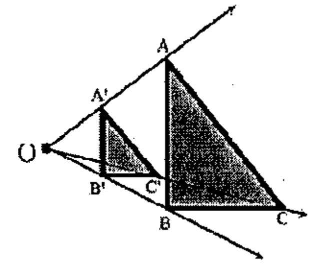
Two solids will have equal volumes if their bases have equal area and their altitudes (heights) are equal



Bisects the chord

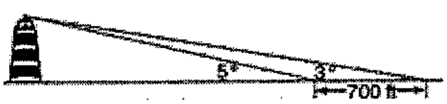


Point of dilation, image and pre-image must be collinear.

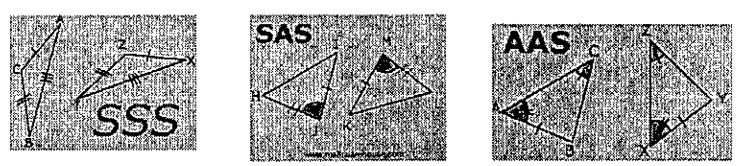


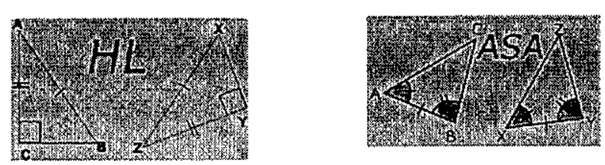
Corresponding Sides of Similar Triangles are Proportional

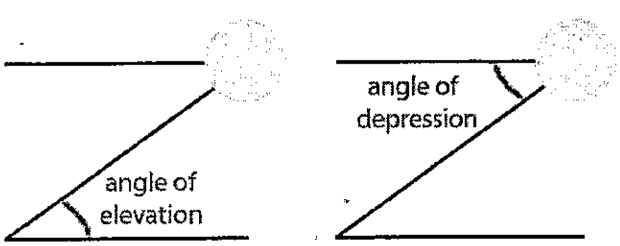
Corresponding Parts of Congruent Triangles are Congruent



When you do NOT have any lengths of any of the sides of the **right triangles**







angle of elevation = angle of depression

Multiply y-intercept by scale factor

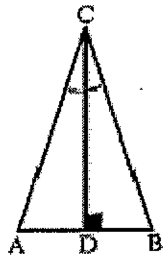
SLOPE STAYS SAME!

Ex. $D_{2,O}$ y= 2x – 4

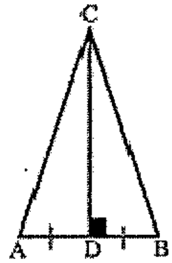
Becomes y = 2x – 8

91 Why are all circles similar?	92 Altitude of an isosceles triangle is also ...
93 Writing an equation of perpendicular bisector	94 How to construct a SQUARE INSCRIBED IN A CIRCLE
95 How to construct a quilateral Triangle / Hexagon INSCRIBED IN A CIRCLE	96 Partitioning a Directed Segment using a graph
97 Rotational Symmetry	98 Point Symmetry
99 Completing the Square for a CIRCLE $x^2 + y^2 + cx + dy = e$	100 Coordinate Geometry Proofs Parallelogram Rectangle Rhombus Square Trapezoid Isosceles Trapezoid

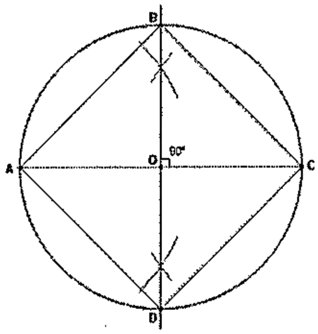
Bisects Vertex Angle



Bisects the BASE



Composition of a Translation and Dilation.



1st Find Midpoint

$$mp = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

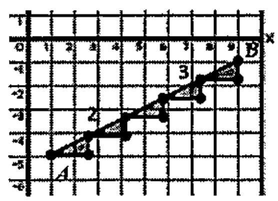
2nd Find Slope

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

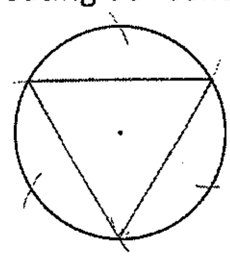
3rd find Negative Reciprocal of slope.

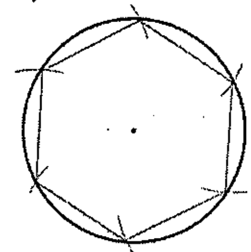
Then use $y - y_1 = m(x - x_1)$ with your midpoint and Negative Reciprocal slope

Divide the slope (rise and run)
Example 2:3 ratio, divide rise and run by 5.
Then count new slope to create partition



Measure radius, mark off radius (creating 60° central angle)

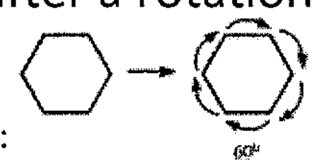




Looks the SAME after a rotation of 180 (turn upside down)

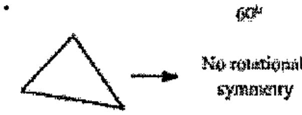
©John Langdon

Looks the SAME after a rotation
Maps onto itself



Formula for regular polygon:

$$\frac{360}{\#\ of\ sides}$$

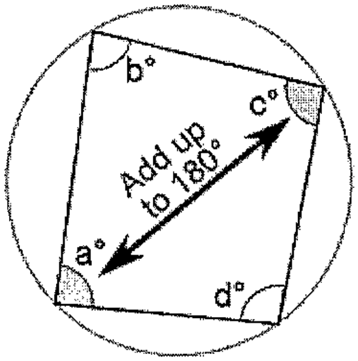


Parallelogram: 4 SLOPES (Opp. Sides | |)
Rectangle: 4 SLOPES (Opp. Sides | |, 1 pair consecutive sides ⊥)
Rhombus: 6 SLOPES (Opp. Sides | |, diagonals ⊥)
Square: 6 SLOPES (Opp. Sides | |, 1 pair consecutive sides ⊥, diagonals ⊥)
Trapezoid: 2 SLOPES (1 pair of | | sides)
Isosceles Trapezoid: 2 SLOPES, 2 DIST (1 pair of | | sides, non | | sides congruent)

$\left(\frac{b}{2}\right)^2$, *add to both sides*

$$x^2 + y^2 - 4x - 6y + 8 = 0$$
$$x^2 - 4x + y^2 - 6y = -8$$
$$x^2 - 4x + \square + y^2 - 6y + \square = -8 + \square + \square$$
$$x^2 - 4x + \boxed{4} + y^2 - 6y + \boxed{9} = -8 + \boxed{4} + \boxed{9}$$
$$(x-2)^2 + (y-3)^2 = 5$$

101 Formula to determine scale factor in a dilation	102 Opposite angles in a cyclic quadrilateral
103 Auxiliary Line	104 **<u>Dilations Properties</u>** Ratio of corresponding sides Ratio of Perimeters Ratio of Areas Ratio of corresponding angles
105	106
107	108
109	110



Scale factor (k) = $\frac{image}{pre-image}$

- Ratio of perimeters is EQUAL to ratio of corresponding sides
- Ratio of areas is equal to the SQUARE of the ratio of corresponding sides
- Ratio of corresponding angles is always 1:1. This is because angle measures are preserved in a dilation

An **auxiliary line** is a line that is added to a figure to aid in a proof.