

mathSUX²

Geometry Cheat Sheet

Notation:

$\cong$ congruent
 $\sim$ similar
 Δ triangle
 $\sphericalangle$ angle
 $\parallel$ parallel
 $\perp$ perpendicular
 $\overline{AB}$ line segment AB
 $\widehat{AB}$ arc AB

Equation of a Line:

$$y = mx + b$$

$$m = \text{slope} = \frac{\Delta y}{\Delta x} = \frac{\text{rise}}{\text{run}}$$

$$b = y - \text{intercept}$$

Point Slope Form:

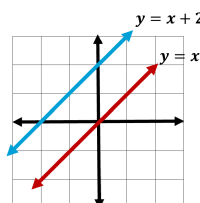
$$y - y_1 = m(x - x_1)$$

Parallel and Perpendicular Lines:

Parallel:

Same Slope

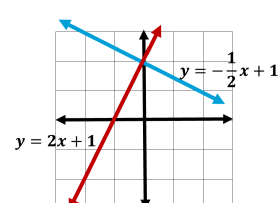
$$m = m$$



Perpendicular: Take

negative reciprocal

$$m \rightarrow -1/m$$



Distance Formula:

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

Law of Sins:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Converting Degrees to Radians:

$$\text{ex: } 60^\circ \times \frac{\pi}{180} = \frac{\pi}{3}$$

Midpoint Formula:

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

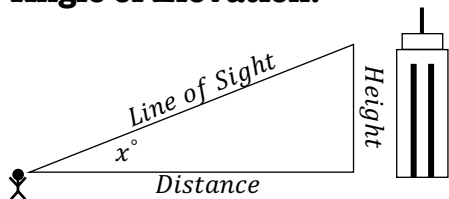
Law of Cosines:

$$c^2 = a^2 + b^2 - 2ab \cos C$$

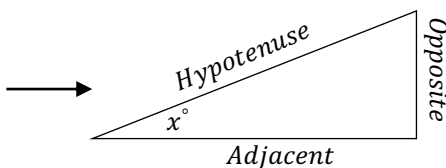
Converting Radians to Degrees:

$$\text{ex: } \frac{\pi}{3} \times \frac{180}{\pi} = 60^\circ$$

Angle of Elevation:



SOH CAH TOA:



$$\sin(x) = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos(x) = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan(x) = \frac{\text{opposite}}{\text{adjacent}}$$

Inverse Trig. Functions:

$$\sec(x) = \frac{1}{\cos(x)}$$

$$\csc(x) = \frac{1}{\sin(x)}$$

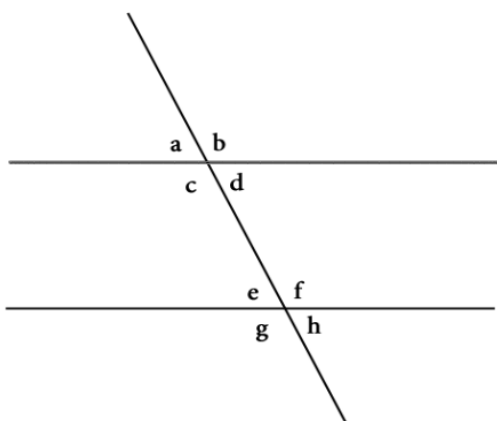
$$\cot(x) = \frac{1}{\tan(x)}$$

Complimentary Angles:

$$\sin(90^\circ - \theta) = \cos(\theta) \quad \csc(90^\circ - \theta) = \sec(\theta)$$

$$\cos(90^\circ - \theta) = \sin(\theta) \quad \sec(90^\circ - \theta) = \csc(\theta)$$

$$\tan(90^\circ - \theta) = \cot(\theta) \quad \cot(90^\circ - \theta) = \tan(\theta)$$

Probability: n = Total number of objects r = Number of chosen objects**Permutation:** ${}_nP_r = \frac{n!}{(n-r)!}$
(Order matters)**Combinations** ${}_nC_r = \frac{n!}{r!(n-r)!}$
(Order doesn't matter)**Conditional:** $P(B|A) = \frac{P(A \cap B)}{P(A)}$ **And:** $P(A \cap B) = P(A) \times P(B)$ (Independent) $P(A \cap B) = P(A) \times P(B|A)$ (Dependent)**Or:** $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (Not Mutually Exclusive) $P(A \cup B) = P(A) + P(B)$ (Mutually Exclusive)**Transversals:** Given two lines are parallel and are cut by a transversal line.**Alternate Interior Angles:** $\angle c = \angle f$ and $\angle d = \angle e$ **Alternate Exterior Angles:** $\angle a = \angle h$ and $\angle b = \angle g$ **Corresponding Angles:** $\angle a = \angle e$, $\angle b = \angle f$, $\angle c = \angle g$, and $\angle d = \angle h$ **Supplementary Angles:** $\angle c + \angle e = 180^\circ$, $\angle d + \angle f = 180^\circ$, $\angle a + \angle b = 180^\circ$,
 $\angle c + \angle d = 180^\circ$, $\angle e + \angle f = 180^\circ$, $\angle g + \angle h = 180^\circ$ **Properties of a Parallelogram:**

- 1) Opposite sides are parallel.
- 2) Pairs of opposite sides are congruent.
- 3) Pairs of opposite angles are congruent.
- 4) Diagonals bisect each other.
- 5) Diagonals separate parallelogram into 2 congruent triangles.
- 6) Interior angles add up to 360° .

The following shapes are all Parallelograms:1) Square (also a rhombus and a rectangle) 2) Rhombus 3) Rectangle **Transformations:**Reflection in the x-axis: $A(x, y) \rightarrow A'(x, -y)$ Reflection in the y-axis: $A(x, y) \rightarrow A'(-x, y)$ Reflection over the line $y=x$: $A(x, y) \rightarrow A'(y, x)$ Reflection through the origin: $A(x, y) \rightarrow A'(-x, -y)$ Transformation to the left m units and up n units: $A(x, y) \rightarrow A'(x - m, y + n)$ Rotation of 90° : $A(x, y) \rightarrow A'(-y, x)$ Rotation of 180° : $A(x, y) \rightarrow A'(-x, -y)$ Rotation of 270° : $A(x, y) \rightarrow A'(y, -x)$ Dilation of n : $A(x, y) \rightarrow A'(xn, yn)$

Congruent Triangles $\cong$:

SAS

SSS

AAS

HL –(only for right triangles)

ASA

When proven use: Corresponding parts of congruent triangles are congruent (CPCTC)

Similar Triangles $\sim$:

AA

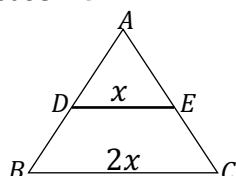
SSS

SAS

When proven use: Corresponding sides of similar triangles are in proportion.

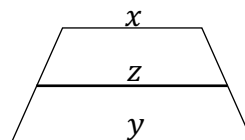
Midpoint Triangles Theorem:

$\triangle ABC$ has midpoints at point D and point E. When points D and E are connected, the length of $\overline{DE}$ is half the length of base $\overline{BC}$.

**Medians of a Trapezoid:**

In a trapezoid, the length of median z is equal to half the length of the sum of both bases x and y .

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

**Types of Triangles:**

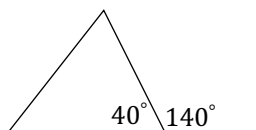
Scalene: No sides are equal.

Equilateral: All sides are equal.

Isosceles: Two sides are equal.

Acute: All angles are $< 90^\circ$.Obtuse: There is an angle $> 90^\circ$.Right: There is an angle $= 90^\circ$.**External Angle Triangles Theorem:**

When any side of a triangle is extended the value of its angle is supplementary to the angle next to it (adding to 180°). ex:



$$40^\circ + 140^\circ = 180^\circ$$

Volume:

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

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

Pyramid: $V = \frac{1}{3}bh$

Cone: $V = \frac{1}{3}\pi r^3$

Prism: $V = bh$

Area:

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

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

Rectangle: $A = bh$

Square: $A = s^2$

Circle: $A = \pi r^2$

Perimeter:

Rectangle: $P = 2l + 2w$

Square: $P = 4s$

Circle: Circumference $= \pi d$

Pythagorean Theorem:

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

Polygon Angle Formulas:

n =number of sides

Value of each Interior Angle: $\frac{180(n-2)}{n}$

Sum of Interior Angles: $180(n-2)$

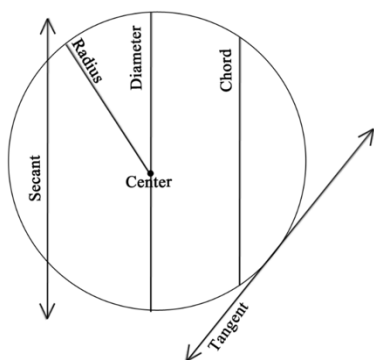
Value of each Exterior Angle: $\frac{360}{n}$

Sum of Exterior Angles: 360°

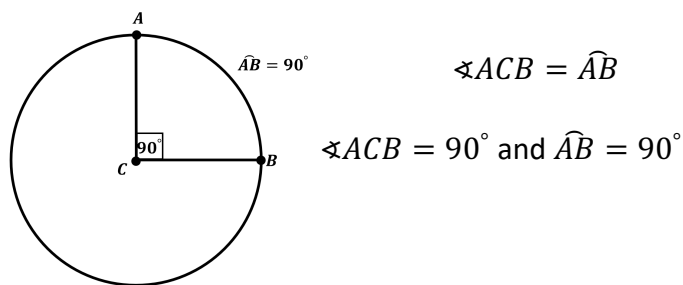
How to Prove Circles Congruent $\cong$:

Circles are equal if they have congruent radii, diameters, circumference, and/or area.

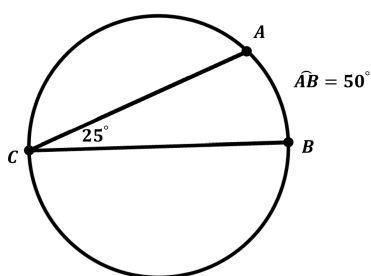
Parts of a Circle:



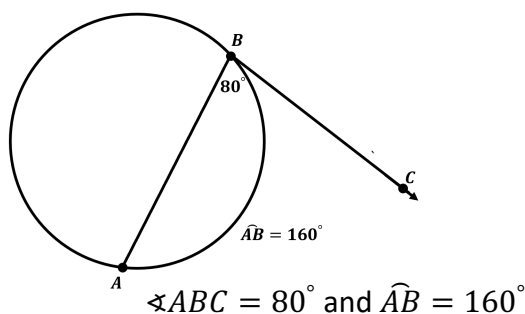
Central Angles = Measure of Arc



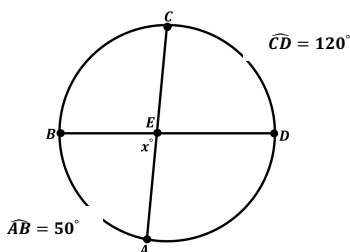
Inscribed Angle = $\frac{1}{2}$ Arc



Tangent/Chord Angle = $\frac{1}{2}$ Arc

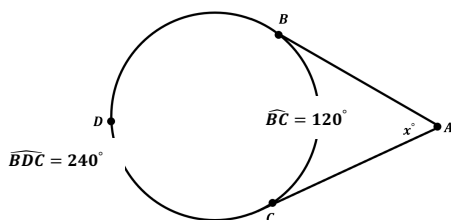


Angle formed by Two Intersecting Chords = $\frac{1}{2}$ the sum of Intercepted Arcs



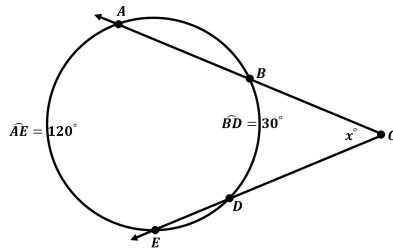
$$\begin{aligned}\angle BEA &= \frac{1}{2}(\widehat{AB} + \widehat{CD}) \\ \angle BEA &= \frac{1}{2}(120^\circ + 50^\circ) \\ \angle BEA &= \frac{1}{2}(170^\circ) \\ \angle BEA &= 85^\circ\end{aligned}$$

Angle formed by Two Tangents = $\frac{1}{2}$ the difference of Intercepted Arc



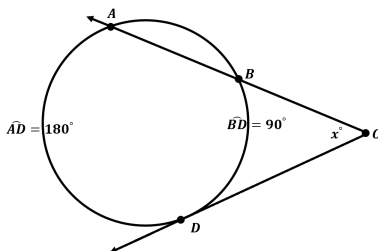
$$\begin{aligned}\angle BAC &= \frac{1}{2}(\widehat{BDC} - \widehat{BC}) \\ \angle BAC &= \frac{1}{2}(240^\circ - 120^\circ) \\ \angle BAC &= \frac{1}{2}(120^\circ) \\ \angle BAC &= 60^\circ\end{aligned}$$

Angle formed by two Secants = $\frac{1}{2}$ the difference of Intercepted Arc



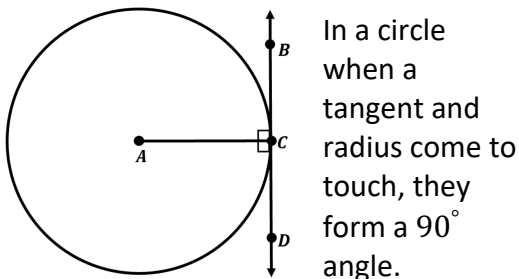
$$\begin{aligned}\angle ACD &= \frac{1}{2}(\widehat{AD} - \widehat{BE}) \\ \angle ACD &= \frac{1}{2}(120^\circ - 30^\circ) \\ \angle ACD &= \frac{1}{2}(90^\circ) \\ \angle ACD &= 45^\circ\end{aligned}$$

Angle formed by a Secant and Tangent = $\frac{1}{2}$ the difference of Intercepted Arc

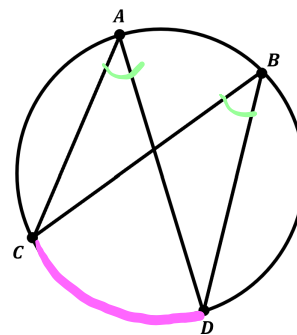


$$\begin{aligned}\angle ACD &= \frac{1}{2}(\widehat{AD} - \widehat{BD}) \\ \angle ACD &= \frac{1}{2}(180^\circ - 90^\circ) \\ \angle ACD &= \frac{1}{2}(90^\circ) \\ \angle ACD &= 45^\circ\end{aligned}$$

Circle Theorems:

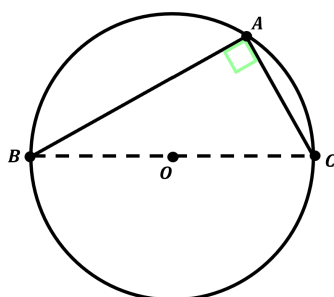


$$\angle ACB = 90^\circ \text{ and } \angle ACD = 90^\circ$$



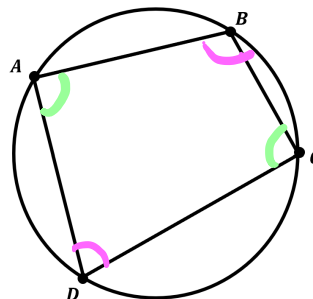
$$\angle A \cong \angle B$$

In a circle when two inscribed angles intercept the same arc, the angles are congruent.



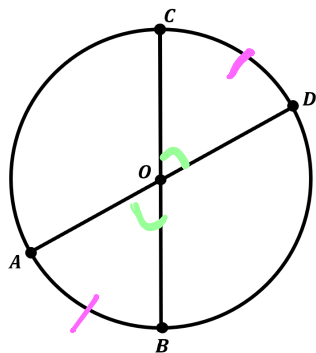
$$\angle BAC \cong 90^\circ$$

In a circle when an angle is inscribed by a semicircle, it forms a 90° angle.



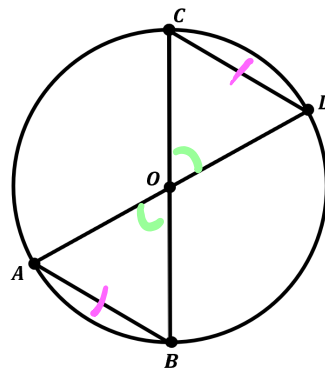
$$\angle A + \angle C = 180^\circ \text{ and } \angle B + \angle D = 180^\circ$$

When a quadrilateral is inscribed in a circle, opposite angles are supplementary.



In a circle when central angles are congruent, arcs are also congruent. (and vice versa)

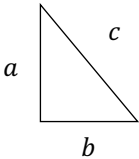
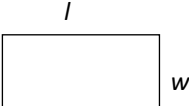
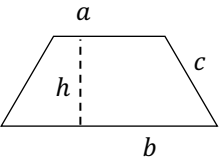
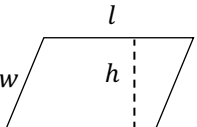
$\angle COD \cong \angle AOB$ Therefore, $\widehat{AB} \cong \widehat{CD}$

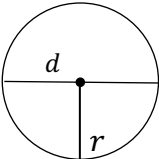
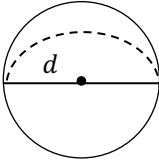
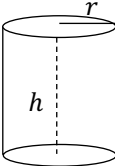
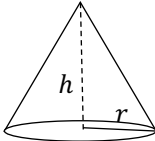
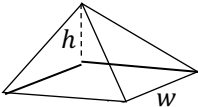
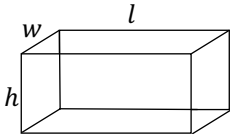
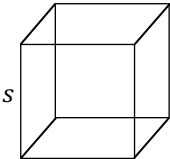


In a circle when central angles are congruent, chords are also congruent. (and vice versa)

$\angle COD \cong \angle AOB$ Therefore, $\widehat{AB} \cong \widehat{CD}$

Perimeter, Area and Volume:

Shape	Perimeter	Area	Volume
Triangle 	$P=a+b+c$	$A = \frac{1}{2}ab$	
Square 	$P=4s$	$A = s^2$	
Rectangle 	$P=2l+2w$	$A = l \times w$	
Trapezoid 	$P=a+b+2c$	$A = \frac{1}{2}(a+b)h$	
Parallelogram 	$P=2l+2w$	$A = l \times h$	

Circle		$C = \pi d$	$A = \pi r^2$	
Sphere			$SA = 4\pi r^2$	$V = \frac{4}{3}\pi r^3$
Cylinder			$SA = 2\pi r^2 + 2\pi rh$	$V = \pi r^2 h$
Cone				$V = \frac{1}{3}\pi r^2 h$
Pyramid				$V = lw \frac{1}{3}h$
Rectangular Prism			$SA = 2(lw + wh + lh)$	$V = l \times w \times h$
Cube			$SA = 6s^2$	$V = s^3$