Basic Algebra Formulas ①

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

Slope-intercept form $y = mx + b$

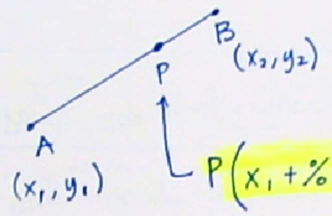
Point-slope form $y - y_1 = m(x - x_1)$

Distance between 2 points
$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

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

Quadratic Formula
$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Partitioning a Segment



$\% = \frac{AP}{AB}$

$P\left(x_1 + \%\,\text{run},\ y_1 + \%\,\text{rise}\right)$

run $\rightarrow x_2 - x_1$; rise $\rightarrow y_2 - y_1$

3 undefined terms in Geometry ②

point ·A — has no size, represents a location

line (A, B, ℓ) — made up of ∞ points, has no thickness, cannot be measured, TPDL – two points determine a line; demonstrates straightness,

plane (A, B, C) — made up of ∞ points that exhibit flatness, no edges, determined by 3 non-collinear points

Transformations ③

Rigid Motions

translation: $(x,y) \rightarrow (x+h, y+k)$

reflections:

- x-axis $(x,y) \rightarrow (x,-y)$
- y-axis $(x,y) \rightarrow (-x,y)$
- over $y = x$ $(x,y) \rightarrow (y,x)$
- over $y = -x$ $(x,y) \rightarrow (-y,-x)$

Dilation not rigid
$k > 0$ centered at origin
$(x,y) \rightarrow (kx, ky)$

rotations:	counterclockwise	clockwise
90°	$(x,y) \rightarrow (-y,x)$	$(x,y) \rightarrow (y,-x)$
180°	$(x,y) \rightarrow (-x,-y)$	$(x,y) \rightarrow (-x,-y)$
270°	$(x,y) \rightarrow (y,-x)$	$(x,y) \rightarrow (-y,x)$

Addition/ Subtraction
Multiplication / Division
Reflexive
Transitive ($\cong$)
Symmetric
Substitution (=)
Simplify
Distributive

Two points determine a line (TPDL)

Segment Addition
Angle Addition

SSS	AAS
SAS	HL
ASA	CPCTC

Properties and Postulats

④

Def. of midpoint
Def. of bisector
Def. of linear pair
Def. of straight $\angle$
Def. of right $\angle$
Def. of vertical $\angle$s
Def. of supp.
Def. of comp.
Def. $\cong$

Def. $\perp$
Def. isosceles $\triangle$
Def. right $\triangle$
Def. ▱

Definitions → Biconditionals

⑤

Common Segment Theorem
$\cong$ supp. Theorem
$\cong$ comp. Theorem
Right $\angle$s $\cong$ Thm.
Vertical $\angle$ Thm.
Linear Pair Thm.
$\cong$ $\angle$s supp → right $\angle$s

If // → AIA $\cong$
If // → CA $\cong$
If // → AEA $\cong$
If // → SSIA supp
If AIA $\cong$ → //
If CA $\cong$ → //
If AEA $\cong$ → //
If SSIA supp → //

If 2 lines form a linear pair and are $\cong$ → $\perp$

If a line $\perp$ to one of 2 // lines → $\perp$ to other line

If 2 lines $\perp$ to same line → //

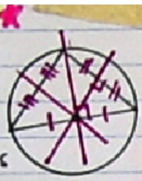
Theorems → Math Statements you can prove ⑥

Sum of $\angle$s in $\triangle$ = 180
Exterior $\angle$ Thm.
3rd $\angle$ Thm.
If $\triangle$ → $\triangle$
If $\triangle$ → $\triangle$
If $\triangle$ → $\triangle$
If $\triangle$ → $\triangle$

If ▱ → opp sides $\cong$
If ▱ → opp $\angle$s $\cong$
If ▱ → diagonals bisect each other
If ▱ → one set opp. sides // and $\cong$

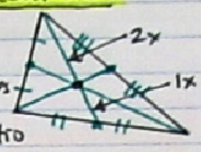
Circumcenter ★

- formed by ⊥ bisectors
- equidistant from all vertices



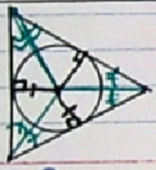
Centroid

- formed by medians
- Centroid divides each median into a 2 : 1 ratio



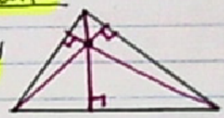
Incenter ★

- formed by ∠ bisectors
- equidistant from sides



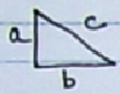
★ Orthocenter

- formed by altitudes



Points of Concurrency

★ Part of Euler's Line



$a^2+b^2=c^2$ right △

$a^2+b^2<c^2$ obtuse △

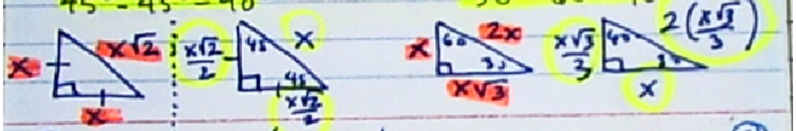
$a^2+b^2>c^2$ acute △

Triples

3-4-5	20-21-29
5-12-13	9-40-41
8-15-17	11-60-61
7-24-25	12-35-37

45°-45°-90°

30°-60°-90°



Right △s / Triples

Sum of Interior ∠s $S=(n-2)180°$

Sum of Exterior ∠s $E=360°$

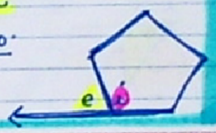
Regular Only

1 interior ∠ $i=\frac{(n-2)180°}{n}$

1 exterior ∠ $e=\frac{360°}{n}$

number of sides $n=\frac{360°}{e}$

$i+e=180°$

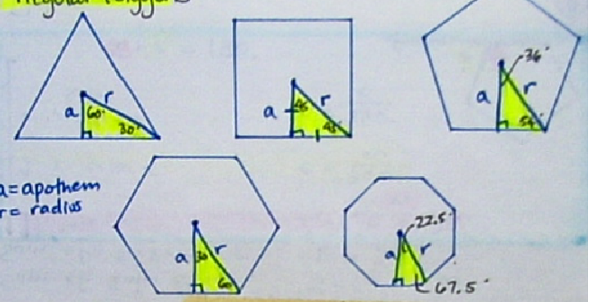


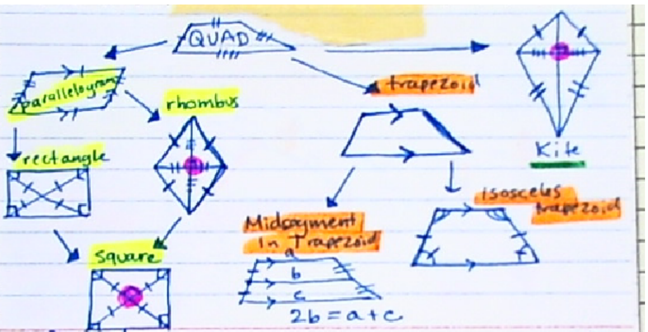
Polygons

Regular Polygons

a = apothem

r = radius



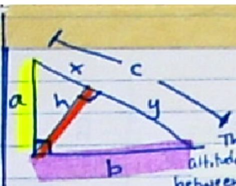


Quads

3 WAYS TO PROVE Δs $\sim$

1. AA $\sim$
2. SSS $\sim$
3. SAS $\sim$

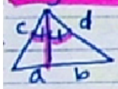
Altitude on Hypotenuse



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

The altitude is the geometric mean between 2 parts of hypotenuse

Angle-Bisector



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

$$\frac{x}{a} = \frac{a}{c} \qquad \frac{y}{b} = \frac{b}{c}$$

A leg is the geometric mean between the adjacent part of hypotenuse and entire hypotenuse.

$\sim$ Figures $\rightarrow$ Dilations

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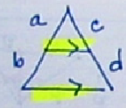
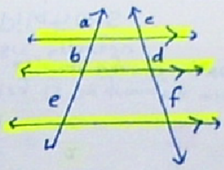
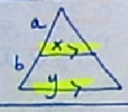
Side-splitters



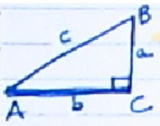


$$\frac{a}{b} = \frac{c}{d} \qquad \frac{a}{c} = \frac{b}{d}$$

$$\frac{a}{a+b+e} = \frac{c}{c+d+f}$$



$$\frac{a}{x} = \frac{a+b}{y}$$



$$\sin A = \frac{opp}{hyp} \qquad \cos A = \frac{adj}{hyp} \qquad \tan A = \frac{opp}{adj}$$

SOH CAH TOA

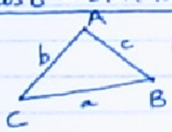
Cofunctions

$\sin A = \cos(90 - A)$

$\cos B = \sin(90 - B)$

Law of Sines (ASA, AAS, ASS?)

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



Law of Cosines (SAS, SSS)

$$a^2 = b^2 + c^2 - 2bc(\cos A)$$
$$b^2 = a^2 + c^2 - 2ac(\cos B)$$
$$c^2 = a^2 + b^2 - 2ab(\cos C)$$

Trigonometry

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