1.) **SIMILAR TRIANGLES**

a.) Some possible proportions:

\[
\frac{a}{A} = \frac{b}{B} = \frac{c}{C} \quad \frac{a}{b} = \frac{A}{B} \quad \frac{a}{c} = \frac{A}{C} \quad \frac{c}{b} = \frac{C}{B}
\]

b.) For a right triangle cut by its altitude

\[
\frac{AC}{CB} = \frac{CB}{CD} \quad \frac{DA}{AB} = \frac{BA}{AC} \quad \frac{AD}{DB} = \frac{BD}{DC}
\]

c.) Or for all possibilities, split into 3 similar triangles:

All corresponding sides are proportional.
2.) **PARALLEL LINES CUT BY A TRANSVERSAL**

![Diagram of parallel lines cut by a transversal]

3.) **ANGLE OF REFLECTION**

For perpendicular mirrors, the incident ray will be parallel to the reflected ray:

![Diagram of angle of reflection]

4.) **TRIANGLES**

a.) $A + B + D = 180^\circ$ and $C = A + B$

![Diagram of a triangle]

b.) Congruent Triangles:
- **ASA**
- **SSS**
AAS

SAS

HL

CPCTC - Corresponding Parts of Congruent Triangles are Congruent

c.) Similar Triangles (corresponding sides are therefore proportional):

AAA

AA

SSS (similar sides)

SAS (similar sides)
d.) ISOSCELES THEOREM: Base angles are congruent.

![Isosceles Theorem](image)

e.) ALTITUDES of a triangle intersect at the ORTHOCENTER:

![Orthocenter Diagram](image)

f.) MEDIANS of a triangle intersect at the CENTROID:

![Centroid Diagram](image)

g.) ANGLE BISECTORS of a triangle intersect at the INCENTER:
h.) PERPENDICULAR BISECTORS of a triangle intersect at the CIRCUMCENTER:

i.) Any point C on the Angle bisector AC is equidistant to the two sides of the angle, i.e., BC=CD.

j.) Area of a triangle: $A = \frac{1}{2}bh$

k.) Area of a triangle by the use of only the sides (Heron’s Theorem)

$$A = \sqrt{s(s - a)(s - b)(s - c)}$$

where $s = \frac{1}{2}(a + b + c) = \text{semiperimeter}$
l.) Pythagorean Theorem: $a^2 + b^2 = c^2$ (for right triangles)

![Right Triangle Diagram]

m.) Law of the sines: \[
\frac{\sin \alpha}{a} = \frac{\sin \beta}{b} = \frac{\sin \gamma}{c}
\]

Law of the Cosines: $c^2 = a^2 + b^2 - 2ab \cos \gamma$

![Triangle Diagram]

5.) POLYGONS (n-gons):

a.) Sum of regular polygon’s interior angle $= 180(n-2)^0$ where n= number of sides.

Measurement of each interior angle $= \frac{180(n-2)^0}{n}$

b.) Sum of regular polygon’s exterior angles $= 360^0$.

Measurement of each exterior angle $= \frac{360^0}{n}$

c.) Area of polygon: $A = \frac{pa}{2}$ where p= perimeter and a = apothem

![Polygon Diagram]
d.) 4-gons (quadrilateral):

1.) Square:
   i.) Perimeter: \( P = 4a \)
   ii.) Area: \( A = a^2 \)

![Square Diagram]

2.) Rectangle:
   i.) Perimeter: \( P = 2a + 2b \)
   ii.) Area: \( A = ab \)

![Rectangle Diagram]

3.) Rhombus
   i.) Perimeter \( P = 4a \)
   ii.) Area: \( A = ah \)

![Rhombus Diagram]

4.) parallelogram
   i.) Perimeter: \( P = 2a + 2b \)
   ii.) Area: \( A = ah \)

![Parallelogram Diagram]
5.) trapezoid
   i.) Perimeter: \( P = a + c + b + B \)
   ii.) Area: \( A = \frac{h(b + B)}{2} = h\overline{m} \) where \( \overline{m} \) is the midsegment
   iii.) Adjacent angles are supplementary (i.e., \( m\angle \alpha + m\angle \beta = 180^\circ \))

6.) arrowhead
   i.) Perimeter: \( P = 2a + 2b \)
   ii.) Area: \( A = ah \)

e.) Star Polygons: \( \left( \frac{n}{m} \right. - gons \) where \( n = \) total number of vertices and \( m = \) number of vertices before a connection.

   \[
   \frac{180 \left( \frac{n}{m} - 2 \right)^\circ}{n}
   \]

1.) Measurement of star polygon’s vertex angle = \( \frac{n}{m} \)

2.) Measurement of star polygon’s exterior (turn) angle = \( \frac{360^\circ m}{n} \) = central angle
3.) example: $5/2\text{gon}$

$5/2\text{gon} = 5$ vertices, connecting every other $2$ (see numbering above)

- Measurement of star polygon’s vertex angle $V = \frac{180(\frac{5}{2} - 2)}{5}^\circ = 36^\circ$

- Measurement of star polygon’s exterior (turn) angle $E = \text{central angle} C = \frac{360^\circ(2)}{5} = 144^\circ$

6.) **CIRCLES**:

a.) Arc length of a sector: $s = \frac{C}{2\pi}$ or $s = \frac{2\pi r}{2\pi}$ or $s = r\theta$

b.) Area of sector: $A = \frac{\pi r^2}{2\pi}$ or $A = \frac{1}{2} r^2 \theta$
c.) $m\angle \alpha = m\hat{A}$ and $m\angle a = \frac{1}{2} m\hat{A}$, where $m\hat{A}$ is the measurement of the arc $A$

![Diagram](image)

d.) $m\angle \alpha = \frac{1}{2} m\left(\hat{A} + \hat{B}\right)$

![Diagram](image)

e.) $m\angle \alpha = \frac{1}{2} m\left(\hat{A} - \hat{B}\right)$

![Diagram](image)

f.) Power of the point $Q$: $P_Q = (AQ)(QD) = (BQ)(QC)$

![Diagram](image)

g.) Power of the point $Q$: $P_Q = (QA)(QC) = (QB)(QD)$

![Diagram](image)
h.) Power of the point Q: \( P_Q = (QB)^2 = (QA)(QC) \)

7.) SIMILAR SOLIDS:

a.) Surface Areas between 2 similar solids: \( \frac{S_1}{S_2} = \left( \frac{\text{Edge}_1}{\text{Edge}_2} \right)^2 \)

b.) Volumes between 2 similar solids: \( \frac{V_1}{V_2} = \left( \frac{\text{Edge}_1}{\text{Edge}_2} \right)^3 \)