Algebra:

- $a(b+c) = ab + ac$
- $(a+b)^2 = a^2 + 2ab + b^2$
- $(a-b)^2 = a^2 - 2ab + b^2$
- $a^2 + b^2 = (a+b)^2 - 2ab$
- $a^2 - b^2 = (a+b)(a-b)$

Quadratic Equations: $ax^2 + bx + c = 0$

Solve by formula: $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

Complete the square:

Make sure a = 1

$ax^2 + bx + (\frac{b}{2})^2 - (\frac{b}{2})^2 + c = 0$

Indices:

- $a^m \times a^n = a^{m+n}$
- $a^m \div a^n = a^{m-n}$
- $(a^m)^n = a^{mn}$
- $a^0 = 1$
- $a^{-n} = \frac{1}{a^n}$
- $(a \times b)^m = a^m \times b^m$
- $(\frac{a}{b})^m = \frac{a^m}{b^m}$
- $(\sqrt[n]{a})^m = a^{\frac{m}{n}}$
- $\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$
- $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$
- $(\sqrt{a})^2 = a$

Variation:

y is proportional to x: $y = kx$

y is inversely proportional to x: $y = \frac{k}{x}$

Simple Interest - To find interest: $i = \frac{PRT}{100}$

Compound Interest: $A = P(1 + \frac{r}{100})^n$

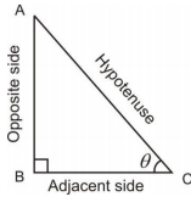
Conversion of units:

km/hr x $\frac{5}{18}$ = m/sec ; m/sec x $\frac{18}{5}$ = km/hr

Pythagoras Theorem: $c^2 = a^2 + b^2$

Trigonometry:

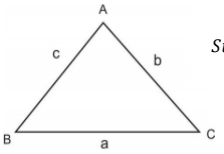
TOA CAH SOH



$Tan\ \theta = \frac{Opposite}{Adjacent} = \frac{O}{A}$

$Cos\ \theta = \frac{Adjacent}{Hypothenuse} = \frac{A}{H}$

$Sin\ \theta = \frac{Opposite}{Hypothenuse} = \frac{O}{H}$



Sine Rule:

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

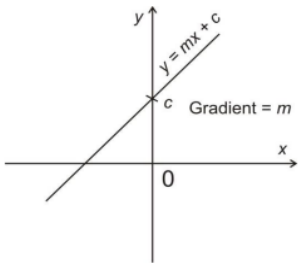
Cosine Rule:

Length of a side: $a^2 =$

Find an angle when all

$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

Co-ordinate Geometry:



Eqn. of a straight line: $y = mx + c$

Gradient of a straight line: $m = \frac{y_2 - y_1}{x_2 - x_1}$

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

Distance between two points:

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

Matrices:

Addition

$\begin{pmatrix} a & b \\ c & d \end{pmatrix} + \begin{pmatrix} p & q \\ r & s \end{pmatrix} = \begin{pmatrix} a+p & b+q \\ c+r & d+s \end{pmatrix}$

Subtraction

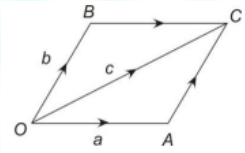
$\begin{pmatrix} a & b \\ c & d \end{pmatrix} - \begin{pmatrix} p & q \\ r & s \end{pmatrix} = \begin{pmatrix} a-p & b-q \\ c-r & d-s \end{pmatrix}$

Multiplication

$\begin{pmatrix} a & b \\ c & d \end{pmatrix} \times \begin{pmatrix} p & q \\ r & s \end{pmatrix} = \begin{pmatrix} ap+br & aq+bs \\ cp+dr & cq+ds \end{pmatrix}$

$k \times \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} ka & kb \\ kc & kd \end{pmatrix}$

Vectors:



Triangular law of addition:

$\overrightarrow{OA} + \overrightarrow{AC} = \overrightarrow{OC}$

Parallelogram law of addition:

$\overrightarrow{OB} + \overrightarrow{OA} = \overrightarrow{OC}$

Polygons:

Sum of Exterior angles = $360°$

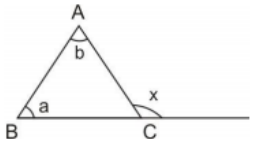
One Exterior angle = $\frac{360°}{n}$

Sum of interior angles = $(n-2) \times 180°$

Types of polygons:

No. of sides	
4	Quadrilateral
5	Pentagon
6	Hexagon
7	Heptagon
8	Octagon
9	Nonagon
10	decagon

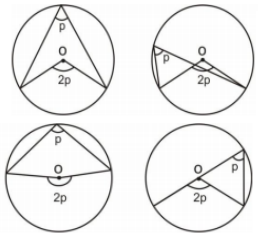
Angle Properties of Triangle:



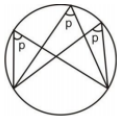
Sum of all angles = $180°$

Exterior angle (x) = Sum of opposite interior angles $(a + b)$

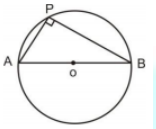
Properties of Circles:



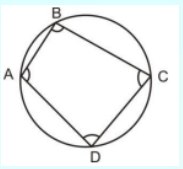
Angle at centre (2p) is twice angle at circumference (p)



Angle in the same segment of a circle are equal



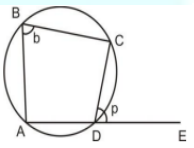
Angle in a semicircle is a right angle.



Opposite angles of a quadrilateral add up to 180°

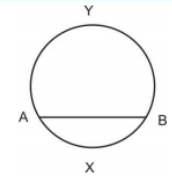
$\angle A + \angle C = 180°$

$\angle B + \angle D = 180°$



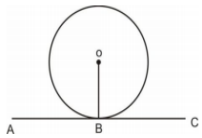
Exterior angle of a quadrilateral equals to interior opposite angle ($\angle b = \angle p$)

Chord of a Circle:



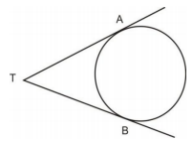
A line joining two points on a circle is called a chord (Line AB).

Tangent to a Circle:



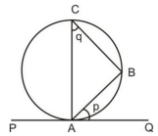
Angle between tangent and radius drawn to contact

$\angle ABO$ or $\angle OBC = 90°$

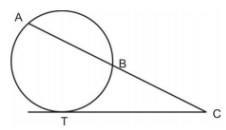


Any point outside of a circle, two tangents drawn to the circle = equal length (TA = TB)

Alternate Segment Theorem:



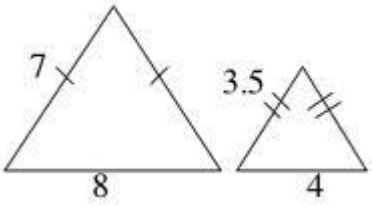
$\angle QAB = \angle ACB\ (p = q)$

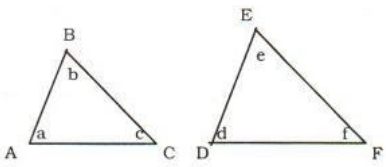


$TC^2 = AC \times BC$

Similar Plane Figures

- Figures are similar only if their corresponding sides are proportional
- their corresponding angles are equal





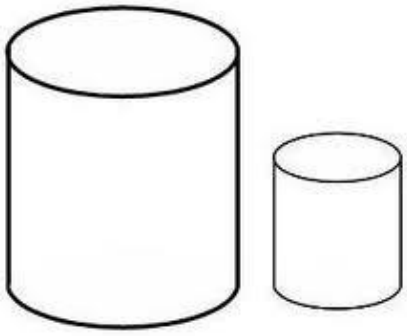
$$\frac{AB}{DE}=\frac{AC}{DF}=\frac{BC}{EF}=k$$

$$\frac{\text{Area of ABC}}{\text{Area of DEF}}=k^2$$

k is the scale factor

Similar Solid Figures

Solids are similar if their corresponding linear dimensions are proportional.



$\frac{r_1}{r_2}=\frac{h_1}{h_2}=k \rightarrow$ k is the scale factor

$$\frac{\text{surface area of A}}{\text{surface area of B}}=k^2$$

$$\frac{\text{volume of A}}{\text{volume of B}}=k^3$$

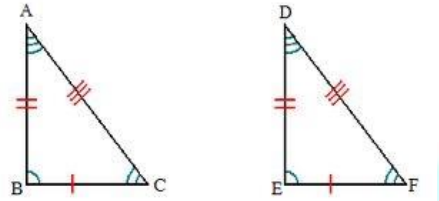
r is the radius, h is the height

Congruent Figures

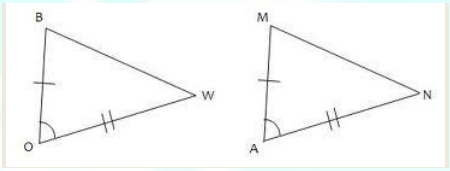
Congruent figures are exactly the same size and shape.

2 triangles are congruent if they satisfy any of the following:

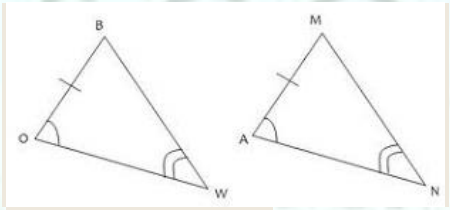
a. SSS property: All 3 sides of one triangle are equal to the corresponding sides of the other triangle.



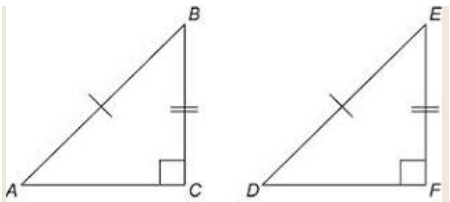
b. SAS property: 2 given sides and a given angle of one triangle are equal to the corresponding sides and angle of the other triangle.



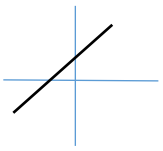
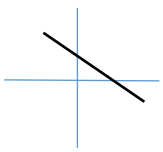
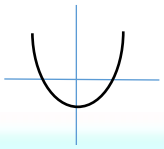
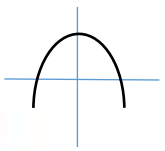
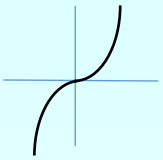
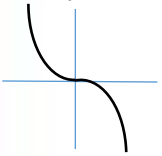
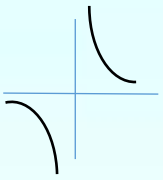
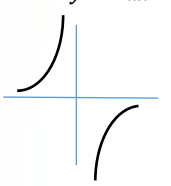
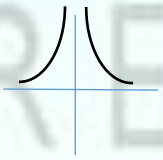
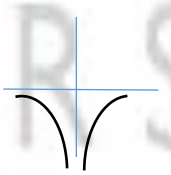
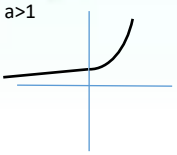
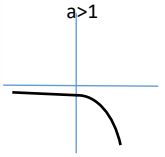
c. AAS property: 2 given angles and a given side of one triangle are equal to the corresponding angles and side of the other triangle.



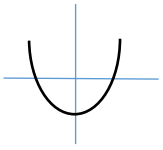
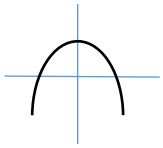
d. RHS property: The hypothenuse and a given side of a right-angled triangle are equal to the hypothenuse and the corresponding side of the other right-angled triangle.



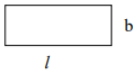
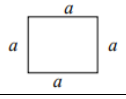
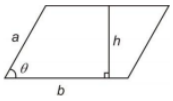
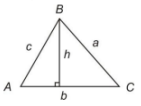
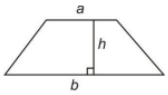
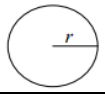
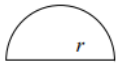
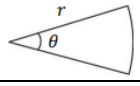
Graphs of functions

Positive	**Negative**
$y = mx + c$	$y = -mx + c$
	
$y = ax^2 + bx + c$	$y = -ax^2 + bx + c$
	
$y = ax^3$	$y = -ax^3$
	
$y = ax^{-1}$	$y = -ax^{-1}$
	
$y = ax^{-2}$	$y = -ax^{-2}$
	
$y = ka^x$ a>1	$y = -ka^x$ a>1
	

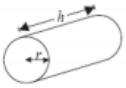
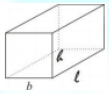
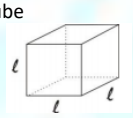
Graphs from complete the square

$y = (x + a)^2 + h$	$y = -(x + a)^2 + h$
	
$\min point\ (-a, h)$	$\max point\ (-a, h)$

Area & Perimeter:

Figure	Area	Perimeter/ Circumference
Rectangle 	$l \times b$	$2\,(l\ +\ b)$
Square 	$a \times a$	$4 \times a$
Parallelogram 	$b \times h$	$2(a+b)$
Triangle 	$\frac{1}{2} \times b \times h$ Or $\frac{1}{2}ab\sin C$	$a+b+c$
Trapezium 	$\frac{1}{2}(a+b)h$	Sum of all sides
Circle 	πr^2	$2\pi r$
Semicircle 	$\frac{1}{2}\pi r^2$	$\frac{1}{2}\pi d + d$
Sector 	$\pi r^2 \times \frac{\theta}{360}$	Length of an arc = $2\pi r \times \frac{\theta}{360}$

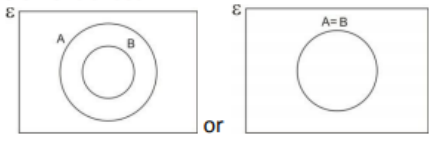
Surface Area & Volume:

Figure	Surface area	Volume
Cylinder 	Curved surface area = $2\pi rh$ Total surface area = $2\pi r(h+r)$	$\pi r^2 h$
Cone 	Curved surface area = πrl Where $l = \sqrt{(r^2+h^2)}$ Total surface area = $\pi r(l+r)$	$\frac{1}{3}\pi r^2$
Sphere 	$4\pi r^2$	$\frac{4}{3}\pi r^3$
Pyramid 	Base area + Area of shapes in the sides	$\frac{1}{3}\times$ base area × perpendicular height
Cubiod 	$2(lb+bh+lh)$	$l \times b \times h$
Cube 	$6l^2$	l^3
Hemisphere 	$2\pi r^2$	$\frac{2}{3}\pi r^3$

Sets:

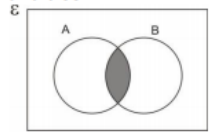
Subset ⊆

$B \subseteq A$ means every elements of set B is also an element of set A.



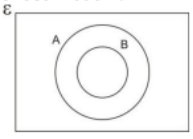
Intersection ∩

$A \cap B$ is the set of elements which are in A and also in B



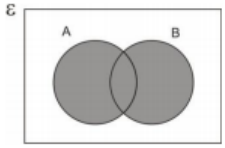
Proper subset ⊂

B ⊂ A means every element of B is an element of set A but B≠A.



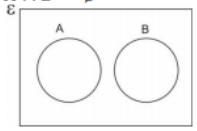
Union ∪

$A \cup B$ is the set of elements in either A , B or both A and B.



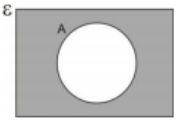
Disjoint sets

Disjoint set do not have any element in common. If A and B are disjoint sets, then $A \cap B = \emptyset$



Complement

The complement of A, written as A' refers to the elements in ε but not in A.



Statistics:

Mean = $\frac{\sum fx}{\sum f}$ = average

Mode of a series of number = number which occurs most frequently

Median = arrange series of numbers in ascending order and then choosing the number in the middle.

Probability:

Prob. Of an event = $\frac{no.of\ favourable\ outcomes}{total\ no.of\ equally\ likely\ outcome}$

Exclusive event (events cannot occur at the same time)

For exclusive event A & B: p(A or B) = p(A) + p(B)

Independent event (events can occur at the same time)

For independent event A & B: p(A and B) = p(A) × p(B)

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