E-Math Formula List-Math (4048)

*Formulas highlighted in yellow are found in the formula list of the exam paper.

Unit Conversion

Area

$1m^2=100cm\times100cm$

$=10\ 000cm^2$

Volume

$1m^3=100cm\times100cm\times100cm$

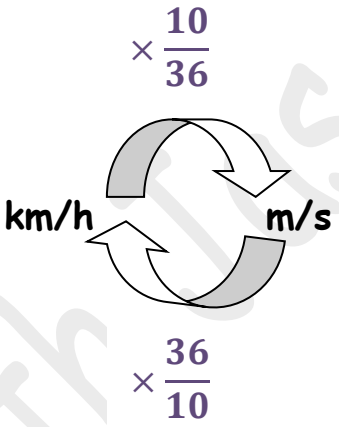
$=1\ 000\ 000cm^3$

1 Litre $=1000cm^3$

(since $1mg=1cm^3$)

$1km^2=1000m\times1000m$

$=1\ 000\ 000m^2$



Financial Math

Percentage Increase

$$= \frac{Increase}{Original}\times100\%$$

Percentage Decrease

$$= \frac{Decrease}{Original}\times100\%$$

Simple Interest

$$I=\frac{P\times R\times T}{100}$$

Compound Interest

$$P+I=P\times\left(1+\frac{R}{100}\right)^n$$

P-Principal ($)

I- Interest Amount ($)

R-Interest Rate (%)

T-Time (Years)

n-No. of Periods

Ratio and Proportion

Conversion between Length (Linear) and Area Ratio.

$$\frac{(L_s)^2}{(L_b)^2} = \frac{A_s}{A_b}$$

$$\frac{\sqrt{A_s}}{\sqrt{A_b}} = \frac{L_s}{L_b}$$

Conversion between Length (Linear) and Volume Ratio.

$$\frac{(L_s)^3}{(L_b)^3} = \frac{V_s}{V_b}$$

$$\frac{\sqrt[3]{V_s}}{\sqrt[3]{V_b}} = \frac{L_s}{L_b}$$

L_s: Length-smaller object

L_b: Length-bigger object

A_s: Area-smaller object

A_b: Area-bigger object

V_s: Volume-smaller object

V_b: Volume-bigger object

To convert Area to Volume & vice versa, first convert to Length.

$$\left(\frac{A_s}{A_b}\right) \xrightarrow[\text{Square}^2]{\sqrt{\text{Square Root}}} \left(\frac{L_s}{L_b}\right) \xrightarrow[\sqrt[3]{\text{Cube Root}}]{\text{Cube}^3} \left(\frac{V_s}{V_b}\right)$$

Speed and Distance

$$Speed = \frac{Distance}{Time} \qquad Acceleration = \frac{Final\ Speed - Initial\ Speed}{Time\ Taken}$$

$$Average\ Speed = \frac{Total\ Distance}{Total\ Time}$$

Distance Travelled is the Area UNDER the **speed /time** graph

Indices	
$x^a \times x^b = x^{a+b}$ $a^m \times b^m = (a \times b)^m$	Base No. same→ Power add Power same→ Base No. multiply
$\frac{x^a}{x^b} = x^{a-b}$ $\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$	Base No. same→ Power minus Power same→ Base No. divide
Note: $(x^a)^b = x^{a \times b}$ $(x^a)^b \neq x^{a+b}$	$x^0 = 1$
$x^{-a} = \frac{1}{x^a}$ $\quad \frac{1}{x^{-a}} = x^a$ $\quad x^a y^{-b} = \frac{x^a}{y^b}$	
$\left(\frac{x}{y}\right)^{-a} = \left(\frac{y}{x}\right)^a$ $\quad x^{\frac{1}{b}} = \sqrt[b]{x^1}$ $\quad x^{\frac{a}{b}} = \sqrt[b]{x^a}$	
$x^{-\frac{a}{b}} = \frac{1}{x^{\frac{a}{b}}} = \frac{1}{\sqrt[b]{x^a}}$ $\quad x^{-\frac{1}{b}} = \frac{1}{x^{\frac{1}{b}}} = \frac{1}{\sqrt[b]{x^1}}$	

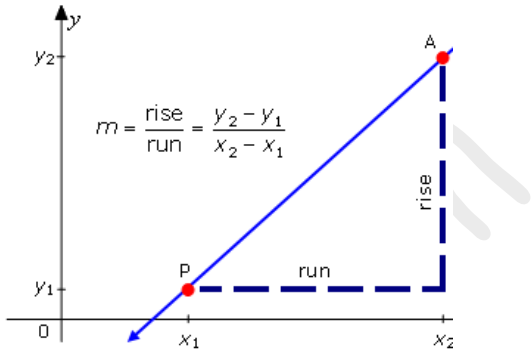
Coordinate Geometry

Linear Graph

Y= m x + c **where** m= gradient

and c= y-intercept

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



Mid-point of a line

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

Distance between two points

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

Polygons

Sum of interior angles of an n-sided polygon.

$(n-2)\times 180^0$

Each interior angle of an n-sided polygon.

$\frac{(n-2)\times 180^o}{n}$

Each exterior angle of an n-sided polygon

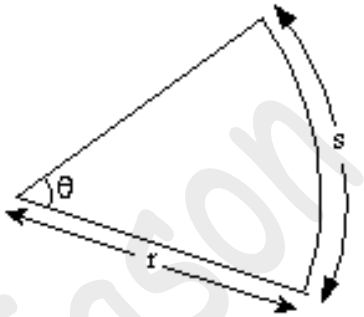
= $\frac{360^0}{n}$

Sum of exterior angles of an n-sided polygon = 360^0

Arc Length, Sector and Segment

Arc Length

$S = \frac{\theta^0}{360^0} \times 2\pi r$ (Degree) Or $S = r\theta$ (Radian)



Area of Sector

$A = \frac{\theta^0}{360^0} \times \pi r^2$ (Degree) Or $A = \frac{1}{2} r^2 \theta$ (Radian)

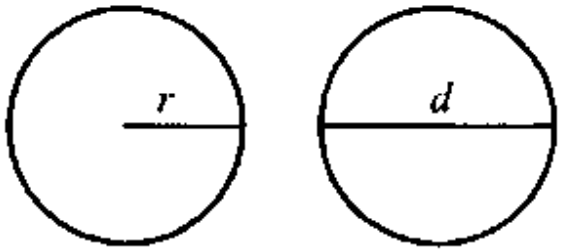
Mensuration

Circles

Area = $\pi \times r^2$

Circumference = $2 \times \pi \times r$

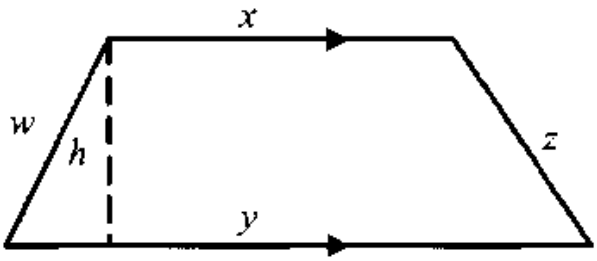
Or $\pi \times d$



Trapezium

Perimeter = w + x + y + z

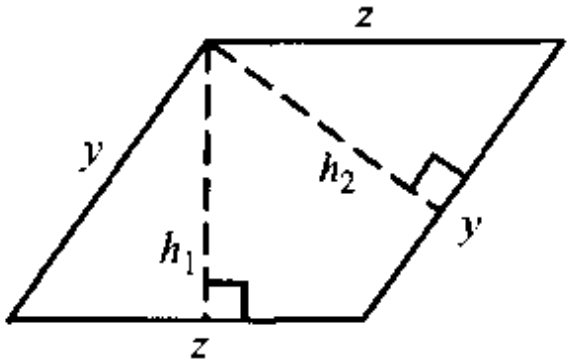
Area= $\frac{1}{2} \times (x + y) \times h$



Parallelogram

Perimeter = 2×y+2×z

Area= y × z



Cylinder

Total Surface Area

(close cylinder)

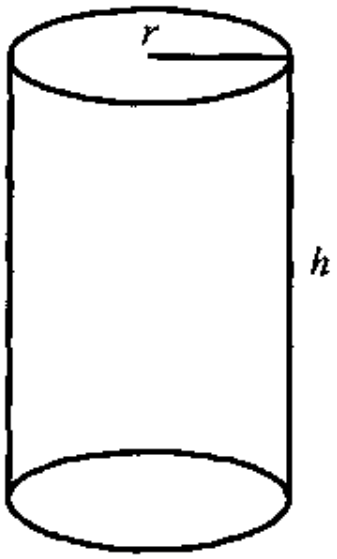
$= 2 \times \pi \times r^2 + 2 \times \pi \times r \times h$

Total Surface Area

(open cylinder)

$= \pi \times r^2 + 2 \times \pi \times r \times h$

Volume $= \pi \times r^2 \times h$



Cone

Total Surface Area =

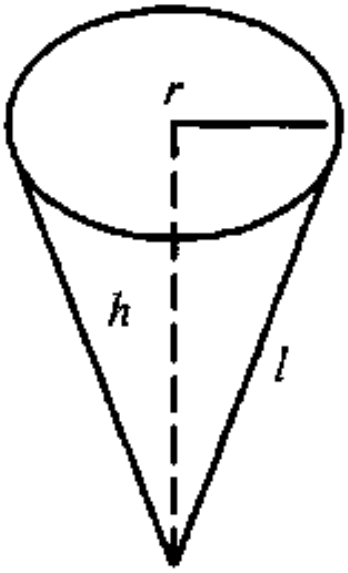
$\pi \times r \times l + \pi \times r^2$

Volume $= \frac{1}{3} \times \pi \times r^2 \times h$

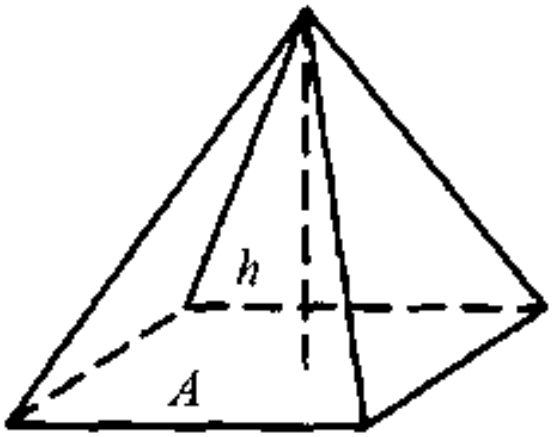
l=slant height

h=vertical height

(Note the difference)



Pyramid



Total Surface Area =

Sum of 4 triangles + base

Volume = $\frac{1}{3} \times A \times h$

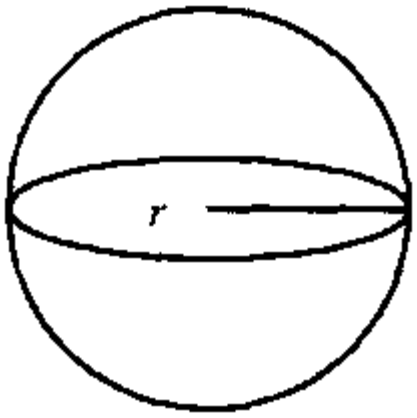
A=base area

h=vertical height

Sphere

Total Surface Area = $4 \times \pi \times r^2$

Volume = $\frac{4}{3} \times \pi \times r^3$



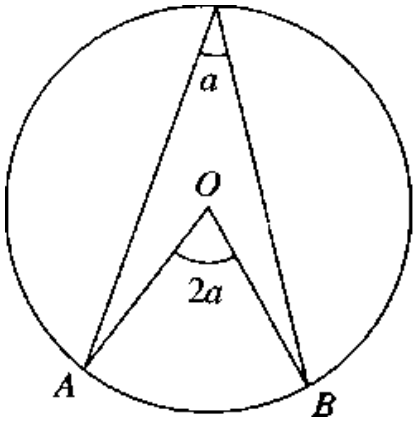
Hemisphere (half-sphere)

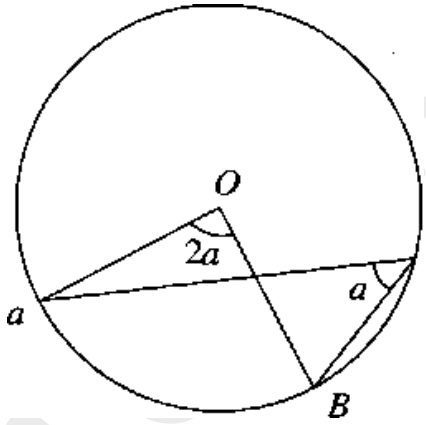
Total Surface Area = $2 \times \pi \times r^2 + \pi \times r^2$

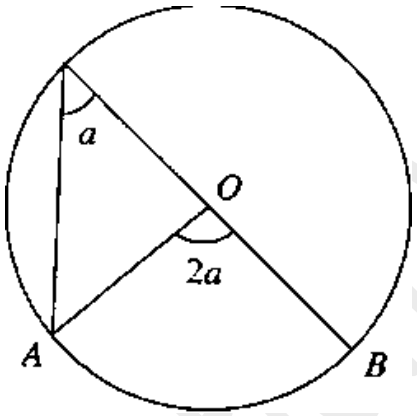
Volume $\frac{2}{3} \times \pi \times r^3$

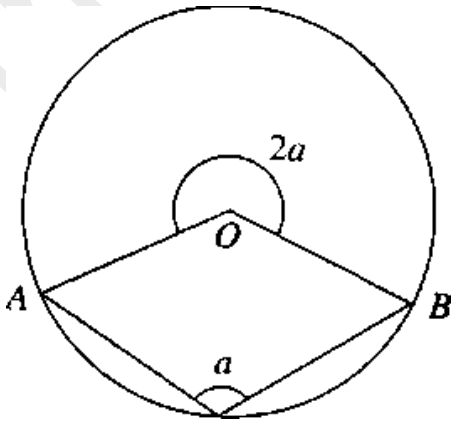
Properties of Circle

Angle at Centre =Twice Angle at Circumference



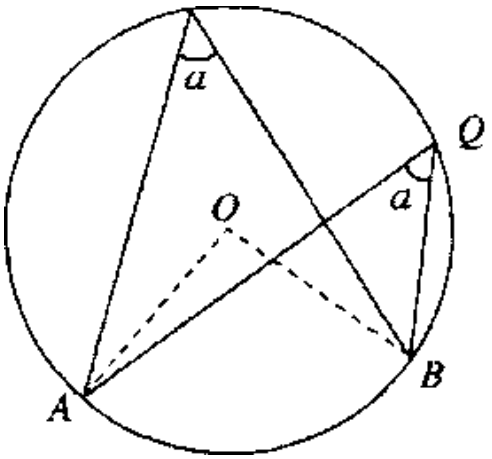




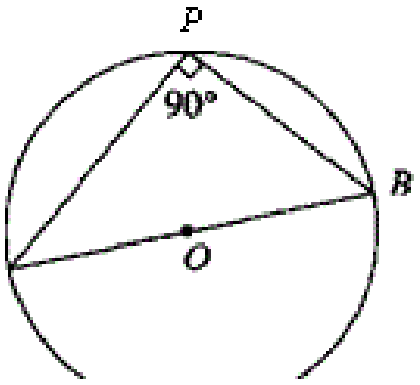


Angles in the Same Segment

(Are Equal)



Angle in a Semi-circle =90°

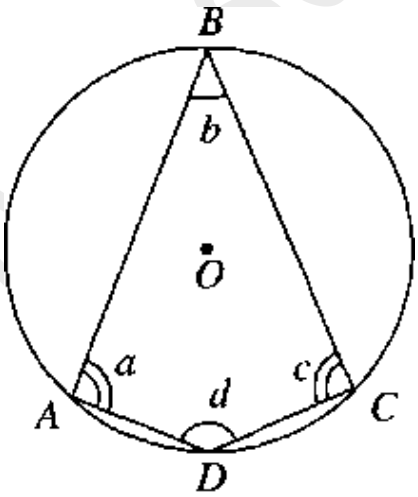


Angles in Opposite Segment

(Add up to 180°)

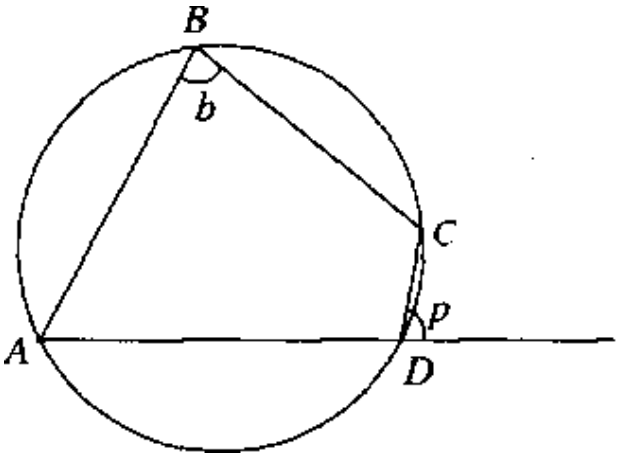
a°+c°=180°

b°+d°=180°

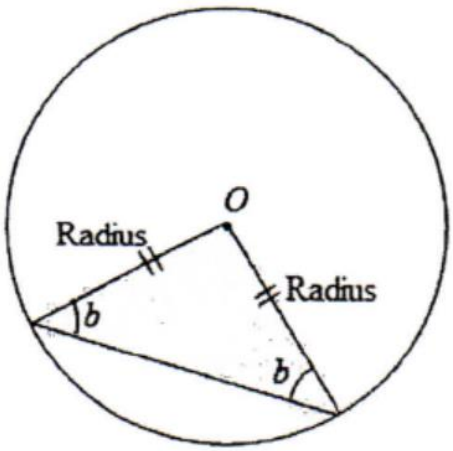


Exterior angle of a cyclic quadrilateral

b°=p°

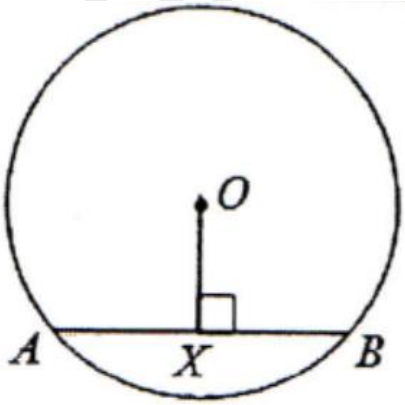


Isosceles Triangle

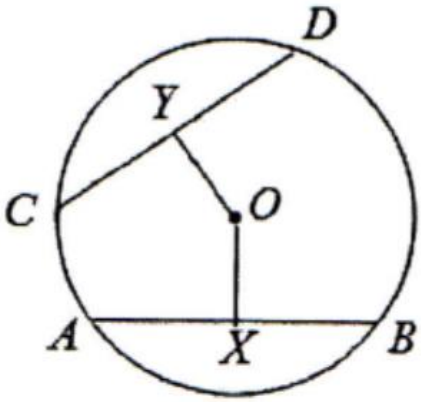


Perpendicular from Centre Bisects Chord

$\angle OXA = \angle OXB = 90^0$

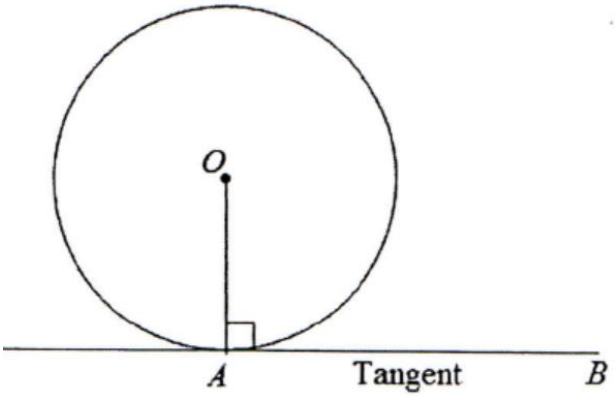


Equal Chord, Equal Distance from Centre



Tangent Perpendicular Radius

$\angle OAB = 90^0$

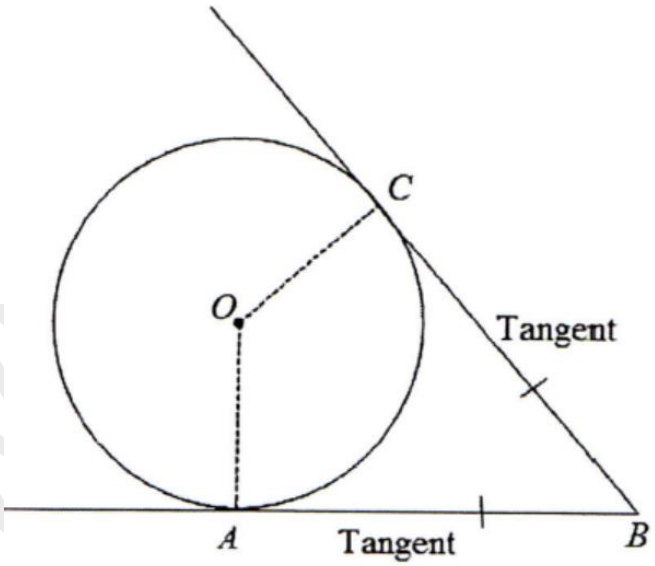


Tangents from External Point

BC=BA

$\angle OCB = \angle OAB = 90^o$

OA = OC (radius)



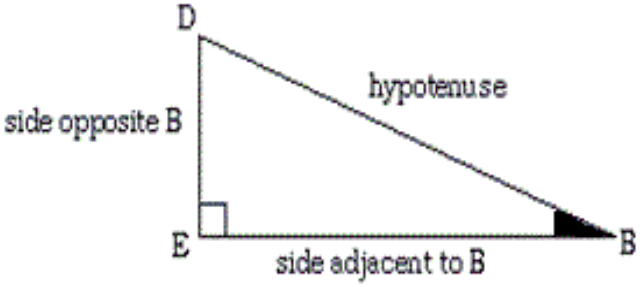
Trigonometry

Note: Use when the triangle is Right Angle.

$$\text{Tan B} = \frac{\text{Opp (DE)}}{\text{Adj (EB)}} \text{ (TOA)}$$

$$\text{Cos B} = \frac{\text{Adj (EB)}}{\text{Hyp (DB)}} \text{ (CAH)}$$

$$\text{Sin B} = \frac{\text{Opp (DE)}}{\text{Hyp (DB)}} \text{ (SOH)}$$



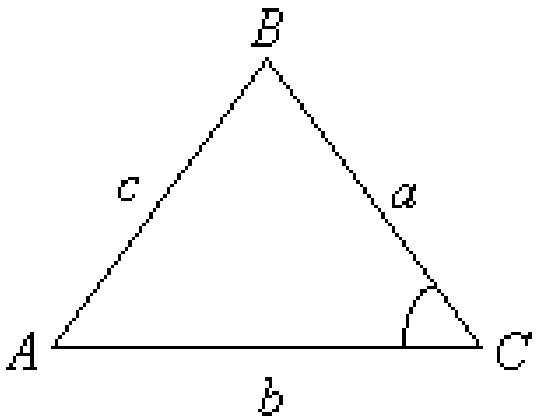
Pythagoras Theorem $DB^2 = DE^2 + EB^2$

Note: Use when the triangle is NOT Right Angle.

Area of Triangle $= \frac{1}{2} \times a \times b \times Sin\,C$

Sine Rule

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



Cosine Rule

$$c^2 = a^2 + b^2 - 2ab \times CosC$$

Matrix

$$A_1 + A_2 = \begin{pmatrix} a_1 & b_1 \\ c_1 & d_1 \end{pmatrix} + \begin{pmatrix} a_2 & b_2 \\ c_2 & d_2 \end{pmatrix}$$

$$= \begin{pmatrix} a_1 + a_2 & b_1 + b_2 \\ c_1 + c_2 & d_1 + d_2 \end{pmatrix}$$

$$A_1 - A_2 = \begin{pmatrix} a_1 & b_1 \\ c_1 & d_1 \end{pmatrix} - \begin{pmatrix} a_2 & b_2 \\ c_2 & d_2 \end{pmatrix}$$

$$= \begin{pmatrix} a_1 - a_2 & b_1 - b_2 \\ c_1 - c_2 & d_1 - d_2 \end{pmatrix}$$

$$k \times A = k \begin{pmatrix} a_1 & b_1 \\ c_1 & d_1 \end{pmatrix}$$

$$= \begin{pmatrix} k \times a_1 & k \times b_1 \\ k \times c_1 & k \times d_1 \end{pmatrix}$$

$$A_1 B = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \begin{pmatrix} w & x \\ y & z \end{pmatrix}$$

$$= \begin{pmatrix} aw + by & ax + bz \\ cw + dy & cx + dz \end{pmatrix}$$

Probability

$$\text{Probability} = \frac{\text{Number Of Successful Outcome}}{\text{Total Number Of Outcomes}} \quad \text{OR} \quad \frac{\text{Success}}{\text{Success + Failure}}$$

If the probability of A **AND** B occurs, then P(A) X P(B).

If the probability of A **OR** B occurs, then P(A) + P(B)

If the probability of A **DOES** NOT occurring, then 1- P(A).

Probability is between and include 0 to 1.

If Probability (P) = 0, it means that there is NO CHANCE of success.
If Probability (P) = 1 it means that success is CERTAIN.

Statistics

Ungroup Data

$$\text{Mean}(\bar{X}) = \frac{\text{Sum Of All Data Values}}{\text{Number Of Data}}$$

Group Data

$$Mean(\bar{X}) = \frac{\sum fx}{\sum f}$$

$Lower\ Quartile = \frac{1}{4}(n+1)th\ Term$ $Median = (\frac{n+1}{2})th\ \text{Term}$ $Upper\ Quartile = \frac{3}{4}(n+1)th\ Term$	n is the total frequency. *These formulas give the POSITION of the value in ascending order. It DOES NOT give the actual value.

Ungroup Data - Standard Deviation (σ)

$$\sigma = \sqrt{\frac{\sum (x-\bar{X})^2}{\sum f}} \quad \text{or} \quad \sigma = \sqrt{\frac{\sum x^2}{n} - \bar{X}^2}$$

Group Data - Standard Deviation (σ)

$$\sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2} \quad \text{or} \quad \sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\bar{X}\right)^2}$$

The End