Formulas of Different Units

Unit # 1

Quadratic Equations

- $(a+b)^2 = a^2 + b^2 + 2ab$
- $(a-b)^2 = a^2 + b^2 - 2ab$
- $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Unit # 2

Theory of Quadratic Equations

- Discriminant $= b^2 - 4ac$
- $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- $1 + \omega + \omega^2 = 0$
- $\omega^3 = 1$
- $\omega = \frac{1}{\omega^2}$ **or** $\omega^2 = \frac{1}{\omega}$
- $(x + y + z)(x^2 + y^2 + z^2 - xy - yz - xz) = x^3 + y^3 + z^3 - 3xyz$
- $S = -\frac{b}{a} = -\frac{\text{Coefficient of } x}{\text{Coefficent of } x^2}$
- $P = \frac{c}{a} = \frac{\text{Constant term}}{\text{Coefficient of } x^2}$
- $x^2 - Sx + P = 0$ **Or**
  $x^2 - (\text{Sum of roots})\,x + \text{Product of roots} = 0$
- Function is Symmetric if $f(\alpha, \beta) = f(\beta, \alpha)$
- $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$
- $\alpha^3 + \beta^3 = (\alpha + \beta)^3 - 3\alpha\beta(\alpha + \beta)$
- $\alpha - \beta = \sqrt{(\alpha + \beta)^2 - 4\alpha\beta}$

Unit # 3

Variations

- **Forth proportional:** $d = \frac{bc}{a}$
- **Third proportional:** $c = \frac{b^2}{a}$
- **Mean proportional:** $b^2 = ac$
- **Continued proportional:** $b^2 = ac$
- **Invertedo Theorem.** If $a : b = c : d$ then $b : a = d : c$

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- **Alternendo Theorem.**
  If $a:b=c:d$ then $a:c=b:d$
- **Componendo Theorem**
  If $a:b=c:d$ then
  (i) $a+b:b=c+d:d$
  (ii) $a:a+b=c:c+d$
- **Dividendo Theorem**
  If $a:b=c:d$ then
  (i) $a-b:b=c-d:d$
  (ii) $a:a-b=c:c-d$
- **Componendo–Dividendo Theorem**
  If $a:b=c:d$ then
  (i) $a+b:a-b=c+d:c-d$
  (ii) $a-b:a+b=c-d:c+d$
- **K Method**
  Let $\frac{a}{b}=\frac{c}{d}=k$
  Then,
  $a=bk, c=dk$

Unit # 5

Sets and Functions

- Number of all possible subsets = 2^n
- Number of all possible proper subsets = 2^n-1.
- Number of improper subsets = 1
- Formula to find number of elements in the power set = 2^n
- $A-B=\{x \mid x\in A \text{ and } x\notin B\}$
- If $A\cap B=\phi$, then A and B are disjoint sets.
- $A'=A^c=U-A$
- **Commutative property of Union**
  $A\cup B=B\cup A$
- **Commutative property of intersection**
  $A\cap B=B\cap A$
- **Associative property of union**
  $A\cup(B\cup C)=(A\cup B)\cup C$
- **Associative property of intersection**
  $A\cap(B\cap C)=(A\cap B)\cap C$
- **Distributive property of union over intersection**
  $A\cup(B\cap C)=(A\cup B)\cap(A\cup C)$
- **Distributive property of intersection over union**
  $A\cap(B\cup C)=(A\cap B)\cup(A\cap C)$

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- **De-Morgan's laws**

  $(A \cup B)' = A' \cap B'$

  $(A \cap B)' = A' \cup B'$
- $A - B = A \cap B'$
- $(A - B)' = A' \cup B$
- Number of elements in Cartesian product $X \times Y = m \times n$
- Number of binary relations $= 2^{m \times n}$
- If $A \subseteq B$, then $A \cup B = A$
- If $A \subseteq B$ and $B \subseteq A$ then $A = B$
- $A \cap A^c = \phi$
- $A \cup A^c = U$

Unit # 6

Basic Statistics

For Ungrouped Data	For Grouped Data
Arithmetic means	
Ungroup Data (Direct Method)	**Grouped Data**
$\bar{X} = \frac{\sum x}{n}$	$\bar{X} = \frac{\sum fx}{\sum f}$
Indirect Method (Short Method)	
$\bar{X} = A + \frac{\sum D}{n}$; $(D = x - A)$	$\bar{X} = A + \frac{\sum fD}{\sum f}$
(Coding Method)	
$A.M = A + \frac{\sum u}{n} \times h$; $\left(u = \frac{x - A}{h}\right)$	$A.M = A + \frac{\sum fu}{\sum f} \times h$
(Median)	
Median $= \left(\frac{n+1}{2}\right)^{th}$ item (n is odd)	
Median $= \frac{1}{2}\left\{\left(\frac{n}{2}\right)^{th} \text{item} + \left(\frac{n+2}{2}\right)^{th} \text{item}\right\}$ (n is even)	Median $= l + \frac{h}{f}\left(\frac{n}{2} - C\right)$

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(Mode)	
Mode = most repeated value of the data	$\text{Mode} = l + \frac{(f_m - f_1)}{2f_m - f_1 - f_2} \times h$
(Geometric Mean)	
$G.M = (x_1 x_2 x_3 \ldots x_n)^{\frac{1}{n}}$ By definition method	$G.M = \text{Anti}\log\left(\frac{\sum f \log X}{\sum f}\right)$
$G.M = \text{Anti}\log\left(\frac{\sum \log X}{n}\right)$ By log method	
Harmonic Mean	
$H.M = \frac{n}{\sum \frac{1}{X}}$	$H.M = \frac{n}{\sum \frac{f}{X}}$
$\text{Weighted Arithmetic Mean} = \bar{X}_w = \frac{\sum wx}{\sum w}$	
Range	
$\text{Range} = X_n - X_1$	Range = upper class boundary of last class – lower class boundary of first class
Variance	
(i) $S^2 = \frac{\sum (X - \bar{X})^2}{n}$ Proper mean formula	**(i)** $S^2 = \frac{\sum f (X - \bar{X})^2}{\sum f}$ Proper mean formula
(ii) $S^2 = \frac{\sum X^2}{n} - \left(\frac{\sum X}{n}\right)^2$ Direct Formula	**(ii)** $S^2 = \frac{\sum fX^2}{\sum f} - \left(\frac{\sum fX}{\sum f}\right)^2$ Direct Formula
Standard Deviation	
(i) $S = \sqrt{\frac{\sum (X - \bar{X})^2}{n}}$ Proper mean formula	**(i)** $S = \sqrt{\frac{\sum f (X - \bar{X})^2}{\sum f}}$ Proper mean formula
(ii) $S = \sqrt{\frac{\sum X^2}{n} - \left(\frac{\sum X}{n}\right)^2}$ Direct Formula	**(ii)** $S = \sqrt{\frac{\sum fX^2}{\sum f} - \left(\frac{\sum fX}{\sum f}\right)^2}$ Direct Formula

Formulas of Different Units

Unit # 7

Introduction to Trigonometry

- $1° = \frac{\pi}{180}$ radians
- $x° = \frac{x\pi}{180}$ radians
- $1 \text{ radian} = \frac{180°}{\pi}$
- $x \text{ radians} = \frac{x(180°)}{\pi}$
- $l = r\theta$
- $A = \frac{1}{2}r^2\theta$
- $\theta \pm 360k = \theta,\ k \in Z$
- $\sin(-\theta) = -\sin\theta$
- $\text{cosec}(-\theta) = -\text{cosec}\theta$
- $\cos(-\theta) = \cos\theta$
- $\sec(-\theta) = \sec\theta$
- $\tan(-\theta) = -\tan\theta$
- $\cot(-\theta) = -\cot\theta$
- Trigonometric table

	0°	30°	45°	60°	90°	180°	270°
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	−1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	−1	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	Undefined	0	Undefined

- $\sin\theta = \frac{y}{r}$
- $\cos\theta = \frac{x}{r}$
- $\tan\theta = \frac{y}{x}$
- $\sin^2\theta + \cos^2\theta = 1$
- $1 + \tan^2\theta = \sec^2\theta$
- $1 + \cot^2\theta = \text{cosec}^2\theta$

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Unit # 8

Projection of a Side of a Triangle

- $(\overline{BC})^2 = (\overline{AB})^2 + (\overline{AC})^2 - 2m\overline{AB}.m\overline{AC}$, when angle opposite to BC is acute.
- $(\overline{BC})^2 = (\overline{AC})^2 + (\overline{AB})^2 + 2(m\overline{AE})\ (m\overline{AD})$, when angle opposite to BC is obtuse.
- If $a^2 + b^2 = c^2$, Δ is a right angled Δ
- If $a^2 + b^2 < c^2$, Δ is a obtuse angled Δ
- If $a^2 + b^2 > c^2$, Δ is a acute angled Δ

where, c is longest side

Unit # 10

Tangent to a Circle

- If two circles touch each other externally then distance between their centers is equal to sum of radii.
- Two circles with centres C_1 and C_2, radii of measure r_1 and r_2 such that $m\overline{C_1C_2} = r_1 + r_2$
- If two circles touch each other internally then distance between their centers is equal to difference of radii.
- Two circles with centres C_1 and C_2, radii r_1 and r_2 such that $m\overline{C_1C_2} = r_1 - r_2$
- Area of Circle $= \pi r^2$
- Area of semi circle $= \frac{1}{2}\pi r^2$
- Perimeter or Circumference of Circle $= 2\pi r = \pi d$
- Semi Perimeter or Half Circumference of Circle $= \pi r$

Unit # 12

Chords and Arcs

- $m\angle AOC = 2m\angle ABC$, where $m\angle AOC$ is central angle and $m\angle ABC$ is circum angle. The angle
- In a semi-circle is a right angle,
- In a segment greater than a semi circle is less than a right angle,
- In a segment less than a semi-circle is greatter than a right angle.
- $m\angle A + m\angle C = 180^\circ$ and $m\angle B + m\angle D = 180^\circ$, where ABCD is cyclic quadrilateral.
- $m\angle ACB = m\angle ADB$, where $m\angle ACB$ and $m\angle ADB$ are angles of same segment.

Unit #13

Angle in a Segment of a Circle

- Perimeter of a regular polygon = n × l, where n is number of sides and l is length of a side.
- The measure of the external angle of a regular hexagon is $\frac{\pi}{3}$.
- The measure of the external angle of a regular octagon is $\frac{\pi}{4}$.

Formula for finding the angle subtended by the side of a n-sided polygon at the centre of the circle $= \frac{360^\circ}{n}$