10^{th} Standard – Maths Formulas

SETS AND FUNCTIONS

1. **Power set** $n[P(A)] = 2^{n(A)}$
2. **Symmetric difference**
   i) $X \Delta Y = (X \setminus Y) \cup (Y \setminus X)$
   ii) $X \Delta Y = (X \cup Y) \setminus (X \cap Y)$
3. **Commutative property**
   a) $A \cup B = B \cup A$
   b) $A \cap B = B \cap A$
4. **Associative property**
   a) $A \cup (B \cup C) = (A \cup B) \cup C$
   b) $A \cap (B \cap C) = (A \cap B) \cap C$
5. **Distributive property**
   a) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
   b) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
6. **De – Morgan's laws of set difference**
   a) $A \setminus (B \cup C) = (A \setminus B) \cap (A \setminus C)$
   b) $A \setminus (B \cap C) = (A \setminus B) \cup (A \setminus C)$
7. **De – Morgan's laws**
   a) $(A \cup B)' = A' \cap B'$
   b) $(A \cap B)' = A' \cup B'$
8. **Cardinality of sets**
   a) $n(A \cup B) = n(A) + n(B) - n(A \cap B)$
   b) $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap A) - n(A \cap C) + n(A \cap B \cap C)$
9. **One – one function**
   Every different element of A has a different image in B.
10. **Onto function**
   Every element in B has a pre – image in A.

SEQUENCES AND SERIES

I) Arithmetic progression

1. **General form** $a, a+d, a+2d, a+3d \ldots\ldots$
2. **General term (or) n^{th} term** $T_n = a + (n-1)d$
3. **Common difference** $d = t_2 - t_1 = \ldots. = t_n - t_{n-1}$
4. **Number of terms in an A.P** $n = \frac{l-a}{d} + 1$
5. **Sum of n terms of an A.P**
   a) $S_n = \frac{n}{2}[2a + (n-1)d]$
   b) $S_n = \frac{n}{2}[a + l]$
6. **If 3 terms in A.P are** $a - d, a, a + d$

II) Geometric progression

7. **General form** $a, ar, ar^2, ar^3, \ldots\ldots, ar^n$.
8. **General term (or) n^{th} term** $T_n = ar^{n-1}$.
9. **Common ratio** $r = \frac{t2}{t1} = \frac{t3}{t2} = \ldots\ldots = \frac{tn}{tn-1}$.
10. **Sum to n terms of a G.P**
   a) If $r > 1$ $S_n = \frac{a(r^n-1)}{r-1}$
   b) If $r < 1$ $S_n = \frac{a(1-r^n)}{1-r}$
   c) If $r = 1$ $S_n = na$
   d) Sum of infinite series $S_\infty = \frac{a}{1-r}$
11. **If 3 terms in G.P are** $\frac{a}{r}, a, ar$

III) Special series

a) $\sum_1^n n = 1 + 2 + 3 + \ldots\ldots + n = \frac{n(n+1)}{2}$

b) $\sum_1^n n^2 = 1^2 + 2^2 + 3^2 + \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$

c) $\sum_1^n n^3 = 1^3 + 2^3 + 3^3 + \ldots\ldots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$

d) $\sum_1^n (2n-1) = 1 + 3 + 5 + \ldots + (2n-1) = \left(\frac{l+1}{2}\right)$

12. Fibonacci sequence

$F_1 = F_2 = 1$ $F_n = F_{n+} F_{n+1}$ $n = 3, 4, 5 \ldots$

1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89…….

ALGEBRA

1. $(a + b)^2 = a^2 + 2ab + b^2$
2. $(a - b)^2 = a^2 - 2ab + b^2$
3. $a^2 - b^2 = (a+b)(a - b)$
4. i) $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
   ii) $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$
5. $a^3 + b^3 = (a+b)^3 - 3ab(a+b)$
6. $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$
7. i) $(a-b)^3 = a^3 + 3a^2b - 3ab^2 - b^3$
   ii) $(a- b)^3 = a^3 - b^3 - 3ab(a+b)$
8. $a^3 - b^3 = (a-b)^3 + 3ab(a - b)$
9. $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$
10. $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$
11. $(x + a)(x + b) = x^2 + (a + b)x + ab$
12. $(x + a)(x + b)(x + c) = x^3 + (ab + bc + ac)x^2 + (a + b + c)x + abc$
13. **General form of a quadratic equation**
    i) $ax^2 + bx + c = 0$
    ii) $x^2 -$ (sum of roots)x + product of roots = 0
14. **Let** $ax^2 + bx + c = 0$ **be a quadratic equation then the value of** x **is**
    $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
15. **Product rule** $a^m \times a^n = a^{m+n}$
16. **Division rule** $\frac{a^m}{a^n} = a^{m-n}$ m<n: an $\neq 0$.
17. **Power rule** $(a^m)^n = a^{mn}$
18. $(a\times b)^m = a^m \times b^m$
19. $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
20. **Let** α **and** β **are the roots of the equation** $ax^2 + bx + c = 0$ **then**
21. $\alpha^2 + \beta^2 = (\alpha+\beta)^2 - 2\alpha\beta$
22. $|\alpha - \beta| = \sqrt{(\alpha+\beta)^2 - 4\alpha\beta}$
23. $\alpha^3 + \beta^3 = (\alpha+\beta)^3 - 3\alpha\beta(\alpha+\beta)$
24. $\alpha^3 - \beta^3 = (\alpha - \beta)^3 + 3\alpha\beta(\alpha - \beta)$
25. $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha+\beta}{\alpha\beta}$
26. $\frac{\alpha}{\beta} + \frac{\beta}{\alpha} = \frac{\alpha^2+\beta^2}{\alpha\beta} = \frac{(\alpha+\beta)^2-2\alpha\beta}{\alpha\beta}$

CO – ORDINATE GEOMETRY

1. **Distance between any two points**
   D = $\sqrt{(x2-x1)^2 + (y2-y1)^2}$ units
2. **Area of a triangle** $A = \frac{1}{2}\begin{pmatrix} x1 & x2 & x3 & x1 \\ y1 & y2 & y3 & y1 \end{pmatrix}$ sq. units
3. **Area of a quadrilateral** $A = \frac{1}{2}\begin{pmatrix} x1 & x2 & x3 & x4 & x1 \\ y1 & y2 & y3 & y4 & y1 \end{pmatrix}$ sq. units
4. **Section formula** *internally* **is** $P = \left(\frac{lx2+mx1}{l+m}, \frac{ly2+my1}{l+m}\right)$
5. **Section formula** *externally* **is** $P = \left(\frac{lx2-mx1}{l-m}, \frac{ly2-my1}{l-m}\right)$
6. **Midpoint formula** $M(x, y) = \left(\frac{x1+x2}{2}, \frac{y1+y2}{2}\right)$
7. **Centroid of a triangle** $G(x, y) = \left(\frac{x1+x2+y3}{3}, \frac{y1+y2+y3}{3}\right)$
8. **Slope of a straight line**
   a) $m = \tan\theta$ $\theta \neq 90^0$ when θ is given
9. $m = \frac{y2-y1}{x2-x1} = \frac{y1-y2}{x1-x2}$ $x_1 \neq x_2$ when two points given
10. $m = \frac{-coefficient\ of\ x}{coefficient\ of\ y}$ when $ax + by + c = 0$ is given
11. **Equation of a straight line**
    a) **General format** $ax + by + c = 0$
    b) **Intercept form** $y = mx + c$

c) **One point is given** $y - y_1 = m(x - x_1)$

d) **Two points are given** $\frac{y-y1}{y2-x1} = \frac{x-y1}{x2-x1}$

e) x **intercept**(a), y **intercept** (b) **is given** $\frac{x}{a} + \frac{y}{b} = 1$

12. **Equation of** x – **axis** $y = 0$
13. **Equation** of y – **axis** $x = 0$
14. **Parallel to** x – **axis** $y = k$
15. **Parallel to** y – **axis** $x = k$
16. **Parallel to** $ax + by + c = 0$ **is** $ax + by + k = 0$.
17. **Perpendicular to** $ax + by + c = 0$ **is** $bx - ay + k = 0$.

TRIGONOMETRY

1. $\sin\theta = \frac{Opposite\ side}{Hypotenuse\ side}$
2. $\cos\theta = \frac{Adjacent\ side}{Hypotenuse\ side}$
3. $\tan\theta = \frac{Opposite\ side}{Adjacent\ side}$
4. $\text{cosec}\theta$ = Reciprocal of $\sin\theta = \frac{Hypotenuse\ side}{Opposite\ side}$
5. $\sec\theta$ = Reciprocal of $\cos\theta = \frac{Hypotenuse\ side}{Adjacent\ side}$
6. $\cot\theta$ = Reciprocal of $\tan\theta = \frac{Adjacent\ side}{Opposite\ side}$
7. $\tan\theta = \frac{\sin\theta}{\cos\theta}$
8. $\cot\theta = \frac{\cos\theta}{\sin\theta}$
9. $\text{cosec}\theta = \frac{1}{\sin\theta}$
10. $\sec\theta = \frac{1}{\cos\theta}$

11. Pythagorean identities

i) $\sin^2\theta + \cos^2\theta = 1 \Rightarrow \cos^2\theta = 1 - \sin^2\theta \Rightarrow \sin^2\theta = 1 - \cos^2\theta$

ii) $\text{cosec}^2\theta - \cot^2\theta = 1 \Rightarrow \text{cosec}^2\theta = 1 + \cot^2\theta \Rightarrow \cot^2\theta = \text{cosec}^2\theta - 1$

iii) $\sec^2\theta - \tan^2\theta = 1 \Rightarrow \sec^2\theta = 1 + \tan^2\theta \Rightarrow \tan^2\theta = \sec^2\theta - 1$

12. Trigonometry θ value table

Θ	0^0	30^0	45^0	60^0	90^0
$\sin\theta$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos\theta$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan\theta$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞
$\text{Cosec}\theta$	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
$\sec\theta$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞
$\cot\theta$	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

MENSURATION

I) Solid right circular cylinder

1) Curved surface Area = $2\pi rh$ sq. units
2) Total surface Area = $2\pi r(h + r)$ sq. units
3) Volume = $\pi r^2 h$ cu. units

II) Right circular hollow cylinder

1) Curved surface Area = $2\pi h(R + r)$ sq. units
2) Total surface Area = $2\pi(R + r)(R - r + h)$ sq. units
3) Volume = $\pi h(R + r)(R - r)$h cu. units

III) Solid right circular cylinder

1) Curved surface Area = πrl sq. units
2) Total surface Area = $\pi r(l + r)$ sq. units
3) Volume = $\frac{1}{3}\pi r^2 h$ cu. units

IV) Sphere

1) Curved surface Area = $4\pi r^2$ sq. units

2) Volume = $\frac{4}{3}\pi r^3$ cu. units

V) Hollow sphere Volume = $\frac{4}{3}\pi(R^3 - r^3)$ cu. Units

VI) Solid hemisphere

1) Curved surface Area = $2\pi r^2$ sq. units
2) Total surface Area = $3\pi r^2$ sq. units
3) Volume = $\frac{2}{3}\pi r^3$ cu. Units

VII) Hollow hemisphere

1) Curved surface Area = $2\pi(R^2 - r^2)$sq. units
2) Total surface Area = $\pi(3R^2 + r^2)$ sq. units
3) Volume = $\frac{2}{3}\pi(R^3 - r^3)$ cu. Units

VIII) A sector of a circle converted into cone

1) CSA of a cone = Area of the sector

$\pi rl = \frac{\theta}{360^0} \times \pi r^2$ cu. Units

IX) **Frustum** Volume = $\frac{1}{3}\pi h(R^2 + r^2 + Rr)$

X) Volume of water flows out through a pipe = (cross section area × Speed × Time)

STATISTICS

1. **Range** = highest value – lowest value
2. **The coefficient of range** = $\frac{L-S}{L+S}$
3. **Standard deviation**

i) **Direct method** $\sigma = \sqrt{\frac{\Sigma x^2}{n} - \left(\frac{\Sigma x}{n}\right)^2}$

ii) **Actual mean method** $\sigma = \sqrt{\frac{\Sigma(x-x)^2}{n}}$

iii) **Assumed mean method** $\sigma = \sqrt{\frac{\Sigma d^2}{n} - \left(\frac{\Sigma d}{n}\right)^2}$ $d = x - A$

iv) **Step deviation method** $\sigma = \sqrt{\frac{\Sigma d^2}{n} - \left(\frac{\Sigma d}{n}\right)^2} \times C$ $d = \frac{x-A}{C}$

v) **Standard deviation for first** n **Natural numbers** $\sigma = \sqrt{\frac{n^2-1}{n}}$

vi) **Standard deviation** = $\sqrt{variance}$

vii) **Coefficient of variance** $(C.V) = \frac{\sigma}{x} \times 100$

PROBABILITY

1. A ***random experiment*** is one which is the exact outcome cannot be predicted before conducting the experiment.
2. The set of all possible outcomes of a random experiment is called its ***sample space***. It is denoted by ***S***.
3. $P(A) = \frac{number\ of\ outcomes\ favourable\ to\ A}{total\ number\ of\ outcomes}$
4. $P(A) = \frac{n(A)}{n(S)}$
5. If A and B are two ***mutually exclusive events***, then $\boldsymbol{A \cap B = \phi}$
6. The probability of an event A lies between 0 and 1.

   $0 \le P(A) \le 1$
7. $P(A) + P(A) = 1$.
8. **Addition theorem on probability**

   $\frac{n(A\cup B)}{n(S)} = \frac{n(A)}{n(S)} + \frac{n(B)}{n(S)} - \frac{n(A\cap B)}{n(S)}$
9. Probability of sure event is **1**.
10. Probability of impossible event is **0**.