10^{th} MATHS ONE MARK QUESTIONS - BOOK BACK FULL SOLUTION EM (2024-2025)

CHAPTER – 1 (RELATIONS AND FUNCTIONS)

1. If $n(A \times B) = 6$ and $A = \{1,3\}$, then $n(B)$ is

(a) 1 (b) 2 (c) 3 (d) 6

Solution:

$n(A) = 2, n(A \times B) = 6 \Longrightarrow n(A) \times n(B) = n(A \times B)$

$$n(B) = \frac{n(A \times B)}{n(A)}$$

$$\boldsymbol{n(B) = \frac{6}{2} = 3}$$

2. $A = \{a, b, p\}$, $B = \{2, 3\}$, $C = \{p, q, r, s\}$ then $n[(A \cup C) \times B]$ is

(a) 8 (b) 20 (c) 12 (d) 16

Solution:

$A \cup C = \{a, b, p, q, r, s\}, B = \{2,3\}$

$$n[(A \cup C) \times B] = 6 \times 2 = \mathbf{12}$$

3. If $A = \{1, 2\}$, $B = \{1,2,3,4\}$, $C = \{5,6\}$ and $D = \{5,6,7,8\}$ then state which of the following statement is true.

(a) $(A \times C) \subset (B \times D)$ (b) $(B \times D) \subset (A \times C)$

(c) $(A \times B) \subset (A \times D)$ (d) $(D \times A) \subset (B \times A)$

Solution:

$$(A \times C) = \{(1,5), (1,6), (2,5), (2,6)\}$$

$$(B \times D) = \{(1,5), (1,6), (1,7), \dots, (4,8)\}$$

It is clearly $(A \times C) \subset (B \times D)$.

4. If there are 1024 relations from a set $A = \{1,2,3,4,5\}$ to a set B, then the number of elements in B is

(a) 3 (b) 2 (c) 4 (d) 8

Solution:

$$n(A) = 5 = p$$

No. of relations from A to $B = 1024$

$$\Longrightarrow 2^{5q} = 1024$$

$$\Longrightarrow (32)^q = (32)^2$$

$$\Longrightarrow q = 2$$

$$\boldsymbol{n(B) = 2}$$

5. The range of the relation $\mathbb{R} = \{(x, x^2) \mid x$ is a prime number less than 13$\}$ is

(a) $\{2,3,5,7\}$ (b) $\{2,3,5,7,11\}$

(c) $\{4,9,25,49,121\}$ (d) $\{1,4,9,25,49,121\}$

Solution:

Prime Numbers less than 13 $= \{2,3,5,7,11\}$

Range of $R = \boldsymbol{\{4, 9, 25, 49, 121\}}$, $R = \{(x, x^2)\}$

6. If the ordered pairs $(a + 2, 4)$ and $(5, 2a + b)$ are equal then (a, b) is

(a) $(2, -2)$ (b) $(5,1)$ (c) $(2,3)$ (d) $(3, -2)$

Solution:

$a + 2 = 5,$ $\Rightarrow \boldsymbol{a = 3}$

$2a + b = 4 \Rightarrow a = 3$

$6 + b = 4$

$\Rightarrow \boldsymbol{b = -2}$

7. Let $n(A) = m$ and $n(B) = n$ then the total number of non - empty relations that can be defined from A to B is

(a) m^n (b) n^m (c) $2^{mn} - 1$ (d) 2^{mn}

Solution:

Total no. of non-empty relations from A to $B = 2^{n(A)n(B)} - 1 = \boldsymbol{2^{mn} - 1}$.

Total. No. of relation is 2^{mn}.

8. If $\{(a, 8), (6, b)\}$ represents an identity function, then the value of a and b are respectively

(a) $(8,6)$ (b) $(8,8)$ (c) $(6,8)$ (d) $(6,6)$

Solution:

$(a, 8), (6, b) \Rightarrow$identity function

$$\boldsymbol{a = 8, b = 6}$$

9. Let $A = \{1,2,3,4\}$ and $B = \{4,8,9,10\}$. A function $f: A \to B$ given by $f = \{(1,4), (2,8), (3,9), (4,10)\}$ is a

(a) Many – One Function (b) Identity Function

(c) One – to – One Function (d) Into Function

Solution:

Different elements of A have different images in B.

f is one -one function .

10. If $f(x) = 2x^2$ and $g(x) = \frac{1}{3x}$, then $f \circ g$ is

(a) $\frac{3}{2x^2}$ (b) $\frac{2}{3x^2}$ (c) $\frac{2}{9x^2}$ (d) $\frac{1}{6x^2}$

Solution:

$$(f \circ g)(x) = f(g(x))$$

$$= f\left(\frac{1}{2x}\right)$$

$$= 2\left(\frac{1}{3x}\right)^2$$

$$= \boldsymbol{\frac{2}{9x^2}}$$

11. If $f : A \to B$ is a bijective function and if $n(B) = 7$, then $n(A)$ is equal to.

(a) 7 (b) 49 (c) 1 (d) 14

Solution:

$f: A \to B$ is bijective (one-one and onto) and $n(B) = 7$ $\boldsymbol{n(A) = 7}$

12. Let f and g be two functions given by
$f = \{(0,1),(2,0),(3,-4),(4,2),(5,7)\}$
$g = \{(0,2),(1,0),(2,4),(-4,2),(7,0)\}$ then the range of $f \circ g$ is
(a) $\{0,2,3,4,5\}$ (b) $\{-4,1,0,2,7\}$
(c) $\{1,2,3,4,5\}$ (d) $\{0,1,2\}$

Solution:

$$(f \circ g)(0) = f(g(0)) = f(2) = 0$$
$$(f \circ g)(1) = f(g(1)) = f(0) = 1$$
$$(f \circ g)(2) = f(g(2)) = f(4) = 2$$
$$(f \circ g)(-4) = f(g(-4)) = f(2) = 0$$
$$(f \circ g)(7) = f(g(7)) = f(0) = 1$$
$$\therefore \textbf{Range} = \{0,1,2\}$$

13. Let $f(x) = \sqrt{1+x^2}$ then
(a) $f(xy) = f(x).f(y)$ (b) $f(xy) \geq f(x).f(y)$
(c) $f(xy) \leq f(x).f(y)$ (d) None of these

Solution:

$$f(x) = \sqrt{1+x^2}$$
$$f(y) = \sqrt{1+y^2}$$
$$f(xy) = \sqrt{1+x^2y^2}$$
$$f(x).f(y) = \sqrt{(1+x^2)(1+y^2)}$$
$$= \sqrt{1+x^2+y^2+x^2+y^2}$$
$$\geq \sqrt{1+x^2y^2}$$
$$\geq f(xy)$$
$$\boldsymbol{f(xy) \leq f(x).f(y)}$$

14. If $g = \{(1,1),(2,3),(3,5),(4,7)\}$ is a function given by $g(x) = \alpha x + \beta$ then the value of α and β are
(a) $(-1,2)$ (b) $(2,-1)$
(c) $(-1,-2)$ (d) $(1,2)$

Solution:

$$g(x) = \alpha x + \beta$$
$$\Rightarrow 1 = \alpha + \beta, 3 = 2\alpha + \beta, 5 = 3\alpha + \beta$$
on Subtracting, $\boldsymbol{\alpha = 2 = \beta = -1}$

15. $f(x) = (x+1)^3 - (x-1)^3$ represents a function which is
(a) Linear (b) Cubic
(c) Reciprocal (d) Quadratic

Solution:

$f(x) = (x+1)^3 - (x-1)^3$
$= (x^3 + 3x^2 + 3x + 1) - (x^3 - 3x^2 + 3x - 1)$
$= \boldsymbol{6x^2 + 2}$, a quadratic function.

CHAPTER – 2 (NUMBERS AND SEQUENCES)

1. Euclid's division lemma states that for positive integers a and b, there exist unique integers q and r such that $a = bq + r$, where r must satisfy.
(a) $1 < r < b$ (b) $0 < r < b$
(c) $0 \leq r < b$ (d) $0 < r \leq b$

Solution:

By definition of Euclid's lemma $\boldsymbol{0 \leq r < b}$

2. Using Euclid's division lemma, if the cube of any positive integer is divided by 9 then the possible remainders are.
(a) 0, 1, 8 (b) 1, 4, 8
(c) 0, 1, 3 (d) 1, 3, 5

Solution:

$$x^3 \equiv y(mod\ 9)$$
when $x = 3, y = 0$(27 is divisible by 9)
when $x = 4, y = 1$(63 is divisible by 9)
when $x = 5, y = 8$(117 is divisible by 9)
∴The remainders are **0, 1, 8,**

3. If the HCF of 65 and 117 is expressible in the form of $65m - 117$, then the value of m is
(a) 4 (b) 2 (c) 1 (d) 3

Solution:

HCF of 65, 117 is 13
$$65m - 117 = 13$$
$$\Rightarrow 65m = 130$$
$$\Rightarrow \boldsymbol{m = 2}$$

4. The sum of the exponents of the prime factors in the prime factorization of 1729 is
(a) 1 (b) 2 (c) 3 (d) 4

Solution:

$$1729 = 7 \times 13 \times 19$$
$$= 7^1 \times 13^1 \times 19^1$$
∴Sum of the exponents = $\boldsymbol{1 + 1 + 1 = 3}$

5. The least number that is divisible by all the numbers from 1 to 10 (both exclusive) is
(a) 2025 (b) 5220 (c) 5025 (d) 2520

Solution:

The required number is the LCM of (Ex: 2.2) 9 sum)
(1, 2, 3, 10)
$$2 = \underline{2} \times 1$$
$$4 = \underline{2} \times 2$$
$$6 = 3 \times \underline{2}$$
$$8 = 2 \times 2 \times \underline{2}$$
$$9 = 3 \times 3$$
$10 = 5 \times \underline{2}$ and 1, 3, 5, 7
L.C.$M = 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 7$
$= \textbf{2520}$

6. $7^{4k} \equiv$ _____(mod 100)
   (a) 1 (b) 2 (c) 3 (d) 4

Solution:

If $\boldsymbol{k = 1}$, 7^4 leaves remainder 1 modulo 100.

7. Given $F_1 = 1, F_2 = 3$ and $F_n = F_{n-1} + F_{n-2}$ then F_5 is
   (a) 3 (b) 5 (c) 8 (d) 11

Solution:

$$F_3 = F_2 + F_1 = \mathbf{4}$$
$$F_4 = F_3 + F_2 = \mathbf{7}$$
$$F_5 = F_4 + F_3 = 4 + 7 = \mathbf{11}$$

8. The first term of an arithmetic progression is unity and the common difference is 4. Which of the following will be a term of this A. P.
   (a) 4551 (b) 10091 (c) 7881 (d) 13531

Solution:

$$a = 1, d = 4$$

∴The A.P is 1, 5, 9, 13, leaves remainder 1 when divided by 4.

∴**7881** Leaves remainder **1 when divided by 4.**

9. If 6 times of 6^{th} term of an A.P is equal to 7 times the 7^{th} term , then the 13^{th} term of the A.P is
   (a) 0 (b) 6 (c) 7 (d) 13

Solution:

$$6(t_6) = 7(t_7)$$
$$\Rightarrow 6(a + 5d) = 7(a + 6d)$$
$$\Rightarrow 6a + 30d = 7a + 42d$$
$$\Rightarrow a + 12d = 0$$
$$\Rightarrow \boldsymbol{t_{13} = 0}$$

10. An A.P consists of 31 terms. If its 16^{th} term is m, then the sum of all the terms of this A.P is
   (a) $16\,m$ (b) $62\,m$ (c) $31\,m$ (d) $\frac{31}{2}\,m$

Solution:

$$n = 31, a + 15d = m$$
$$\Rightarrow S_n = \frac{n}{2}[2a + (n-1)d]$$
$$\Rightarrow S_{31} = \frac{31}{2}[2a + 30d]$$
$$= 31(a + 15d)$$
$$= \mathbf{31m}$$

11. In an A.P the first term is 1 and the common difference is 4. How many terms of the A.P must be taken for their sum to be equal to 120?.
   (a) 6 (b) 7 (c) 8 (d) 9

Solution:

$$a = 1, d = 4, S_n = 120$$
$$\Rightarrow \frac{n}{2}(2a + (n-1)d) = 120$$
$$\Rightarrow \frac{n}{2}(2 + (n-1)4) = 120$$
$$\Rightarrow n(1 + 2n - 2) = 120$$
$$\Rightarrow n(2n - 1) = 120$$
$$\Rightarrow 2n^2 - n - 120 = 0$$
$$\Rightarrow (n-8)(2n+15) = 0$$
$$\Rightarrow (n-8) = 0$$

-240 → $-\frac{16}{2}$, $\frac{15}{2}$

$$\boldsymbol{n = 8}$$

12. If $A = 2^{65}$ and $B = 2^{64} + 2^{63} + 2^{62} + \cdots + 2^0$ which of the following is true?.
   (a) B is 2^{64} more than A
   (b) A and B are Equal
   (c) B is larger than A by 1
   (d) A is larger than B by 1

Solution:

2^4 is greater than $2^0 + 2^1 + 2^2 + 2^3$ by 1

2^5 is greater than $2^0 + 2^1 + 2^2 + 2^3 + 2^4$ by 1

∵ 2^{65} is greater than $2^0 + 2^1 + +2^{64}$ by 1

∵ **A is larger than $\boldsymbol{B}$ by 1.**

13. The next term of the sequence $\frac{3}{16}, \frac{1}{8}, \frac{1}{12}, \frac{1}{18}, \ldots$ is
   (a) $\frac{1}{24}$ (b) $\frac{1}{27}$ (c) $\frac{2}{3}$ (d) $\frac{1}{81}$

Solution:

$$r = \frac{\frac{1}{8}}{\frac{3}{16}} = \frac{1}{8} \times \frac{16}{3} = \frac{2}{3}$$

Next term of the sequence $= \frac{1}{18} \times \frac{2}{3}$

$$= \boldsymbol{\frac{1}{27}}$$

14. If the sequence $t_1, t_2, t_3, \ldots$ are in A.P then the sequence $t_6, t_{12}, t_{18}, \ldots$ is
   (a) A Geometric Progression
   (b) An Arithmetic Progression
   (c) Neither an Arithmetic Progression nor a Geometric Progression
   (d) A constant sequence

Solution:

Obivously they should be in **A.P**.

15. The value of $(1^3 + 2^3 + 3^3 + \cdots + 15^3) - (1 + 2 + 3 + \cdots + 15)$ is
   (a)14400 (b) 14200 (c) 14280 (d) 14520

Solution:

$$\left(\frac{15 \times 16}{2}\right)^2 - \left(\frac{15 \times 16}{2}\right)$$
$$= 14400 - 120$$
$$= \mathbf{14280}$$

CHAPTER – 3 (ALGEBRA)

1. A system of three linear equations in three variables is inconsistent if their planes.
   (a) Intersect only at a point
   (b) Intersect in a line
   (c) Coincides with each other
   (d) do not intersect

Solution:

System of equations is in consistent if their planes **do not intersect.**

2. The solution of the system $x+y-3z=-6$, $-7y+7z=7, 3z=9$ is
   (a) $x=1, y=2, z=3$
   (b) $x=-1, y=2, z=3$
   (c) $x=-1, y=-2, z=3$
   (d) $x=1, y=-2, z=3$

Solution:

$(3) \Rightarrow 3z=9 \Rightarrow z=3$

$(2) \Rightarrow -y+z=1 \Rightarrow -y+3=1$

$-y=-2$

$y=2$

$(1) \Rightarrow x+y-3z=-6$

$x+2-9=-6$

$x=7-6$

$\boldsymbol{x=1}$

3. If $(x-6)$ is the HCF of $x^2-2x-24$ and x^2-kx-6 then the value of k is
   (a) 3 (b) 5 (c) 6 (d) 8

Solution:

$x^2-2x-24=(x-6)(x+4)$

$x^2-kx-6=(x-6)(x+1)$

$\therefore$ $(x+1$ is the only possible factor)

$=x^2-5x-6$

$\boldsymbol{\therefore k=5}$

4. $\frac{3y-3}{y} \div \frac{7y-7}{3y^2}$ is
   (a) $\frac{9y}{7}$ (b) $\frac{9y^3}{(21y-21)}$
   (c) $\frac{21y^2-42y+21}{3y^3}$ (d) $\frac{7(y^2-2y+1)}{y^2}$

Solution:

$$=\frac{3y-3}{y} \div \frac{7y-7}{3y^2}$$

$$=\frac{3(y-1)}{y} \div \frac{3y^2}{7(y-1)}$$

$$=\boldsymbol{\frac{9y}{7}}$$

5. $y^2+\frac{1}{y^2}$ is not equal to
   (a) $\frac{y^4+1}{y^2}$ (b) $\left(y+\frac{1}{y}\right)^2$
   (c) $\left(y-\frac{1}{y}\right)^2+2$ (d) $\left(y+\frac{1}{y}\right)^2-2$

Solution:

$$y^2+\frac{1}{y^2} \neq \left(y+\frac{1}{y}\right)^2$$

6. $\frac{x}{x^2-25}-\frac{x}{x^2+6x+5}$ gives
   (a) $\frac{x^2-7x+40}{(x-5)(x+5)}$ (b) $\frac{x^2+7x+40}{(x-5)(x+5)(x+1)}$
   (c) $\frac{x^2-7x+40}{(x^2-25)(x+1)}$ (d) $\frac{x^2+10}{(x^2-25)(x+1)}$

Solution:

$$=\frac{x}{x^2-25}-\frac{8}{x^2+6x+5}$$

$$=\frac{x}{(x+5)(x-5)}-\frac{8}{(x+5)(x+1)}$$

$$=\frac{x(x+1)-8(x-5)}{(x+5)(x-5)(x+1)}$$

$$=\frac{x^2+x-8x+40}{(x+5)(x-5)(x+1)}$$

$$=\boldsymbol{\frac{x^2-7x+40}{(x^2-25)(x+1)}}$$

7. The square root of $\frac{256x^8y^4z^{10}}{25x^6y^6z^6}$ is equal to
   (a) $\frac{16}{5}\left|\frac{x^2z^4}{y^2}\right|$ (b) $16\left|\frac{y^2}{x^2z^4}\right|$
   (c) $\frac{16}{5}\left|\frac{y}{xz^2}\right|$ (d) $\frac{16}{5}\left|\frac{xz^2}{y}\right|$

Solution:

$$=\sqrt{\frac{256x^8y^4z^{10}}{25x^6y^6z^6}}$$

$$=\frac{16}{5}\left|\frac{x^4y^2z^5}{x^3y^3z^3}\right|$$

$$=\boldsymbol{\frac{16}{5}\left|\frac{xz^2}{y}\right|}$$

8. Which of the following should be added to make x^4+64 a perfect square
   (a) $4x^2$ (b) $16x^2$ (c) $8x^2$ (d) $-8x^2$

Solution:

$=x^4+64$

$=(x^2)^2+8^2$

$=(x^2)^2+8^2+2(x^2)(8)$

$=(x^2+8)^2$, perfect square

$\therefore$ $\boldsymbol{16x^2}$ should be added

9. The solution of $(2x-1)^2 = 9$ is equal to
   $(a) -1$ $(b)\ 2$ $(c) -1, 2$
   (d) None of these

Solution:

$$(2x-1)^2 = 9 \Rightarrow 2x - 1 = \pm 3$$
$$\Rightarrow 2x = 4, 2x = -2$$
$$\mathbf{x = 2, x = -1}$$

10. The value of a and b if $4x^4 - 24x^3 + 76x^2 + ax + b$ is a perfect square are
   $(a)\ 100, 120$ $(b)\ 10, 12$
   $(c) -120, 100$ $(d)\ 12, 10$

Solution:

	$2x^2 - 6x + 10$
2	$4x^4 - 24x^3 + 76x^2 + ax + b$
	$4x^4\ (-)$
$4x^2 - 6x$	$-24x^3 + 76x^2$
	$-24x^3 + 36x^2 (-)$
$4x^2 - 12x + 10$	$40x^2 + ax + b$
	$40x^2 - 120x + 100$
	$(-)$
	0

$$a + 120 = 0, \quad \mathbf{a = -120}$$
$$b - 100 = 0, \quad \mathbf{b = 100}$$

11. If the roots of the equation $q^2x^2 + p^2x + r^2 = 0$ are the squares of the roots of the equation $qx^2 + px + r = 0$ then q, p, r are in ________.
   (a) A.P (b) G.P
   (c) Both A.P and G.P (d) None of these

Solution:

Roots of $q^2x^2 + p^2x + r^2 = 0$ are squares of Roots of $qx^2 + px + r = 0$

$$\Rightarrow \alpha^2 + \beta^2 = \frac{-p^2}{q^2}, \quad \alpha^2\beta^2 = \frac{r^2}{q^2}$$
$$\Rightarrow \alpha + \beta = \frac{-p}{q}, \quad \alpha\beta = \frac{r}{q}$$
$$\Rightarrow (\alpha+\beta)^2 - 2\alpha\beta = \frac{-p^2}{q^2}$$
$$\Rightarrow \frac{p^2}{q^2} - \frac{2r}{q} = \frac{-p^2}{q^2}$$
$$\Rightarrow \frac{2r}{q} = \frac{2p^2}{q^2}$$
$$\Rightarrow r = \frac{2p^2}{q^2}$$
$$\Rightarrow p^2 = qr$$

$\therefore$ **q, p, r are in G.P.**

12. Graph of a linear equation is a ________.
   (a) Straight line (b) Circle
   (c) Parabola (d) Hyperbola

Solution:

Graph of a linear polynomial is a **Straight line**.

13. The number of points of intersection of the quadratic polynomial $x^2 + 4x + 4$ with the X axis is
   $(a)\ 0$ $(b)\ 1$ $(c)\ 0$ or 1 $(d)\ 2$

Solution:

$$(x+2)^2 = 0$$
$$\Rightarrow x + 2 = 0$$
$$\Rightarrow x = -2$$

$\therefore$The polynomial will meet x - axis at $\mathbf{(-2, 0)}$

No. of points of intersection = **1**.

14. For the given matrix $A = \begin{pmatrix} 1 & 3 & 5 & 7 \\ 2 & 4 & 6 & 8 \\ 9 & 11 & 13 & 15 \end{pmatrix}$ the order of the matrix A^T is
   $(a)\ 2 \times 3$ $(b)\ 3 \times 2$ $(c)\ 3 \times 4$ $(d)\ 4 \times 3$

Solution:

A has 3 rows & 4 columns

$\therefore$ A is of order $\mathbf{3 \times 4}$

15. If A is a 2×3 matrix and B is a 3×4 matrix how many columns does AB have
   $(a)\ 3$ $(b)\ 4$ $(c)\ 2$ $(d)\ 5$

Solution:

$$A \to 2 \times 3, B \to 3 \times 4$$

$\therefore$ AB is of order 2×4

. $\therefore$No. of columns of **$A \times B$ is 4**.

16. If number of columns and rows are not equal in a matrix then it is said to be a
   (a) Diagonal matrix (b) Rectangular matrix
   (c) Square matrix (d) Identity matrix

Solution:

No. of rows $\neq$ No. of columns

$\Rightarrow$Matrix is said to be **rectangular**.

17. Transpose of a column matrix is
   (a) Unit matrix (b) Diagonal matrix
   (c) Column matrix (d) Row matrix

Solution:

Transpose of a column matrix is a **Row matrix**

Ex: If $A = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$ $A^T = (1\ 2\ 3)$

18. Find the matrix X if $2X + \begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix} = \begin{pmatrix} 5 & 7 \\ 9 & 5 \end{pmatrix}$

$(a)\ \begin{pmatrix} -2 & -2 \\ 2 & -1 \end{pmatrix}$ $(b)\ \begin{pmatrix} 2 & 2 \\ 2 & -1 \end{pmatrix}$

$(c)\ \begin{pmatrix} 1 & 2 \\ 2 & 2 \end{pmatrix}$ $(d)\ \begin{pmatrix} 2 & 1 \\ 2 & 2 \end{pmatrix}$

Solution:

$$2X + \begin{pmatrix} 1 & 3 \\ 5 & 7 \end{pmatrix} = \begin{pmatrix} 5 & 7 \\ 9 & 5 \end{pmatrix}$$

$$\Rightarrow 2X = \begin{pmatrix} 4 & 4 \\ 4 & -2 \end{pmatrix}$$

$$\Rightarrow \boldsymbol{X = \begin{pmatrix} 2 & 2 \\ 2 & -1 \end{pmatrix}}$$

19. Which of the following can be calculated from the given matrices $A = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{pmatrix}$,

$B = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$ $(i)\ A^2\ \ (ii)\ B^2\ \ (iii)\ AB\ \ (iv)\ BA$

(a) (i) and (ii) only (b) (ii) and (iii) only

(c) (ii) and (iv) only (d) All of these

Solution:

A is of order 3×2

i) A^2 is not possible $[(3 \times 2)(3 \times 2)$ is not possible$]$

B is of order 3×3

ii) **B^2 is possible**

iii) AB is not defined (no. of columns in $A \neq$ no. of rows in B)

iv) BA is of order 3×3. **BA is possible.**

20. If $A = \begin{pmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 0 \\ 2 & -1 \\ 0 & 2 \end{pmatrix}$ and $C = \begin{pmatrix} 0 & 1 \\ -2 & 5 \end{pmatrix}$ which of the following statements are correct?. $(i)\ AB + C = \begin{pmatrix} 5 & 5 \\ 5 & 5 \end{pmatrix}$

$(ii)\ BC = \begin{pmatrix} 0 & 1 \\ 2 & -3 \\ -4 & 10 \end{pmatrix}$ $(iii)\ BA + C = \begin{pmatrix} 2 & 5 \\ 3 & 0 \end{pmatrix}$

$(iv)\ (AB)C = \begin{pmatrix} -8 & 20 \\ -8 & 13 \end{pmatrix}$

(a) (i) and (ii) only (b) (ii) and (iii) only

(c) (iii) and (iv) only (d) All of these

Solution:

i) $AB + C = \begin{pmatrix} 1+4+0 & 0-2+6 \\ 3+4+0 & 0-2+2 \end{pmatrix} + \begin{pmatrix} 0 & 1 \\ -2 & 5 \end{pmatrix}$

$$= \begin{pmatrix} 5 & 4 \\ 7 & 0 \end{pmatrix} + \begin{pmatrix} 0 & 1 \\ -2 & 5 \end{pmatrix}$$

$$= \begin{pmatrix} 5 & 5 \\ 5 & 5 \end{pmatrix} \textbf{ Correct}$$

ii) $B \to 3 \times 2$, $C \to 2 \times 2$

$\therefore$BC is of order 3×2

$BC = \begin{pmatrix} 0+0 & 1+0 \\ 0+2 & 2-5 \\ 0-4 & 0+10 \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ 2 & -3 \\ -4 & 10 \end{pmatrix}$ **Correct**

iii) $BA + C \neq \begin{pmatrix} 2 & 5 \\ 3 & 0 \end{pmatrix}$, ($BA$ is of order 3×3)

iv) $AB = \begin{pmatrix} 5 & 4 \\ 7 & 0 \end{pmatrix}$

$$ABC = \begin{pmatrix} 5 & 4 \\ 7 & 0 \end{pmatrix}\begin{pmatrix} 0 & 1 \\ -2 & 5 \end{pmatrix}$$

$$= \begin{pmatrix} 0-8 & 5+20 \\ 0+0 & 7+0 \end{pmatrix}$$

$$\Rightarrow \begin{pmatrix} -8 & 25 \\ 0 & 7 \end{pmatrix} \neq \begin{pmatrix} -8 & 20 \\ -8 & 13 \end{pmatrix}$$

∴(i) & (ii) only are correct

CHAPTER – 4 (GEOMETRY)

1. If in triangles ABC and EDF, $\frac{AB}{DE} = \frac{BC}{FD}$ then they will be similar, when

$(a)\ \angle B = \angle E$ $(b)\ \angle A = \angle D$

$(c)\ \angle B = \angle D$ $(d)\ \angle A = \angle F$

Solution:

$\Delta ABC \sim \Delta EDF$ if $\frac{AB}{DE} = \frac{BC}{FD}$ and

$\boldsymbol{\angle B = \angle D}$

$\angle A = \angle F$

$\angle C = \angle F$

2. In $\Delta LMN, \angle L = 60^\circ, \angle M = 50^\circ$. If $\Delta LMN \sim \Delta PQR$ then the value of $\angle R$ is.

$(a)\ 40^\circ$ $(b)\ 70^\circ$ $(c)\ 30^\circ$ $(d)\ 110^\circ$

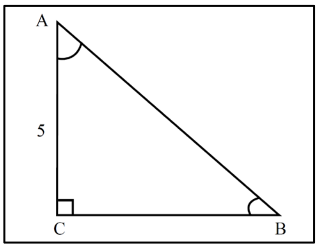
Solution:

$$\angle R = 180^\circ - (\angle L + \angle M)$$
$$= 180^\circ - (60^\circ + 50^\circ)$$
$$= 180^\circ - 110^\circ$$
$$= \boldsymbol{70^\circ}$$

3. If ΔABC is an isosceles triangle with $\angle C = 90^\circ$ and $AC = 5\ cm$ then AB is

$(a)\ 2.5\ cm$ $(b)\ 5\ cm$ $(c)\ 10\ cm$ $(d)\ 5\sqrt{2}\ cm$

Solution:



ΔABC is isosceles $= \angle B = \angle A = 25^\circ$

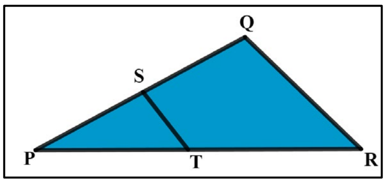
$$\sin 45^\circ = \frac{5}{AB}$$

$$\Rightarrow \frac{1}{\sqrt{2}} = \frac{5}{AB}$$

$$\Rightarrow \boldsymbol{AB = 5\sqrt{2}\ cm}$$

4. In a given figure $ST \parallel QR, PS = 2\ cm$ and $SQ = 3\ cm$. Then the ratio of the area of ΔPQR to the area of ΔPST is

(a) 25 : 4
(b) 25 : 7
(c) 25 : 11
(d) 25 : 13



Solution:

$$\frac{\text{Area of } \Delta PQR}{\text{Area of } \Delta PST} = \frac{PQ^2}{PS^2}$$

Where $PQ = PS + SQ = 2 + 3 = 5$

$$= \frac{25}{4}$$

$\therefore$ **Ratio = 25: 4**

5. The perimeters of two similar triangles ΔABC and ΔPQR are 36 cm and 24 cm respectively. If $PQ = 10\ cm$, then the length of AB is

(a) $6\frac{2}{3}\ cm$ (b) $\frac{10\sqrt{6}}{3}\ cm$ (c) $66\frac{2}{3}\ cm$ (d) $15\ cm$

Solution:

$$\frac{\text{Perimeter of } \Delta ABC}{\text{Perimeter of } \Delta PQR} = \frac{36}{24} = \frac{AB}{PQ}$$

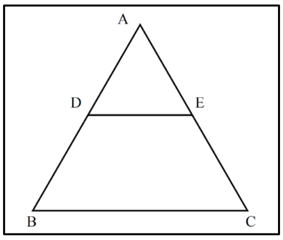
$$\Rightarrow \frac{3}{2} = \frac{AB}{10}$$

$\Rightarrow$ **AB = 15 cm**

6. If in $\Delta ABC, DE \parallel BC. AB = 3.6\ cm,\ AC = 2.4\ cm$ and $AD = 2.1\ cm$ then the length of AE is

(a) $1.4\ cm$ (b) $1.8\ cm$ (c) $1.2\ cm$ (d) $1.05\ cm$

Solution:



By $BPT, \frac{AD}{AB} = \frac{AE}{AC} \Rightarrow \frac{2.\cdot 1}{36} = \frac{AE}{2.4}$

$$\Rightarrow AE = 2.4 \times \frac{2.\cdot 1}{36}$$

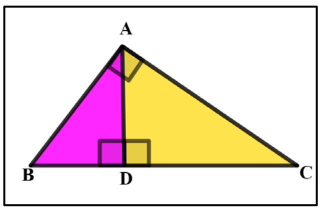
$$= \frac{2}{3} \times 2.1$$

$$= 2 \times 0.7$$

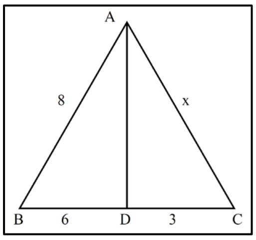
$=$ **1.4 cm**

7. In a ΔABC, AD is the bisector of $\angle BAC$. If $AB = 8\ cm, BD = 6\ cm$ and $DC = 3\ cm$. The length of the side AC is

(a) $6\ cm$
(b) $4\ cm$
(c) $3\ cm$
(d) $8\ cm$



Solution:



By $ABT, \frac{8}{x} = \frac{6}{3}$

$$\Rightarrow \frac{8}{x} = 2$$

$\Rightarrow$ **$x = 4$ cm**

8. In the adjacent figure $\angle BAC = 90^\circ$ and $AD \perp BC$ then

(a) $BD.CD = BC^2$ (b) $AB.AC = BC^2$
(c) $BD.CD = AD^2$ (d) $AB.AC = AD^2$

Solution:

$$\Delta DBA \sim \Delta DAC$$

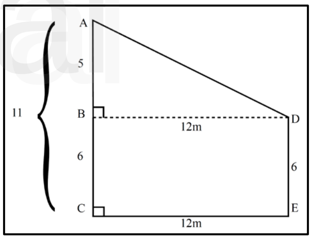
$$\frac{BD}{AD} = \frac{AD}{CD}$$

$\Rightarrow$ **$AD^2 = BD \times CD$**

9. Two poles of heights 6 m and 11 m stand vertically on a plane ground. If the distance between their feet is 12 m , what is the distance between their tops?.

(a) $13\ m$ (b) $14\ m$ (c) $15\ m$ (d) $12.8\ m$

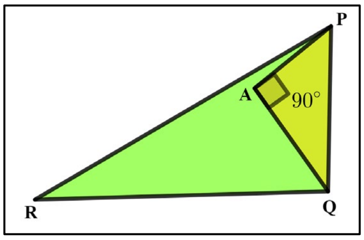
Solution:



$AD = \sqrt{12^2 + 5^2} = \sqrt{169} =$ **13 cm**

10. In the given figure, $PR = 26\ cm,\ QR = 24\ cm,\ \angle PAQ = 90^\circ,\ PA = 6\ cm$ and $QA = 8\ cm$. Find $\angle PQR$

(a) 80°
(b) 85°
(c) 75°
(d) 90°



Solution:

In PAQ, PA = 6, $QA = 8$

$$\Rightarrow PQ = \sqrt{64 + 36}$$

$$= \sqrt{100}$$

$$= 10$$

Also, in ΔPQR, $PQ^2 + QR^2 = 100 + 576$

$$= 676$$

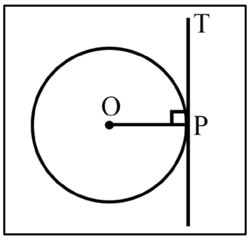
$$= 26^2$$

$$= PR^2$$

$Q = 90^\circ$

11. A tangent is perpendicular to the radius at the
(*a*) Centre (*b*) Point of contact
(*c*) Infinity (*d*) Chord

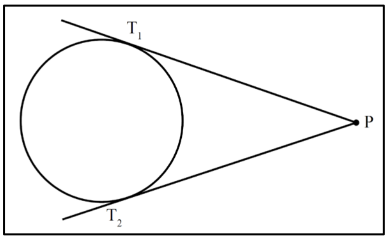
Solution:



A tangent is perpendicular to the radius at the point of contact.

12. How many tangents can be drawn to the circle from an exterior point?.
(*a*) One (*b*) Two
(*c*) Infinite (*d*) Zero

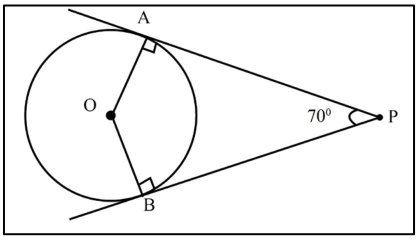
Solution:



Two tangents can be drawn to the circle from an **external point**.

13. The two tangents from an external points P to a circle with centre at O are PA and PB. If $\angle APB = 70^\circ$ then the value of $\angle AOB$ is
(*a*) 100° (*b*) 110° (*c*) 120° (*d*) 130°

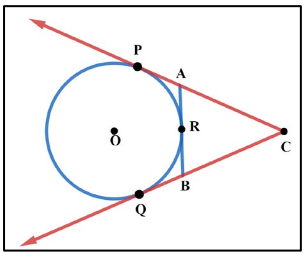
Solution:



$OA \perp AP, OB \perp BP$

$$\angle AOB + 90^\circ + 90^\circ + 70^0 = 360^\circ$$
$$\Rightarrow \angle AOB = 360^\circ - 250^\circ$$
$$= \mathbf{110^\circ}$$

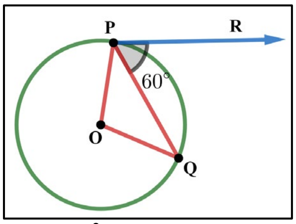
14. In figure CP and CQ are tangents to a circle with centre at O. ARB is another tangent touching the circle at R. If $CP = 11\ cm$ and $BC = 7\ cm$, then the length of BR is
(*a*) $6\ cm$
(*b*) $5\ cm$
(*c*) $8\ cm$
(*d*) $4\ cm$



Solution:

$$CP = CQ = 11 \text{ cm}, BC = 7$$
$$BQ = 11 - 7 = 4$$
$$\mathbf{BR = BQ = 4\ cm}$$

15. In figure if PR is tangent to the circle at P and O is the centre of the circle, then $\angle POQ$ is
(*a*) 120°
(*b*) 100°
(*c*) 110°
(*d*) 90°



Solution:

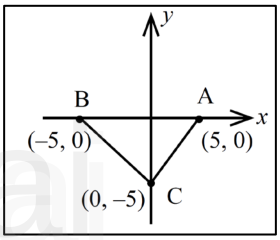
$\angle RPQ = 60^\circ \Rightarrow QO'P = 60^\circ$(O' is on the circle)

$$\Rightarrow QOP = 2(60)$$
$$= \mathbf{120^\circ}$$

CHAPTER – 5 (COORDINATE GEOMETRY)

1. The area of triangle formed by the points $(-5, 0), (0, -5)$ and $(5, 0)$ is.
(*a*) 0 sq.units (*b*) 25 sq.units
(*c*) 5 sq.units (*d*) None of these

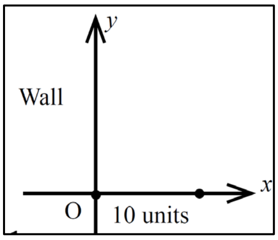
Solution:



$$\text{Area of ABC} = \frac{1}{2} \times b \times h$$
$$= \frac{1}{2} \times 10 \times 5$$
$$= \mathbf{25\ sq.units}$$

2. A man walks near a wall, such that the distance between him and the wall is 10 units. Consider the wall to be the Y axis. The path travelled by the man is
(*a*) $x = 10$ (*b*) $y = 10$
(*c*) $x = 0$ (*d*) $y = 0$

Solution:



Equation of path travelled by the man is $\mathbf{x = 10}$

3. The straight line given by the equation $x = 11$ is
   (a) Parallel to X axis (b) Parallel to Y axis
   (c) Passing through the origin
   (d) Passing through the point $(0,11)$

Solution:

Equation **$x = C$ is a line parallel** to y - axis

4. If $(5,7),(3,p)$ and $(6,6)$ are collinear, then the value of p is
   $(a)\ 3$ $(b)\ 6$ $(c)\ 9$ $(d)\ 12$

Solution:

$A(5,7), B(3,p), C(6,6)$ are collinear

$\therefore$Slope of AB =Slope of BC

$$\frac{p-7}{-2} = \frac{6-p}{3}$$

$$3p - 21 = -12 + 2p$$

$$\boldsymbol{p = 9}$$

5. The point of intersection of $3x - y = 4$ and $x + y = 8$ is
   $(a)\ (5,3)$ $(b)\ (2,4)$ $(c)\ (3,5)$ $(d)\ (4,4)$

Solution:

Substitute and check the point to satisfy the given lines.

$$3x - y = 4, x + y = 8$$

$$3(3) - 5 = 4, 3 + 5 = 8. \ \boldsymbol{(3,5)}$$

6. The slope of the line joining $(12,3),(4,a)$ is $\frac{1}{8}$. The vale of 'a' is
   $(a)\ 1$ $(b)\ 4$ $(c) - 5$ $(d)\ 2$

Solution:

Slope of $(12,3)$, $(4,a) = \frac{1}{8}$

$$\Rightarrow \frac{a-3}{-8} = \frac{1}{8}$$

$$\Rightarrow a - 3 = -1$$

$$\Rightarrow \boldsymbol{a = 2}$$

7. The slope of the line which is perpendicular to a line joining the points $(0,0)$ and $(-8,8)$ is
   $(a) - 1$ $(b)\ 1$ $(c)\ \frac{1}{3}$ $(d) - 8$

Solution:

Slope of the line joining $(0,0), (-8,8)$

$$= \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{8-0}{-8-0}$$

$$= -1$$

$\therefore$Slope of the line perpendicular to it **= 1.**

8. If slope of the line PQ is $\frac{1}{\sqrt{3}}$ then slope of the perpendicular bisector of PQ is
   $(a)\ \sqrt{3}$ $(b) - \sqrt{3}$ $(c)\ \frac{1}{\sqrt{3}}$ $(d)\ 0$

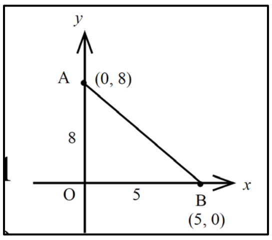
Solution:

Slope of $PQ = \frac{+1}{\sqrt{3}}$

Slope of its perpendicular bisector $\boldsymbol{= -\sqrt{3}}$

9. If A is a point on the Y axis whose ordinate is 8 and B is a point on the X axis whose abscissae is 5 then the equation of the line AB is
   $(a)\ 8x + 5y = 40$ $(b)\ 8x - 5y = 40$
   $(c)\ x = 8$ $(d)\ y = 5$

Solution:



Here $a = 5, b = 8$

Equation of the line is $\frac{x}{5} - \frac{y}{8} = 1$

$$\Rightarrow \boldsymbol{8x + 5y - 40 = 0}$$

10. The equation of a line passing through the origin and perpendicular to the line $7x - 3y + 4 = 0$ is
    $(a)\ 7x - 3y + 4 = 0$ $(b)\ 3x - 7y + 4 = 0$
    $(c)\ 3x + 7y = 0$ $(d)\ 7x - 3y = 0$

Solution:

Equation of the line perpendicular to

$$7x - 3y + 4 = 0 \text{ is}$$

$$3x + 7y + k = 0$$

Since it passes through $(0,0)$, $k = 0$

$$\boldsymbol{\therefore 3x + 7y = 0}$$

11. Consider four straight lines $(i)\ l_1; 3y = 4x + 5$
    $(ii)\ l_2; 4y = 3x - 1$ $(iii)\ l_3; 4y + 3x = 7$
    $(iv)\ l_4; 4x + 3y = 2$
    Which of the following statement is true?.
    (a) l_1 and l_2 are perpendicular
    (b) l_1 and l_4 are parallel
    (c) l_2 and l_4 are perpendicular
    (d) l_2 and l_3 are parallel

Solution:

i) Slope of $l_1 = 4/3$

ii) Slope of $l_2 = 3/4$

iii) Slope of $l_3 = -3/4$

iv) Slope of $l_4 = -4/3$

Here l_1 and l_3 are perpendicular

l_2 and l_4 are perpendicular

But 3rd option is a contradiction

12. A straight line has equation $8y = 4x + 21$. Which of the following is true
(a) The slope is 0.5 and the y intercept is 2.6
(b) The slope is 5 and the y intercept is 1.6
(c) The slope is 0.5 and the y intercept is 1.6
(d) The slope is 5 and the y intercept is 2.6

Solution:

Given equation is $8y = 4x + 21$

$$\Rightarrow y = \frac{1}{2}x + \frac{21}{8}$$
$$\Rightarrow y = 0.5x + 2.6$$

Slope = 0.5, y − intercept = 2.6

13. When proving that a quadrilateral is a trapezium, it is necessary to show
(a) Two sides are parallel
(b) Two parallel and two non – parallel sides
(c) Opposite sides are parallel
(d) All sides are of equal length

Solution:

A quadrilateral is trapezoid if one pair of **opposite sides are parallel and another pair is non parallel.**

14. When proving that a quadrilateral is a parallelogram by using slopes you must find
(a) The slopes of two sides
(b) The slopes of two pair of opposite sides
(c) The lengths of all sides
(d) Both the lengths and slopes of two sides

Solution:

We should find the **slopes of all the sides** when proving a quadrilateral is a parallelogram.

15. (2, 1) is the point of intersection of two lines
(a) $x - y - 3 = 0$; $3x - y - 7 = 0$
(b) $x + y = 3$; $3x + y = 7$
(c) $3x + y = 3$; $x + y = 7$
(d) $x + 3y - 3 = 0$; $x - y - 7 = 0$

Solution:

Substitute (2,1) & check in all pair of lines.

$\boldsymbol{x + y = 3, 3x + y = 7}, 2 + 1 = 3, 6 + 1 = 7.$

CHAPTER – 6 (TRIGONOMETRY)

1. The value of $\sin^2\theta + \frac{1}{1+\tan^2\theta}$ is equal to
(a) $\tan^2\theta$ (b) 1 (c) $\cot^2\theta$ (d) 0

Solution:

$$= \sin^2\theta + \frac{1}{1+\tan^2\theta}$$
$$= \sin^2\theta + \frac{1}{\sec^2\theta}$$
$$= \sin^2\theta + \cos^2\theta$$
$$= \mathbf{1}$$

2. $\tan\theta\, cosec^2\theta - \tan\theta$ is equal to
(a) $\sec\theta$ (b) $\cot^2\theta$ (c) $\sin\theta$ (d) $\cot\theta$

Solution:

$$= \tan\theta . \text{cosec}^2\theta - \tan\theta$$
$$= \tan\theta(\text{cosec}^2\theta - 1)$$
$$= \tan\theta . \cot^2\theta$$
$$= \frac{1}{\cot\theta} \times \cot^2\theta$$
$$= \boldsymbol{\cot\theta}$$

3. If $(\sin\alpha + cosec\,\alpha)^2 + (\cos\alpha + sec\,\alpha)^2 = k + tan^2\alpha + cot^2\alpha$, then the value of k is equal to
(a) 9 (b) 7 (c) 5 (d) 3

Solution:

$$(\sin\alpha + \text{cosec}\,\alpha)^2 + (\cos\alpha + \sec\alpha)^2 = k + \tan^2\alpha + \cot^2\alpha$$
$$\Rightarrow \sin^2\alpha + \text{cosec}^2\alpha + 2\sin\alpha . \text{cosec}\,\alpha + \cos^2\alpha + \sec^2\alpha + 2\cos\alpha\sec\alpha = k + \tan^2\alpha + \cot^2\alpha$$
$$1 + 2 + 2 + \text{cosec}^2\alpha + \sec^2\alpha = k + \tan^2\alpha + \cot^2\alpha$$
$$5 + 1 + \cot^2\alpha + 1 + \tan^2\alpha = k + \tan^2\alpha + \cot^2\alpha$$
$$7 + \cot^2\alpha + \tan^2\alpha = k + \tan^2\alpha + \cot^2\alpha$$

$\therefore \boldsymbol{k = 7}$

4. If $\sin\theta + \cos\theta = a$ and $\sec\theta + \text{cosec}\,\theta = b$, then the value of $b(a^2 - 1)$ is equal to
(a) $2a$ (b) $3a$ (c) 0 (d) $2ab$

Solution:

$$b(a^2 - 1) = (\sec\theta + \text{cosec}\,\theta)[(\sin\theta + \cos\theta)^2 - 1]$$
$$= \left(\frac{1}{\cos\theta} + \frac{1}{\sin\theta}\right)[2\sin\theta\cos\theta]$$
$$= 2\sin\theta + 2\cos\theta$$
$$= 2(\sin\theta + \cos\theta)$$

$\boldsymbol{= 2a}$

5. If $5x = \sec\theta$ and $\frac{5}{y} = \tan\theta$, then $x^2 - \frac{1}{y^2}$ is equal to
(a) 25 (b) $\frac{1}{25}$ (c) 5 (d) 1

Solution:

$$5x = \sec\theta, \frac{5}{x} = \tan\theta$$
$$\sec^2\theta - \tan^2\theta = 1$$
$$25x^2 - \frac{25}{x^2} = 1$$
$$25\left(x^2 - \frac{1}{x^2}\right) = 1$$
$$\boldsymbol{x^2 - \frac{1}{x^2} = \frac{1}{25}}$$

6. If $\sin\theta = \cos\theta$, then $2tan^2\theta + sin^2\theta - 1$ is equal to

$(a)\ \frac{-3}{2}$ $(b)\ \frac{3}{2}$ $(c)\ \frac{2}{3}$ $(d)\ \frac{-2}{3}$

Solution:

Given $\sin\theta = \cos\theta \Rightarrow \theta = 45^\circ$

$$\therefore 2\tan^2\theta + \sin^2\theta - 1$$
$$= 2\tan^2 45^\circ + \sin^2 45^\circ - 1$$
$$= 2(1) + \left(\frac{1}{\sqrt{2}}\right) - 1$$
$$= 2 + \frac{1}{2} - 1$$
$$= \frac{3}{2}$$

7. If $x = a\tan\theta$ and $y = b\sec\theta$ then

$(a)\ \frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$ $(b)\ \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

$(c)\ \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ $(d)\ \frac{x^2}{a^2} - \frac{y^2}{b^2} = 0$

Solution:

$$x = a\tan\theta, y = b\sec\theta$$
$$\tan\theta = \frac{x}{a}, \sec\theta = \frac{y}{b}$$
$$\sec^2\theta - \tan^2\theta = 1$$
$$\frac{y^2}{b^2} - \frac{x^2}{a^2} = 1$$

8. $(1 + \tan\theta + \sec\theta)(1 + \cot\theta - cosec\,\theta)$ is equal to

$(a)\ 0$ $(b)\ 1$ $(c)\ 2$ $(d) - 1$

Solution:

$$= (1 + \tan\theta + \sec\theta)(1 + \cot\theta - cosec\,\theta)$$
$$= \left(1 + \frac{\sin\theta}{\cos\theta} + \frac{1}{\cos\theta}\right)\cdot\left(1 + \frac{\cos\theta}{\sin\theta} - \frac{1}{\sin\theta}\right)$$
$$= \left(\frac{(\cos\theta + \sin\theta) + 1}{\cos\theta}\right)\left(\frac{(\sin\theta + \cos\theta) - 1}{\sin\theta}\right)$$
$$= \left(\frac{(\cos\theta + \sin\theta)^2 - 1}{\cos\theta.\sin\theta}\right) = \frac{2\sin\theta\cos\theta}{\cos\theta\sin\theta}$$
$$= 2$$

9. $a\cot\theta + b\,cosec\,\theta = p$ and $b\cot\theta + a\,cosec\,\theta = q$ then $p^2 - q^2$ is equal to

$(a)\ a^2 - b^2$ $(b)\ b^2 - a^2$ $(c)\ a^2 + b^2$ $(d)\ b - a$

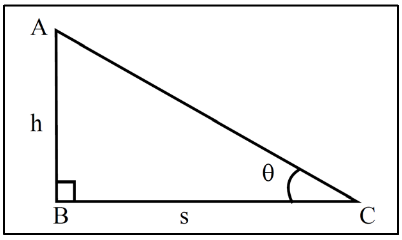
Solution:

$$p^2 - q^2 = (a\cot\theta + b\,\text{cosec}\,\theta)^2 - (b\cot\theta + a\,\text{cosec}\,\theta)^2$$
$$= a^2\cot^2\theta + b^2\text{cosec}^2\theta + 2ab\cot\theta\,\text{cosec}\,\theta) - b^2\cot^2\theta + a^2\text{cosec}^2\theta + 2ab\cot\theta\,\text{cosec}\,\theta)$$
$$= a^2(\cot^2\theta - \text{cosec}^2\theta) + b^2(\text{cosec}^2 - \cot^2\theta)$$
$$= a^2(-1) + b^2(1)$$
$$= b^2 - a^2$$

10. If the ratio of the height of a tower and the length of its shadow is $\sqrt{3} : 1$, then the angle of elevation of the sun has measure

$(a)\ 45^\circ$ $(b)\ 30^\circ$ $(c)\ 90^\circ$ $(d)\ 60^\circ$

Solution:

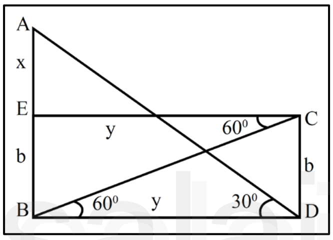


$$\tan\theta = \frac{h}{s} = \frac{\sqrt{3}}{1} = \sqrt{3} \Rightarrow \theta = 60^\circ$$

11. The electric pole subtends an angle of 30° at a point on the same level as its foot. At a second point 'b' metres above the first, the depression of the foot of the pole is 60°. The height of the pole (in metres) is equal to

$(a)\ \sqrt{3}\,b$ $(b)\ \frac{b}{3}$ $(c)\ \frac{b}{2}$ $(d)\ \frac{b}{\sqrt{3}}$

Solution:



$$\tan 60^\circ = \frac{b}{y}$$
$$\sqrt{3} = \frac{b}{y}$$
$$\Rightarrow y = \frac{b}{\sqrt{3}}$$

$$\tan 30^\circ = \frac{x + b}{y}$$
$$\frac{1}{\sqrt{3}} = \frac{x + b}{y}$$
$$\Rightarrow y = \sqrt{3}(x + b)$$

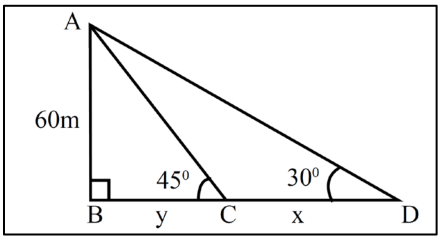
$$\sqrt{3}(x + b) = \frac{b}{\sqrt{3}}$$
$$\Rightarrow 3(x + b) = b$$
$$\Rightarrow b + x = \frac{b}{3}$$

height of tower $= \frac{b}{3}$ **mts**

12. A tower is 60 m heigh. Its shadow reduces by x metres when the angle of elevation of the sun increases from 30° to 45° then x is equal to

$(a)\ 41.92\,m$ $(b)\ 43.92\,m$ $(c)\ 43\,m$ $(d) 45.6\,m$

Solution:



In ΔABC,

$$\tan 45^\circ = \frac{AB}{BC} = \frac{60}{y}$$
$$\Rightarrow 1 = \frac{60}{y}$$
$$\Rightarrow y = 60^\circ$$

In ΔABD,

$$\tan 30^\circ = \frac{AB}{BD}$$

$$\frac{1}{\sqrt{3}} = \frac{60}{x+y}$$

$$\Rightarrow x + y = 60\sqrt{3}$$

$$\Rightarrow x + 60 = 60\sqrt{3}$$

$$\Rightarrow x = 60\sqrt{3} - 60$$

$$= 60(\sqrt{3} - 1)$$

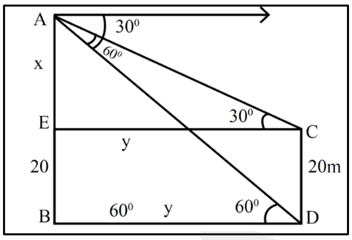
$$= 60 \times 0.732$$

$$= \mathbf{43.92m}$$

13. The angle of depression of the top and bottom of 20 m tall building from the top of a multistoried building are 30° and 60° respectively. The height of the multistoried building and the distance between two building (in metres) is

$(a)\ 20, 10\sqrt{3}$ $(b)\ 30, 5\sqrt{3}$ $(c)\ 20,10$ $(d)\ 30,10\sqrt{3}$

Solution:



In ΔACE,

$$\tan 30^\circ = \frac{AE}{EC}$$

$$\frac{1}{\sqrt{3}} = \frac{x}{y}$$

$$y = \sqrt{3} - - - (1)$$

In ΔADB,

$$\tan 60^\circ = \frac{AB}{BD}$$

$$\sqrt{3} = \frac{x+20}{y}$$

$$y = \frac{x+20}{\sqrt{3}} - - - (2)$$

From (1) & (2)

$$\sqrt{3}x = \frac{x+20}{\sqrt{3}}$$

$$3x = x + 20$$

$$2x = 20$$

$$x = 10$$

Height of multistoried building

$$= x + 20$$

$$= 10 + 20$$

$$= 30m$$

Distance between 2 buildings

$$y = \frac{x+20}{\sqrt{3}} = \frac{30}{\sqrt{3}} = 10\sqrt{3}$$

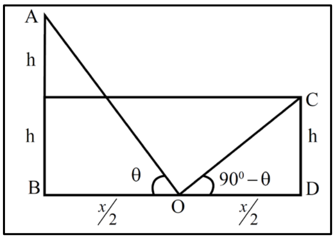
$$= 10\ (1.732)$$

$$= \mathbf{17.32}$$

14. Two persons are standing 'x' metres apart from each other and the height of the first person is double that of the other. If from the middle point of the line joining their feet an observer finds the angular elevations of their tops to be complementary, then the height of the shorter person (in metres) is

$(a)\ \sqrt{2}\,x$ $(b)\ \frac{x}{2\sqrt{2}}$ $(c)\ \frac{x}{\sqrt{2}}$ $(d)\ 2x$

Solution:



CD $= h$ =height of shorter person

AB $= 2h$ =height of taller person

$BD = x$ mrs. $= BO = OD = \frac{x}{2}$

In ΔAOB,

$$\tan\theta = \frac{2h}{x/2} = \frac{4h}{x} - - - (1)$$

ΔCOD,

$$\tan(90^\circ - \theta) = \frac{h}{x/2}$$

$$\cot\theta = \frac{h}{x/2} = \frac{2h}{x}$$

$$\tan\theta = \frac{x}{2h} - - - (2)$$

From (1)& (2)

$$\frac{4h}{x} = \frac{x}{2h}$$

$$8h^2 = x^2$$

$$h^2 = \frac{x^2}{8}$$

$$h = \frac{x}{2\sqrt{2}}$$

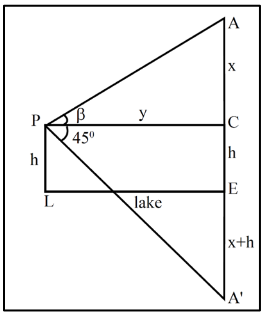
Height of the shorter person $= \mathbf{\frac{x}{2\sqrt{2}}}$ **mrs.**

15. The angle of elevation of a cloud from a point h metres above a lake is β . The angle of depression of its reflection in the lake is 45°. The height of location of the cloud from the lake is

$(a)\ \frac{h(1+\tan\beta)}{1-\tan\beta}$ $(b)\ \frac{h(1-\tan\beta)}{1+\tan\beta}$

$(c)\ h\tan(45^\circ - \beta)$ (d) None of these

Solution:



LE →Surface of the lake

P →Point of observation

$$PL = h \text{ mrs} = CE$$

A, A' →Positions of cloud & its reflection

$$AE = A'E = x + h$$

In ΔAPC,

$$\tan\beta = \frac{x}{y}$$

$$y = \frac{x}{\tan\beta} --- (1)$$

In $\Delta A'PC$,

$$\tan 45 = \frac{x+2h}{y} \Rightarrow \frac{x+2h}{y} = 1$$

$$y = x + 2h --- (2)$$

From (1) & (2),

$$x + 2h = \frac{x}{\tan\beta}$$

$$2h = \frac{x}{\tan\beta} - x$$

$$2h = x\left(\frac{1}{\tan\beta} - 1\right)$$

$$2h = x\left(\frac{1-\tan\beta}{\tan\beta}\right)$$

$$x = \frac{2h\tan\beta}{1-\tan\beta}$$

Height of the cloud $= h + x$

$$= h + \frac{2h\tan\beta}{1-\tan\beta}$$

$$= h\left[1 + \frac{2\tan\beta}{1-\tan\beta}\right]$$

$$= \boldsymbol{h\left[\frac{1+\tan\beta}{1-\tan\beta}\right]}$$

CHAPTER – 7 (MENSURATION)

1. The curved surface area of a right circular cone of height 15 cm and base diameter 16 cm is

   (a) $60\pi\ cm^2$ (b) $68\pi\ cm^2$
   (c) $120\pi\ cm^2$ (d) $136\pi\ cm^2$

Solution:

$$h = 15 \text{ cm}, r = 8 \text{ cm}$$

$$\Rightarrow l = \sqrt{h^2 + r^2}$$

$$= \sqrt{225 + 64}$$

$$= \sqrt{289}$$

$$= 17$$

CSA of Cone $= \pi rl$

$$= \pi \times 8 \times 17$$

$$= \boldsymbol{136\pi cm^2}$$

2. If two solid hemispheres of same base radius r units are joined together along their bases, then curved surface area of this new solid is

   (a) $4\pi r^2$ sq. units (b) $6\pi r^2$ sq. units
   (c) $3\pi r^2$ sq. units (d) $8\pi r^2$ sq. units

Solution:

The CSA of the new solid is nothing but the CSA of a sphere **$= 4\pi r^2$ sq.units**

3. The height of a right circular cone whose radius is 5 cm and slant height is 13 cm will be

   (a) $12\ cm$ (b) $10\ cm$ (c) $13\ cm$ (d) $5\ cm$

Solution:

$r = 5cm, l = 13cm$

$$h = \sqrt{l^2 - r^2}$$

$$= \sqrt{169 - 25}$$

$$= \sqrt{144}$$

$$= \mathbf{12\ cm}$$

4. If the radius of the base of a right circular cylinder is halved keeping the same height, then the ratio of the volume of the cylinder thus obtained to the volume of original cylinder is

   (a) $1:2$ (b) $1:4$ (c) $1:6$ (d) $1:8$

Solution:

$$\frac{\text{Volume of New Cylinder}}{\text{Volume of Original Cylinder}} = \frac{\pi R^2 h}{\pi r^2 h}$$

where $R = \frac{r}{2}$

$$= \frac{R^2}{r^2}$$

$$= \frac{\frac{r^2}{4}}{r^2}$$

$$= \frac{1}{4}$$

$$\boldsymbol{V_1 : V_2 = 1:4}$$

5. The total surface area of a cylinder whose radius is $\frac{1}{3}$ of its height is

   (a) $\frac{9\pi h^2}{8}$ sq. units (b) $24\pi h^2$ sq. units
   (c) $\frac{8\pi h^2}{9}$ sq. units (d) $\frac{56\pi h^2}{9}$ sq. units

Solution:

$$\text{TSA of Cylinder} = 2\pi r(h + r)$$

where $r = \frac{1}{3}h$

$$= 2\pi \times \frac{h}{3}\left(h + \frac{h}{3}\right)$$
$$= 2\pi \frac{h}{3} \times \frac{4h}{3}$$
$$= \frac{8\pi h^2}{9} \text{ Sq. units}$$

6. In a hollow cylinder, the sum of the external and internal radii is 14 cm and the width is 4 cm. If its height is 20 cm, the volume of the material in it is
   (a) $5600\pi\ cm^3$ (b) $1120\pi\ cm^3$
   (c) $56\pi\ cm^3$ (d) $3600\pi\ cm^3$

Solution:

$R + r = 14$ cm, $h = 20$ cm, $W = 4$ cm

$R - r = 4$ cm

Volume of hollow cylinder

$$= \pi h(R^2 - r^2)$$
$$= \pi h(R + r)(R - r)$$
$$= \pi \times 20 \times 14 \times 4$$
$$= 1120\pi\ cm^3$$

7. If the radius of the base of a cone is tripled and the height is doubled then the volume is
   (a) Made 6 times (b) Made 18 times
   (c) Made 12 times (d) Unchanged

Solution:

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

When $r \to 3r$, $h \to 2h$

Volume of new cone

$$= \frac{1}{3}\pi \times 9r^2 \times 2h$$
$$= 18\left(\frac{1}{3}\pi r^2 h\right)$$
$$= 18 \text{ times}$$

8. The total surface area of a hemi – sphere is how much times the square of its radius.
   (a) π (b) 4π (c) 3π (d) 2π

Solution:

TSA of a hemisphere $= 3\pi r^2$

$= 3\pi$ (square of its radius)

$= 3\pi$ times r^2

9. A solid sphere of radius x cm is melted and cast into a shape of a solid cone of same radius. The height of the cone is
   (a) $3x\ cm$ (b) $x\ cm$ (c) $4x\ cm$ (d) $2x\ cm$

Solution:

Volume of sphere=Volume of Cone

$$\Rightarrow \frac{4}{3}\pi r^3 = \frac{1}{3}\pi r^2 h$$
$$\Rightarrow \frac{4}{3}\pi x^3 = \frac{1}{3}\pi x^2 h$$
$$\Rightarrow h = \frac{\frac{4}{3}\pi x^3}{\frac{1}{3}\pi x^2 h} = 4x$$

10. A frustrum of a right circular cone is of height 16 cm with radii of its as 8 cm and 20 cm. Then, the volume of the frustrum is
   (a) $3328\pi\ cm^3$ (b) $3228\pi\ cm^3$
   (c) $3240\pi\ cm^3$ (d) $3340\pi\ cm^3$

Solution:

Volume of Frustum of a Cone

$$= \frac{\pi h}{3}(R^2 + Rr + r^2)$$
$$= \frac{\pi}{3} \times 16\ [400 + 160 + 64]$$
$$= \frac{16\pi}{3} \times 624$$
$$= 16\pi \times 208$$
$$= 3328\pi \text{ cm}^3$$

11. A shuttle cock used for playing badminton has the shape of the combination of
   (a) A cylinder and a sphere
   (b) A hemisphere and a cone
   (c) A sphere and a cone
   (d) Frustrum of a cone and a hemisphere

Solution:

Frustum of a cone & a hemisphere

12. A spherical ball of radius r_1 units is melted to make 8 new identical balls each of radius r_2 units. Then $r_1 : r_2$ is
   (a) 2 : 1 (b) 1 : 2 (c) 4 : 1 (d) 1 : 4

Solution:

Volume of a sphere = 8 (Volume ofnew identical balls)

$$\frac{4}{3}\pi r_1^3 = 8\left(\frac{4}{3}\pi r_2^3\right)$$
$$\Rightarrow \frac{r_1^3}{r_2^3} = \frac{8}{1}$$
$$r_1 : r_2 = 2 : 1$$

13. The volume (in cm^3) of the greatest sphere that can be cut off from a cylindrical log of wood of base radius 1 cm and height 5 cm is
   (a) $\frac{4}{3}\pi$ (b) $\frac{10}{3}\pi$ (c) 5π (d) $\frac{20}{3}\pi$

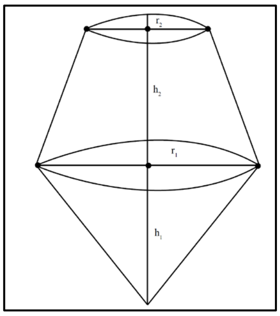
Solution:

Volume of sphere $= \frac{4}{3}\pi r^3$ where $r = 1$

$$= \frac{4}{3}\pi$$

14. The height and radius of the cone of which the frustrum is a part are h_1 units and r_1 units respectively. Height of the frustrum is h_2 units and radius of the smaller base is r_2 units. If $h_2 : h_1 = 1 : 2$ then $r_2 : r_1$ is
(a) 1 : 3 (b) 1 : 2 (c) 2 : 1 (d) 3 : 1

Solution:



Given $h_2 : h_1 = 1 : 2$

$$\Rightarrow h_2 = \frac{1}{2} h_1 \; \frac{r_2}{r_1} = \frac{1}{2} = \mathbf{1:2}$$

15. The ratio of the volumes of a cylinder, a cone and a sphere, if each has the same diameter and same height is
(a) 1 : 2 : 3 (b) 2 : 1 : 3
(c) 1 : 3 : 2 (d) 3 : 1 : 2

Solution:

Ratio of volumes of Cylinder, Cone, Sphere

$$= \pi r^2 h : \frac{1}{3}\pi r^2 h : \frac{4}{3}\pi r^3 h$$

with same height & same radius.

Since each of them has same diameter and same height,

$$h = 2r$$

$$V_1 = \pi r^2 (2r) = 2\pi r^3$$

$$V_2 = \frac{1}{3}\pi r^2 (2r) = \frac{2}{3}\pi r^3$$

$$V_3 = \frac{4}{3}\pi r^3$$

$$V_1 : V_2 : V_3 = 2 : \frac{2}{3} : \frac{4}{3}$$

$$= 6 : 2 : 4$$

$$= \mathbf{3 : 1 : 2}$$

CHAPTER – 8 (STATISTICS AND PROBABILITY)

1. Which of the following is not a measure of dispersion?.
(a) Range (b) Standard deviation
(c) Arithmetic Mean (d) Variance

Solution:

A.M is not a measure of dispersion and it is a measure of central tendency.

2. The range of the data 8, 8, 8, 8, 8 ... 8 is
(a) 0 (b) 1 (c) 8 (d) 3

Solution:

$$\text{Range} = L - S$$

$$8 - 8 = \mathbf{0}$$

3. The sum of all deviations of the data from its mean is
(a) Always positive (b) Always negative
(c) Zero (d) Non – Zero integer

Solution:

Sum of all deviations of the data from the mean = 0

$$\boldsymbol{\Sigma(x - \bar{x}) = 0}$$

4. The mean of 100 observations is 40 and their standard deviation is 3. The sum of squares of all observations is
(a) 40000 (b) 160900 (c) 160000 (d) 30000

Solution:

$\bar{x} = 40, n = 100, \sigma = 3$

$$\sigma^2 = \frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2$$

$$9 = \frac{\sum x^2}{100} - (40)^2$$

$$\frac{\sum x^2}{100} = 1609$$

$$\boldsymbol{\sum x^2 = 160900}$$

5. Variance of first 20 natural numbers is
(a) 32.25 (b) 44.25 (c) 33.25 (d) 30

Solution:

Variance for first 20 natural numbers

$$\sigma^2 = \frac{n^2 - 1}{12}$$

$$= \frac{400 - 1}{12}$$

$$= \frac{399}{12}$$

$$= \mathbf{33.25}$$

6. The standard deviation of a data is 3. If each value is multiplied by 5 then the new variance is
(a) 3 (b) 15 (c) 5 (d) 225

Solution:

$\sigma = 3$ of a data.

If each value is multiplied by 5,then the new $SD = 15$

$$\text{Variance} = (SD)^2$$

$$= 15^2$$

$$= \mathbf{225}$$

7. If the standard deviation of x, y, z is p then the standard deviation of $3x+5, 3y+5, 3z+5$ is
(a) $3p+5$ (b) $3p$ (c) $p+5$ (d) $9p+15$

Solution:

SD of $x, y, z = p$

$\Rightarrow SD$ of $3x, 3y, 3z = 3p$

$\Rightarrow SD$ of $3x+5, 3y+5, 3z+5 = 3p$.

8. If the mean and coefficient of variation of a data are 4 and 87.5 % then the standard deviation is
(a) 3.5 (b) 3 (c) 4.5 (d) 2.5

Solution:

$\overline{x} = 4$, CV $= 87.5, \sigma = ?$

$$CV = \frac{\sigma}{\overline{x}} \times 1000$$

$$87.5 = \frac{\sigma}{4} \times 100$$

$$\sigma = \frac{87.5}{25}$$

$$= 3.5$$

9. Which of the following is incorrect?.
(a) $P(A) > 1$ (b) $0 \leq P(A) \leq 1$
(c) $P(\phi) = 0$ (d) $P(A) + P(\bar{A}) = 1$

Solution:

$P(A) > 1$ is incorrect.

since $0 \leq P(A) \leq 1$

10. The probability a red marble selected at random from a jar containing p red, q blue and r green marbles is
(a) $\frac{q}{p+q+r}$ (b) $\frac{p}{p+q+r}$ (c) $\frac{p+q}{p+q+r}$ (d) $\frac{p+r}{p+q+r}$

Solution:

n (Red) $= p, n(S) = p+q+r$

Required probability $= \frac{p}{p+q+r}$

11. A page is selected at random from a book. The probability that the digit at units place of the page number chosen is less than 7 is
(a) $\frac{3}{10}$ (b) $\frac{7}{10}$ (c) $\frac{3}{9}$ (d) $\frac{7}{9}$

Solution:

P (digit at unit's place of the page is less than 7) $= \frac{7}{10}$

$n(S) = 10, A = \{0,1,2,3,4,5,6\}$,

$n(A) = 7$

12. The probability of getting a job for a person is $\frac{x}{3}$. If the probability of not getting the job is $\frac{2}{3}$ then the value of x is
(a) 2 (b) 1 (c) 3 (d) 1.5

Solution:

Given $P(A) = \frac{x}{3}, P(\overline{A}) = \frac{2}{3}$

$$P(A) + P(\overline{A}) = 1$$

$$\Rightarrow \frac{x+2}{3} = 1$$

$$\Rightarrow x + 2 = 3$$

$$\Rightarrow x = 1$$

13. Kamalan went to play a lucky draw contest. 135 tickets of the lucky draw were sold. If the probability of Kamalan winning is $\frac{1}{9}$, then the number of tickets bought by Kamalan is
(a) 5 (b) 10 (c) 15 (d) 20

Solution:

$n(S) = 135$ $n(A) = x$

$P(A) = \frac{x}{135} = \frac{1}{9}$ (given)

$$\Rightarrow x = \frac{135}{9} = 15$$

14. If a letter is chosen at random from the English alphabets $\{a, b, \ldots z\}$, then the probability that the letter chosen precedes x
(a) $\frac{12}{13}$ (b) $\frac{1}{13}$ (c) $\frac{23}{26}$ (d) $\frac{3}{26}$

Solution:

$n(S) = 26$

$n(A) = 23\ (26-3)$

$$P(A) = \frac{23}{26}$$

15. A purse contains 10 notes of ₹ 2000, 15 notes of ₹ 500, and 25 notes of ₹ 200. One note is drawn at random. What is the probability that the note is either a ₹ 500 note or ₹ 200 note?
(a) $\frac{1}{5}$ (b) $\frac{3}{10}$ (c) $\frac{2}{3}$ (d) $\frac{4}{5}$

Solution:

$n(S) = 50, n(A) = 10, n(B) = 15, n(C) = 25$

$P(B \cup C) = P(B) + P(C)$ (B & C are mutually exclusive)

$$= \frac{15}{50} + \frac{25}{50}$$

$$= \frac{40}{50}$$

$$= \frac{4}{5}$$

*****

ALL THE BEST STUDENTS

PREPARED & TYPED BY
Y.SEENIVASAN. M.Sc,B.Ed
MATHS TEACHER