1 SETS

1 OMQ + 1 VSAQ + 1 SAQ [1 M + 2M +4M = 7 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

$1\times1=$ 1 Mark

I. Select the correct option from the given choices.

1. List of elements of the set $\{x : x \text{ is an integer}, x^3 \le 50\}$ [3]
   1) $\{2, 3, 4\}$ 2) $\{1, 3, 4\}$
   3) $\{1, 2, 3\}$ 4) $\{1, 2, 4\}$

2. Set builder form of $\{1, 2, 3, 4\}$ is [2]
   1) $\{x: x \text{ is a positive integer}, x^2 < 30\}$ **2) $\{x: x \text{ is a positive integer}, x^2 + 1 < 20\}$**
   3) $\{x: x \text{ is a positive integer}, x^2 - 1 < 15\}$ 4) $\{x: x \text{ is a positive integer}, 2x < 20\}$

3. Which of the following statement is true [4]
   1) $\{a, b\} \subset \{x: x \text{ is a vowel in the English alphabet}\}$ 2) $\{1, 2, 3, 4\} \subset \{1, 2, 3\}$
   3) $\{5\} \in \{4, 5, 6\}$ **4) $\{2, 3\} \in \{1, \{2, 3\}, 4, 5\}$**

4. The set builder form of interval $[-4, 5)$ is [1]
   1) $\{x: x \text{ is a real}, -4 \le x < 5\}$ 2) $\{x: x \text{ is a real}, -4 < x < 5\}$
   3) $\{x: x \text{ is a real}, -4 \le x \le 5\}$ 4) $\{x: x \text{ is a real}, -4 < x \le 5\}$

5. $A = \{1, 2, 3, 4, 5\}, B = \{4, 5, 6, 7, 8\}$ then $(A-B) \cup (B-A) =$ [2]
   1) $\{1, 2, 3, 4, 5, 6, 7, 8\}$ **2) $\{1, 2, 3, 6, 7, 8\}$** 3) $\{1, 2, 4, 5, 6\}$ 4) $\{2, 4, 6, 8\}$

6. $A = \{1, 2, 3, 4\}, B = \{2, 3, 4\}, C = \{3, 4, 5, 6\}$ then $A \cap (B \cup C) =$ [BMP1] [1]
   1) $\{2, 3, 4\}$ 2) $\{1, 2, 3, 4\}$ 3) $\{3, 4, 5, 6\}$ 4) $\{1, 6\}$

7. Which of the following is false? [2]
   1) $(A')' = A$ **2) $A \cup A' = \varnothing$** 3) $(A \cup B)' = A' \cap B'$ 4) $\varnothing' = U$ (U is universal set)

8. 1f $U = \{1, 2, 3, 4, 5\}$ and $A = \{2, 3\}$, then $\varnothing' \cap A =$ [3]
   1) $\varnothing$ B) U **3) A** 4) $\{1, 4, 5\}$

9. $U = \{x : x \text{ a natural number } 1 < x < 15\}$ and $A = \{x : x \text{ is a prime number } 1 < x < 15\}$, then $A' =$....
   1) $\{2, 3, 5, 7, 11, 13\}$ **2) $\{4, 6, 8, 9, 10, 12, 14\}$** [2]
   3) $\{2, 3, 4, 5, 7, 11, 13\}$ 4) $\{2, 4, 6, 8, 10, 12, 14\}$

10. Which of the following is not a subset of $\{a, b, c, d\}$? [3]
    1) $\varnothing$ 2) $\{a, b\}$ **3) $\{d, e\}$** 4) $\{b, d\}$]

[☞ Answers for MCQ are kept in **bold font**]

KEY & HINTS FOR MCQ

1. (3)

Sol: $1^3 = 1, 2^3 = 8, 3^3 = 27, 4^3 = 64$ (×) $(\because x^3 \le 50)$ $\therefore$ Given set A= {1,2,3}

2. (2)

Sol: From (2), $x \in Z^+$, $x^2 + 1 < 20 \Rightarrow 1^2+1=3; 2^2+1=5; 3^2+1=10; 4^2+1=17; 5^2+1=26$ (×)

$\therefore$ the given set = {1, 2, 3, 4}

3. (4)

Sol: The set element {2,3} is itself is a member of the set {1, {2, 3}, 4, 5}

4. (1)

Sol: From (1), $x \in R$, $+x \in (-4,5) \Rightarrow x \le -4$ ($\because$ 4 is included); $x > 5$ ($\because$ 5 is excluded)

☛ In the textual options there is a correction. x should be Real but not Integer.

5. (2)

Sol: $A - B = \{1, 2, 3, \cancel{4}, \cancel{5}\} - \{4, 5, 6, 7, 8\} = \{1, 2, 3\}$;

$B - A = \{\cancel{4}, \cancel{5}, 6, 7, 8\} - \{1, 2, 3, 4, 5\} = \{6, 7, 8\}$

$\therefore (A - B) \cup (B - A) = \{1, 2, 3, 6, 7, 8\}$

6. (1)

Sol: $B \cup C = \{2, 3, 4\} \cup \{3, 4, 5, 6\} = \{2, 3, 4, 5, 6\}$

$A \cap (B \cup C) = \{1, 2, 3, 4\} \cap \{2, 3, 4, 5, 6\} = \{2, 3, 4\}$

7. (2)

Sol: Infact $A \cup A' = U$

8. (3)

Sol: $\varnothing' \cap A = U \cap A = A$, for any set A. $(\because \varnothing' = U)$

9. (2)

Sol: U = {x : x is a natural 1 < x < 15} = {2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14}

A = {x : x is a prime number 1< x < 15} = {2, 3, 5, 7, 11, 13}

$A' = U - A = \{\cancel{2}, \cancel{3}, 4, 5, 6, \cancel{7}, 8, 9, 10, 11, 12, 13, 14\} - \{2, 3, 5, 7, 11, 13\}$

$= \{4, 6, 8, 9, 10, 12, 14\}$.

10. (3)

Sol: In the set {d,e}, the element e is not a member of the given set {a, b, c, d}

2 RELATIONS AND FUNCTIONS

1 OMQ + 1 VSAQ + 1 SAQ + 1 LAQ [1 M + 2M +4M +8M= 15 M]

I.MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

I. Select the correct option from the given choices.

1. If $\left(2x+1,\frac{y}{2}\right)=(3,3)$ then the values of x & y are [1]

1) 1, 6 2) 2, 2 3) 3, 3 4) $7,\frac{3}{2}$

2. A = {1, 2, 3}, B = {a, b} then A × B = [3]

1) {(1, a), (2, b), (3, a)} 2) {(a, 1), (b, 2), (a, 3), (b, 3)}

3) {(1, a), (1, b), (2, a), (2, b), (3, a), (3, b)} 4) {(1, a), (1, b), (2, b), (3, b)}

3. A relation can be represented as **[BMP2]** [4]

1) Roster method 2) Set-builder method

3) An arrow diagram **4) In above three forms**

4. If A = {1, 2, 3, 4} and a relation R from A to A is defined by R = {(x, y) : y = 2x} then co-domain of R is [2]

1) {2, 4} **2) {1, 2, 3, 4}** 3) {1, 3} 4) {1.4}

5. If $f(x)=\frac{|x|}{x}$ then $f(0)=$ [3]

1) 1 2) –1 **3) undefined** 4) 0

6. The domain of the function $\frac{1}{\sqrt{x^2-25}}$ is **[MAR-26]** [1]

1) (–∞, –5) ∪ (5, ∞) 2) (– ∞, – 5] ∪[5, ∞)

3) (–∞, –5] ∪ (5, ∞) 4) (–∞,–5) ∪ [5, ∞)

7. Range of the function $f(x) = x^2$, x∈ R is [1]

1) [0 , ∞) 2) (– ∞, ∞) 3) (– ∞, 0) 4) (0, ∞)

8. A function f(x) defined by $f(x) = x^2 + 2x - 7$ then the value of f(3) = [3]

1) 2 2) –7 **3) 8** 4) 9

9. Let f = {(0, 1), (1, 3), (2, 5)} be a linear function from N to N then f(x) = [2]

1) 2x – 1 **2) 2x + 1** 3) $x^2 - 1$ 4) $x^2 + 1$

10. The domain of $\sqrt{|x|-x}$ is [1]

1) R 2) [0, ∞) 3) (– ∞, 0] 4)Z

KEY & HINTS FOR MCQ

1. **(1)**

Sol: $\left(2x+1, \frac{y}{2}\right) = (3,3) \Rightarrow 2x+1=3 \Rightarrow x=1; \frac{y}{2}=3 \Rightarrow y=6$

2. **(3)**

Shortcut Solution: $n(A) = 3$, $n(B) = 2 \Rightarrow n(A \times B) = 3 \times 2 = 6$

Among the given, option (3) has 6 elements.

3. **(4)**

A relation is basically a set of ordered pairs.

So it can be represented as roster method, Set-builder method and an arrow diagram.

4. **(2)**

Sol: Since the relation is defined from A to A, then co-domain of R is A= {1, 2, 3, 4}

5. **(3)**

$f(0) = \frac{|0|}{0} = \frac{0}{0}$ which is undefined

6. **(1)**

Sol: $\frac{1}{\sqrt{x^2-25}}$ is defined $\Rightarrow x^2 - 25 > 0 \Rightarrow (x+5)(x-5) > 0 \Rightarrow x < -5$ or $x > 5$

$\therefore$ Domain $= (-\infty, -5) \cup (5, \infty)$

7. **(1)**

Sol: Let $y=f(x)=x^2$ Square of any real is non-negative. $\therefore x \in R \Rightarrow x^2 \geq 0 \Rightarrow f(x) \geq 0 \Rightarrow y \geq 0$.

$\therefore$ Range of $f(x) = [0, \infty)$

8. **(3)**

Sol: $f(x) = x^2 + 2x - 7 \Rightarrow f(3) = 9+6-7 = 8$.

9. **(2)**

Sol: Let $f: N \to N$ be $f(x) = ax + b$

Given $f = \{(0, 1), (1, 3), (2, 5)\}$ $\Rightarrow f(0)=1 \Rightarrow a(0)+b=1 \Rightarrow b=1$; $f(1) = 3$

$\Rightarrow a(1)+b=3 \Rightarrow a+1=3 \Rightarrow a=2$ $\therefore f(x) = ax + b = 2x + 1$

10. **(1)**

Sol: $\sqrt{|x|-x}$ is defined when $|x| - x \geq 0 \Rightarrow |x| \geq x \Rightarrow x \in R$. $\therefore$ domain = R.

3 TRIGONOMETRIC FUNCTIONS

1 OMQ + 1 VSAQ + 1 LAQ [1 M + 2M +8 M = 11 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

$1\times1=$ 1 Mark

1. The value of cos 5π is [3]

1 0 2) 1 **3) –1** 4) None of these

2. The value of cos 1° cos2° cos3° ...cos179° = [BMP1] [2]

1) $1/\sqrt{2}$ **2) 0** 3) 1 4) –1

3. If $\sin\theta + \operatorname{cosec}\theta = 2$ then $\sin^2\theta + \operatorname{cosec}^2\theta$ is equal to [3]

1) 1 2) 4 **3) 2** 4) None of these

4. If tan θ = 1/2, tan ϕ = 1/3, then θ + ϕ = [4]

1) π/6 2) π 3) 0 **4) π/4**

5. The value of $\dfrac{1-\tan^2 15^\circ}{1+\tan^2 15^\circ}$ is [3]

1) 1 2) $\sqrt{3}$ 3) $\sqrt{3}/2$ 4) 2

6. The value of sin (45° + θ) – cos(45° – θ) is [4]

1) 2cosθ 2) 2 sinθ 3) 1 **4) 0**

7. The value of $\cot\left(\dfrac{\pi}{4}+\theta\right)\cot\left(\dfrac{\pi}{4}-\theta\right)$ is [3]

1) –1 2) 0 **3) 1** 4) None of these

8. $\cos 2\theta \cos 2\phi + \sin^2(\theta-\phi) - \sin^2(\theta+\phi)$ equal to [2]

1) sin2(θ + ϕ) **2) cos2 (θ + ϕ)** 3) sin2 (θ – ϕ) 4) cos2 (θ – ϕ)

9. The value of sin 50° – sin 70° + sin 10° is equal to [2]

1) 1 **2) 0** 3) 1/2 4) 2

10. If sinθ+ cosθ = 1 then the value of sin2θ is equal to [3]

1) 1 2) 1/2 **3) 0** 4) –1

KEY & HINTS FOR MCQ

1. **(3)**

Sol: $\cos 5\pi = \cos(4\pi + \pi) = \cos\pi = -1$.

2. **(2)**

Sol: We have cos90°=0 in the middle of the given product. Hence the given value is 0.

3. **(3)**

Sol: Given $\sin\theta+\operatorname{cosec}\theta=2 \Rightarrow (\sin\theta+\operatorname{cosec}\theta)^2=2^2 \Rightarrow \sin^2\theta+\operatorname{cosec}^2\theta+2\sin\theta\operatorname{cosec}\theta=4$

$\Rightarrow \sin^2\theta+\operatorname{cosec}^2\theta+2(1)=4 \Rightarrow \sin^2\theta+\operatorname{cosec}^2\theta=4-2=2$

4. **(4)**

Sol: $\tan(\theta+\phi)=\dfrac{\tan\theta+\tan\phi}{1-\tan\theta\tan\phi}=\dfrac{\frac{1}{2}+\frac{1}{3}}{1-\frac{1}{2}\cdot\frac{1}{3}}=\dfrac{3+2}{6-1}=1=\tan\dfrac{\pi}{4} \quad \therefore \theta+\phi=\dfrac{\pi}{4}$

5. **(3)**

Sol: $\dfrac{1-\tan^2 15^\circ}{1+\tan^2 15^\circ}=\cos 2(15^\circ)=\cos 30^\circ=\dfrac{\sqrt{3}}{2}$

6. **(4)**

Sol: **Shortcut Solution:** When $\theta = 0^\circ$ we have $\sin 45^\circ-\cos 45^\circ=\dfrac{1}{\sqrt{2}}-\dfrac{1}{\sqrt{2}}=0$ **(or)**

$\sin(45^\circ+\theta)-\cos(45^\circ-\theta)=(\sin 45^\circ\cos\theta+\cos 45^\circ\sin\theta)-(\cos 45^\circ\cos\theta+\sin 45^\circ\sin\theta)$

$$=\left(\frac{1}{\sqrt{2}}\cos\theta+\frac{1}{\sqrt{2}}\sin\theta\right)-\left(\frac{1}{\sqrt{2}}\cos\theta+\frac{1}{\sqrt{2}}\sin\theta\right)=0$$

7. **(3)**

Sol: **Shortcut Solution:** When θ=0° we have $\cot\left(\dfrac{\pi}{4}+\theta\right)\cot\left(\dfrac{\pi}{4}-\theta\right)=\cot\left(\dfrac{\pi}{4}\right)\cot\left(\dfrac{\pi}{4}\right)=1\times1=1$

8. **(2)**

Sol: $\cos2\theta\cos2\phi+\sin^2(\theta+\phi)-\sin^2(\theta+\phi)$

$=\cos2\theta\cos2\phi+\sin[(\theta-\phi)+(\theta+\phi)]\sin[(\theta-\phi)-(\theta+\phi)]$

$=\cos2\theta\cos2\phi+\sin2\theta\sin(-2\phi)=\cos2\theta\cos2\phi-\sin2\theta\sin2\phi=\cos(2\theta+2\phi)=\cos2(\theta+\phi)$

9. **(2)**

Sol: $(\sin 50^\circ-\sin 70^\circ)+\sin 10^\circ=2\cos\left(\dfrac{50^\circ+70^\circ}{2}\right)\sin\left(\dfrac{50^\circ-70^\circ}{2}\right)+\sin 10^\circ$

$$=2\cos60^\circ\sin(-10^\circ)+\sin10^\circ=-\sin10^\circ+\sin10^\circ=0$$

10. **(3)**

Sol: $\sin\theta+\cos\theta=1 \Rightarrow (\sin\theta+\cos\theta)^2=1 \Rightarrow \sin^2\theta+\cos^2\theta+2\sin\theta\cos\theta=1$

$\Rightarrow 1+\sin2\theta=1 \Rightarrow \sin2\theta=0$

Shortcut Solution: When θ=0° we have $\sin\theta+\cos\theta=\sin 0+\cos 0=0+1=1$

$\therefore \sin2\theta=\sin2(0)=\sin0=0$

4 COMPLEX NUMBERS

1 OMQ + 1 VSAQ + 1 SAQ [1 M + 2M + 4 M = 7 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. The value of i^{-999} is [3]

   1) 1 2) -1 **3) i** 4) $-i$

2. The multiplicative inverse of $1+i$ is [1]

   1) $\frac{1}{2}(1-i)$ 2) $\frac{1}{2}(1+i)$ 3) $1-i$ 4) i

3. The modulus of $5+4i$ is [3]

   1) 41 2) -41 **3) $\sqrt{41}$** 4) $\sqrt{-41}$

4. The value of $\sqrt{-25}\times\sqrt{-9}$ **[MAR-26] [BMP2]** [2]

   1) 15 **2) -15** 3) $15i$ 4) None of these

5. The conjugate of $\frac{2-i}{1-2i}$ is [3]

   1) $\frac{4+3i}{5}$ 2) $4-3i$ **3) $\frac{4-3i}{5}$** 4) 1

6. The value of $(z+3)(\overline{z+3})$ is equivalent to [1]

   1) $|z+3|^2$ 2) $|z-3|$ 3) z^2+3 4) None of these

7. Let $x, y \in R$, then $x + iy$ is a non real complex number if [4]

   1) $x = 0$ 2) $y = 0$ 3) $x \neq 0$ **4) $y \neq 0$**

8. If $a + ib = c + id$ then [4]

   1) $a^2 + c^2 = 0$ 2) $b^2 + c^2 = 0$ 3) $b^2 + d^2 = 0$ **4) $a^2 + b^2 = c^2 + d^2$**

9. The sum of the series $i + i^2 + i^3$ ... upto 1000 terms is [2]

   1) 1 **2) 0** 3) -1 4) -2

10. Then complex number z which satisfies the condition $\left|\frac{i+z}{i-z}\right|=1$ lies on [2]

    1) Circle $x^2 + y^2 = 1$ **2)The X-axis** 3) The Y-axis 4) The line $x + y = 1$

KEY & HINTS FOR MCQ

1. (3)

Sol: $i^{-999}=\frac{1}{i^{999}}=\frac{i}{i^{1000}}=\frac{i}{(i^2)^{500}}=\frac{i}{(-1)^{500}}=\frac{i}{1}=i$

2. (1)

Sol: Multiplicative inverse of 1 + i is $\frac{1}{1+i}=\frac{1-i}{(1+i)(1-i)}=\frac{1-i}{1+1}=\frac{1}{2}(1-i)$

3. (3)

Sol: $|5+4i|=\sqrt{25+16}=\sqrt{41}$

4. (2)

Sol: $\sqrt{-25}\times\sqrt{-9}=5i\times 3i=15i^2=15(-1)=-15$

5. (3)

Sol: Conjugate of $\frac{2-i}{1-2i}=\overline{\frac{2-i}{1-2i}}=\frac{2+i}{1+2i}=\frac{(2+i)(1-2i)}{(1+2i)(1-2i)}=\frac{2-4i+i-2i^2}{1+4}=\frac{2-3i-2(-1)}{1+4}=\frac{4-3i}{5}$

6. (1)

Sol: $(z+3)(\bar{z}+3)=(z+3)(\bar{z}+\bar{3})\;=(z+3)\overline{(z+3)}=|z+3|^2$ $[\because \text{for real } a, \bar{a}=a]$

7. (4)

Sol: If y = 0 then x + iy = x + 0 = x∈R $\therefore$ x + iy is a non-real complex number when y ≠ 0

8. (4)

Sol: Given a + ib = c + id $\Rightarrow a=c, b=d \Rightarrow a^2=c^2, b^2=d^2 \Rightarrow a^2+b^2=c^2+d^2$

9. (2)

Sol: $i+i^2+i^3$ ....up to 1000 terms $=\frac{i(i^{1000}-1)}{i-1}=\frac{i\left[(i^2)^{500}-1\right]}{i-1}=\frac{i[(-1)^{500}-1]}{i-1}=\frac{i(1-1)}{i-1}=0$

10. (2)

Sol: $\left|\frac{i+z}{i-z}\right|=1\Rightarrow|i+z|=|i-z|\Rightarrow|i+x+iy|\;=|i-(x+iy)|\Rightarrow|x+i(1+y)|\;=|-x+(1-y)i|$

$\Rightarrow x^2+(1+y)^2=x^2+(1-y^2)\Rightarrow(1+y)^2=(1-y)^2\;\Rightarrow 4y=0\Rightarrow y=0$. This is equation of x-axis.

$\therefore$ Locus of z lies on the x-axis.

5 LINEAR INEQUALITIES

1 SAQ [4 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. The length of a rectangle is four times its breadth. If the minimum perimeter of the rectangle is 160 cm, then [3]
   1) breadth > 16 cm 2) length < 20 cm **3) breadth ≥ 16 cm** 4) length ≤ 20 cm
2. Consider the linear inequality $-3x + 15 < -12$ then [1]
   1) $x \in (9, \infty)$ 2) $x \in [9, \infty)$ 3) $x \in (-\infty, 9]$ 4) $x \in [-9, 10)$
3. Suppose we have three real numbers which include x,y and b given by $x > y$, $b < 0$. Determine the relation between the three variables. [3]
   1) $x / b < y$ 2) $x \le y$ **3) $x / b < y / b$** 4) $x \ge y / b$
4. If $|x - 2| > 6$, then [3]
   1) $x \in (-4, 8)$ 2) $x \in [-4, 8]$
   3) $x \in (-\infty, -4) \cup (8, \infty)$ 4) $x \in (-\infty, -4) \cup [8, \infty)$
5. If $\frac{|x-8|}{(x-8)} \ge 0$, then [4]
   1) $x \in [8, \infty)$ 2) $x \in (7, 8)$ 3) $x \in (-\infty, 8)$ **4) $x \in (8, \infty)$**
6. If $|x + 5| \ge 10$, then [4]
   1) $x \in (-15, 15]$ 2) $x \in (-15, 5]$
   3) $x \in (-\infty, -15] \cup [5, \infty)$ **4) $x \in (-\infty, -15] \cup [15, \infty)$**
7. If $4x + 4 < 6x + 5$, then x belongs to the interval [2]
   1) $(2, \infty)$ **2) $(-1/2, \infty)$** 3) $(-\infty, 1/2)$ 4) $(-4, \infty)$
8. The solution of the linear inequality $2x - 17 > 3 - 8x$ is [4]
   1) $x \ge 2$ 2) $x < 2$ 3) $x \le 2$ **4) $x > 2$**
9. Isha scored 90 and 90 marks in the first two-class tests. The minimum marks x she should get in the third test to have an average of atleast 90 marks, is [1]
   1) $x \ge 90$ 2) $x > 90$ 3) $x \le 90$ 4) $x < 90$
10. The set of values of x in $5x + 2 > 12$ is (x is areal number) [3]
    1) $(-2, 2)$ 2) $(-1, \infty)$ **3) $(2, \infty)$** 4) $(-2, 1)$
11. When x is an integer. The values of x satisfying the linear inequality $5x - 2 \le 3x + 2$ are [3]
    1) $\{\ldots,-2,-1,0,1\}$ 2) $\{\ldots,-3,-2,-1,0,1\}$ **3) $\{\ldots,-2,-1,0,1,2\}$** 4) $\{\ldots,-2,-1,0,1,2,3\}$
12. The set of values of x satisfying $50x \le 150$, where x is the natural number is [4]
    1) $\{1, 2, 3, 4\}$ 2) $\{1, 2\}$ 3) $\{0, 1, 2\}$ **4) $\{1, 2, 3\}$**
13. If $9x > -36$, then the least integral value of x is [1]
    1) -3 2) -4 3) -5 4) -6

KEY & HINTS FOR MCQ

1. **(3)**

Sol: Let x be the length and y be the breadth of the rectangle.

Given $x = 4y$ and minimum perimeter of the rectangle is 160

$\Rightarrow 2(x + y) \geq 160 \Rightarrow x + y \geq 80 \Rightarrow 4y + y \geq 80 \Rightarrow 5y \geq 80 \Rightarrow y \geq 16$ $\therefore$ breadth $\geq$ 16cm.

2. **(1)**

Sol: Given $-3x + 15 < -12 \Rightarrow 15 + 12 < 3x \Rightarrow 27 < 3x \Rightarrow 3x > 27 \Rightarrow x > 9 \Rightarrow x \in (9, \infty)$

3. **(3)**

4. **(3)**

Sol: $|x - 2| > 6 \Rightarrow \pm (x - 2) > 6 \Rightarrow x - 2 > 6$ (or) $-(x - 2) > 6 \Rightarrow x > 8$ (or) $x - 2 < -6$

$\Rightarrow x > 8$ (or) $x < -4 \Rightarrow x \in (-\infty, -4) \cup (8, \infty)$

5. **(4)**

Sol: $\dfrac{|x-8|}{x-8} \geq 0 \Rightarrow x-8 > 0 \Rightarrow x > 8 \Rightarrow x \in (8, \infty)$

6. **(4)**

Sol: $|x + 5| \geq 10 \Rightarrow \pm (x + 5) \geq 10 \Rightarrow x + 5 \geq 10$ (or) $-(x + 5) \geq 10$

$\Rightarrow x \geq 5$ (or) $x + 5 \leq -10 \Rightarrow x \leq -15$ (or) $x \geq 5 \Rightarrow x \in (-\infty, -15] \cup [5, \infty)$

7. **(2)**

Sol: $4x + 4 < 6x + 5 \Rightarrow 4 - 5 < 6x - 4x \Rightarrow -1 < 2x \Rightarrow 2x > -1 \Rightarrow x > \dfrac{-1}{2} \Rightarrow x \in \left(-\dfrac{1}{2}, \infty\right)$

8. **(4)**

Sol: $2x - 17 > 3 - 8x \Rightarrow 2x + 8x > 3 + 17 \Rightarrow 10x > 20 \Rightarrow x > 2$

9. **(1)**

Sol: Let x be the minimum marks that Isha should get in third test.

Average marks of Isha in 3rd test is atleast 90 $\Rightarrow \dfrac{90 + 90 + x}{3} \geq 90 \Rightarrow 180 + x \geq 270 \Rightarrow x \geq 90$

10. **(3)**

Sol: $5x + 2 > 12 \Rightarrow 5x > 12 - 2 \Rightarrow 5x > 10 \Rightarrow x > 2 \Rightarrow x \in (2, \infty)$

11. **(3)**

Sol: $5x - 2 \leq 3x + 2 \Rightarrow 5x - 3x \leq 2 + 2 \Rightarrow 2x \leq 4 \Rightarrow x \leq 2$.

12. **(4)** ☛ Given textual key (2) has to be changed.

Sol: The three natural numbers 1, 2, 3 satisfy the given inequality $50x \leq 150$.

13. **(1)**

Sol: $9x > -36 \Rightarrow x > -4$, x is valid for -3.

6 PERMUTATIONS AND COMBINATIONS

1 OMQ + 1 VSAQ + 1 SAQ [1 M + 2M +4M = 7 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. A student has 5 pants and 8 shirts. The number of ways in which he can wear the dress in different combinations as [4]
   1) $^8P_5$ 2) $^8C_5$ 3) $8! \times 5!$ **4) 40**
2. If $^nP_4 = 1680$ then n is **[BMP2]** [2]
   1) 7 **2) 8** 3) 9 4) 10
3. If $^nP_r = 1320$ then r is [1]
   1) 3 2) 4 3) 15 4) 6
4. A man has 3 sons and 6 schools within his reach. In how many ways he can send his sons to school if no two of his sons are to read in the same school. [1]
   1) $^6P_3$ 2) $^6C_3$ 3) 6^3 4) 3^6
5. The number of arrangements that can be formed by taking all the letters {T, U, E, S, D.A.Y} [2]
   1) 720 **2) 5040** 3) 120 4) 40320
6. The number of arrangements that can be made out of the letters in expansion $a^4\ b^3\ c^5$ when written in full length is [4]
   1) $\frac{9!}{3!2!4!}$ 2) $\frac{7!}{2!3!2!}$ 3) $\frac{5!}{4!3!2!}$ **4) $\frac{(12)!}{4!3!5!}$**
7. The number of permutations of 4-digit numbers that can be formed using the digits 1, 2, 3, 4, 5, 6 when repetition is allowed is [3]
   1) $^6P_4$ 2) $^6C_4$ **3) 6^4** 4) 4^6
8. The number ways of arranging 8 men and 4 women in a row is [3]
   1) 8! 2) 4! **3) (12)!** 4) (11)!
9. The number of positive divisors of 1080 is [3]
   1) 8 2) 16 **3) 32** 4) 40
10. The number of ways of selecting 4 boys and 3 girls from a group of 8 boys and 5 girls is [2]
    1) $^8C_4 + {}^5C_3$ **2) $^8C_4 \times {}^5C_3$** 3) $^8C_4 - {}^5C_3$ 4) None
11. If $^{12}C_{S+1} = {}^{12}C_{2S-5}$ then the value of s is **[MAR-26]** [4]
    1) 4 2) 8 3) 12 **4) 6**
12. The number of diagonals of a polygon of 10 sides is [1]
    1) 35 2) 36 3) 38 4) 39
13. A polygon has 54 diagonals. Then the number of its sides is [4]
    1) 7 2) 9 3) 10 **4) 12**

KEY & HINTS FOR MCQ

1. (4)

Sol: The student can select a pant from 5 pants in 5 ways and a shirt from 8 shirts in 8 ways.

$\therefore$ Required number of ways $= 5 \times 8 = 40$.

2. (2)

$^nP_4 = 1680 = 8 \times 7 \times 6 \times 5 = {}^8P_4$

3. (1)

Sol: $^nP_r = 1320 = 12 \times 11 \times 10 = {}^{12}P_3 \Rightarrow r = 3$.

4. (1)

The number of ways that he can send his 3 sons to 6 schools if no two of them are in the same school $= {}^6P_3$.

5. (2)

Sol: The required number of arrangements $= 7! = 5040$

6. (4)

Sol: The required number of arrangements $= \dfrac{12!}{4!3!5!}$

7. (3)

Sol: The number of 4-digit numbers $= 6^4$.

8. (3)

Sol: $(8 + 4)! = 12!$

9. (3)

Sol: $1080 = 2^3 \times 3^3 \times 5^1$ Hence, the number of positive divisors $= (3+1)(3+1)(1+1) = 32$.

10. (2)

Sol: The no.of ways of selecting 4 boys and 3 girls from a group of 8 boys and 5 girls= $^8C_4 \times {}^5C_3$.

11. (4)

Sol: $^{12}C_{s+1} = {}^{12}C_{2s-5} \Rightarrow s + 1 = 2s-5$ (or) $(s + 1) + (2s-5) = 12 \Rightarrow s = 6$ (or) $3s = 16 \Rightarrow s = 16/3$

$\therefore s = 6$ [$\because$ s cannot be a fraction]

12. (1)

Sol: Number of diagonals of a polygon of 10 sides $= \dfrac{10(10-3)}{2} = 35$

13. (4)

Sol: Number of diagonals $= 54 \Rightarrow \dfrac{n(n-3)}{2} = 54 \Rightarrow n(n-3) = 108 = 12 \times 9 = 12(12-3) \Rightarrow n = 12$

7 BINOMIAL THEOREM

1 OMQ + 1 VSAQ + 1 SAQ [1 M + 2M +4 M = 7 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

$1\times1=$ 1 Mark

1. The 3^{rd} term of $\left(3x-\frac{y^3}{6}\right)^4$ is [1]

1) ${}^4C_2(3x)^2\left(\frac{-y^3}{6}\right)^2$ 2) ${}^4C_2(3x)^2\left(\frac{-y^2}{6}\right)^2$ 3) ${}^4C_2(3x)^3\left(\frac{-y^3}{6}\right)^2$ 4) ${}^4C_2(3x)^3\left(\frac{-y^2}{6}\right)^2$

2. $C_0 + 3.C_1 + 3^2 \cdot C_2 + ... + 3^n.C_n =$ [3]

1) 2^n 2) 3^n **3) 4^n** 4) 5^n

3. The middle term in the expansion of $(4 + 2x)^6$ is [2]

1) $11240\,x^2$ **2) $10240\;x^3$** 3) $12240\,x^4$ 4) $10340\,x^4$

4. The coefficient of $x^2\,y^2$ in the expansion of $(x + 1)^2\,(y + 1)^3$ is [1]

1) 3 2) 5 3) 2 4) 10

5. In the expansion of $(1 + x)^{20}$, if the coefficients of r^{th} and $(r + 4)^{th}$ terms are equal, then r is [3]

1) 7 2) 8 **3) 9** 4) 10

6. The remainder when 8^{48} is divided by 63 is [3]

1) 4 2) 2 **3) 1** 4) 7

7. The expansion of $(x + y)^{1000}$ is [2]

1) $\sum_{r=0}^{100} {}^{1000}C_r\, x^{r-1000} y^r$ **2) $\sum_{r=0}^{1000} {}^{1000}C_r\, x^{1000-r}\, y^r$** 3) $\sum_{r=0}^{999} {}^{1000}C_r\, x^{r-1000}\, y^r$ 4) $\sum_{r=0}^{999} {}^{1000}C_r\, x^{1000-r}\, y^r$

8. The coefficients of the first and the last terms of the expansion $(x + y)^n$ are [4]

1) 2 2) 3 3) n **4) 1**

9. The expansion of $(xy + 2)^2$ is [2]

1) $x^2 + y^2 + 4$ **2) $x^2\,y^2 + 4xy + 4$** 3) $xy^2 + 4 + 2xy$ 4) $x^2\,y^2 + 2xy + 4$

10. The term ${}^{91}C_2\;x^{89}$ belongs to [3]

1) x^{89} 2) $(x-2)^{90}$ **3) $(x-1)^{91}$** 4) $(x+1)^{90}$

11. The coefficient of $x^8\,y^{10}$ in the expansion of $(x + y)^{18}$ is **[MAR-26][BMP1]** [1]

1) ${}^{18}C_8$ 2) ${}^{18}P_{10}$ 3) 2^{18} 4) None of these

KEY & HINTS FOR MCQ

1. **(1)**

Sol: Third term of $\left(3x-\frac{y^3}{6}\right)^4$ is $T_3 = T_{2+1} = {}^4C_2\,(3x)^{4-2}\left(\frac{-y^3}{6}\right)^2 = {}^4C_2(3x)^2\left(\frac{-y^3}{6}\right)^2$

2. **(3)**

Sol: $C_0 + 3.\,C_1 + 3^2\,.\,C_2 + ... + 3^n\,.\,C_n = (1+3)^n = 4^n.$

3. **(2)**

Sol: As n = 6 is even, the middle term is $T_{\left(\frac{6}{2}+1\right)} = T_{3+1} = {}^6C_3(4)^3(2x)^3 = 20\times64\times8x^3 = 10240x^3$

4. **(1)**

Sol: $(x+1)^2\,(y+1)^3 = (x^2+2x+1)(y^3+3y^2+3y+1)$. $\therefore$ Coeff. of x^2y^2 is 3.

5. **(3)**

Sol: In $(1+x)^{20}$, the coefficients of r^{th} and $(r+4)^{th}$ terms are equal

$\Rightarrow {}^{20}C_{r-1} = {}^{20}C_{r+3} \Rightarrow (r-1)+(r+3) = 20 \Rightarrow 2r = 18 \Rightarrow r = 9.$

6. **(3)**

Sol: $8^{48} = 64^{24} = (63+1)^{24} = 63q + 1$ for some integer q. $\therefore$ Remainder = 1.

7. **(2)** Σ form of binomial expansion = Σ r^{th} term

8. **(4)**

Sol: Coefficient of first term is ${}^nC_0 = 1$ and Coefficient of last term is ${}^nC_n = 1$

9. **(2)**

Sol: $(xy+2)^2 = (xy)^2 + 2(xy)\,(12) + 2^2 = x^2\,y^2 + 4xy + 4.$

10. **(3)** The index n should be 91.

11. **(1)**

Sol: The coefficient of $x^8\,y^{10}$ in $(x+y)^{18}$ is ${}^{18}C_{10} = {}^{18}C_8.$

8 SEQUENCES & SERIES

1OMQ + 1 LAQ [1 M + 8M = 9 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. Which of the following is finite sequence? [3]
   1) 48, 24, 12,..... 2) 48, 24, 12.....
   3) 2, 4, 6, 8, 10 4) 2, 3, 5, 7, 11, 13,...
2. Which of the following relation gives Fibonacci sequence? [1]
   1) $a_n = a_{n-1} + a_{n-2}, n > 2$ 2) $a_{n-1} = a_n + a_{n-2}, n > 2$
   3) $a_{n-2} = a_n + a_{n-1}, n > 2$ 4) $a_n = a_{n+1} + a_{n-2}, n > 2$
3. The first term of Fibonacci sequence is [1]
   1) 0 2) 1 3) 2 4) 3
4. If $a_n = 4n + 6$, then 15^{th} term of the sequence is [4]
   1) 6 2) 10 3) 60 **4) 66**
5. A series can also be denoted by symbol [2]
   1) πa_n **2) Σa_n** 3) ϕa_n 4) θa_n
6. The sum of first five terms of series 2 + 4 + 6 +.... is [4]
   1) 14 2) 16 3) 20 **4) 30**
7. $\sum_{n=1}^{4}(2n+3) = \ldots\ldots$ **[BMP1]** [4]
   1) 5 2) 12 3) 21 **4) 32**
8. If $a_{n+1} = a_n \cdot r$ then the sequence is called [2]
   1) arithmetic progression **2) geometric progression**
   3) harmonic progression 4) special progression
9. The n^{th} term of G.P. is [3]
   1) $a_n = a + (n - 1) d$ 2) $a_n = a + nd$ **3) $a_n = a.r^{n-1}$** 4) $a_n = ar^n$
10. If r = 1in G .P. then what is the sum of n terms is [1]
    1) na 2) a/n 3) (n – 1) a 4) (n+1) a
11. If 4, 8, 16, 32, ... are in G.P. then the sum upto 5^{th} term is [4]
    1) 16 2) 64 3) 128 **4) 124**
12. Find the sum of series $1+\frac{1}{2}+\frac{1}{4}+\ldots\ldots.$ upto 6 terms [1]
    1) $\frac{63}{32}$ 2) $\frac{32}{63}$ 3) $\frac{26}{53}$ 4) $\frac{53}{26}$
13. The geometric mean of 3 and 12 is................ [2]
    1) 4 **2) 6** 3) 9 4) 12
14. If A.M. of two numbers is 15/2 and their G.M. is 6 then find the two numbers [2]
    1) 6 and 8 **2) 12 and 3** 3) 24 and 6 4) 27 and 3
15. If A means arithmetic mean and G means geometric mean then which of the following is true? [2]
    1) A > G **2) A ≥ G** 3) G > A 4) G ≥ A
16. The ratio of A.M. and G.M of two positive numbers a and b(a > b) is 5: 3. Then the ratio of a to b is [1]
    1) 9 : 1 2) 3 : 5 3) 1 : 9 4) 3 : 1

KEY & HINTS FOR MCQ

1. **(3)** In the given options only option (3) has finite number of terms.
2. **(1)** From option (1), in $a_n = a_{n-1} + a_{n-2},\ n > 2$ put n= 3,4,5,.... then $a_3 = a_2+a_1$; $a_4 = a_3+a_2$;
   Thus, each number is the sum of two previous numbers. Hence, Fibonacci **sequence.**
3. **(1)** Fibonacci sequence is 0,1,1,2,3,5,......Here first term is 0. ☛The textual given option (2) is a mistake.
4. **(4)** $a_n = 4n + 6 \Rightarrow T_{15} = a_{15} = 4(15) + 6 = 66$.
5. **(2)** **Series:** $a_1 + a_2 + ... + a_n = \Sigma a_n$
6. **(4)** Sum of first five terms of 2 + 4 + 6 +........ = 2 + 4 + 6 + 8 + 10 = 30.
7. **(4)** $\sum_{n=1}^{4}(2n+3) = 2\left(\frac{4\times5}{1\times2}\right)+3(4) = 20+12 = 32.$
8. **(2)** $a_{n+1} = a_n r \Rightarrow r = \frac{a_{n+1}}{a_n} =$ common ratio. Hence the sequence is G.P.
9. **(3)** n^{th} term of G.P. is $a_n = ar^{n-1}$
10. **(1)** In the G.P.: a, ar, ar^2, ..., ar^{n-1} putting r = 1 we get a + a + a, ..., + a = na
11. **(4)** a = 4, r = 2. Sum of five terms $S_5 = \frac{4(2^5-1)}{2-1} = 4\times31 = 124$
12. **(1)** $1+\frac{1}{2}+\frac{1}{4}+....\text{upto 6 terms } S_6 = \frac{(1-(1/2)^6)}{1-1/2} = 2\left(1-\frac{1}{2^6}\right) = 2-\frac{1}{32} = \frac{63}{32}.$
13. **(2)** Geometric mean of 3 and 12 is $\sqrt{3\times12} = \sqrt{36} = 6$
14. **(2)** Let the two numbers be a, b. A.M. of a, b is $\frac{15}{2} \Rightarrow \frac{a+b}{2} = \frac{15}{2} \Rightarrow a+b = 15$ ....(1)
   G.M. of a, b is $6 \Rightarrow \sqrt{ab} = 6 \Rightarrow ab = 36$ ....(2)
   $(a-b)^2 = (a+b)^2 - 4ab = (15)^2 - 4(36) = 225 - 144 = 81 \Rightarrow a - b = 9$ ......(3)
   $(1)+(3) \Rightarrow 2a = 24 \Rightarrow a = 12, b = 12 - 9 = 3$
15. **(2)** A.M. of two positive numbers is always greater than or equal to G.M.
16. **(1)** Ratio of A.M, G.M of a and b is 5 : 3
   $\Rightarrow \frac{a+b}{2} : \sqrt{ab} = 5:3 \Rightarrow \frac{a+b}{2\sqrt{ab}} = \frac{5}{3} \Rightarrow 9(a+b)^2 = 25(4ab) \Rightarrow 9a^2+18ab+9b^2 = 100ab$
   $\Rightarrow 9a^2 - 82ab + 9b^2 = 0 \Rightarrow (9a-b)(a-9b) = 0 \Rightarrow 9a - b = 0 \text{ (or) } a - 9b = 0$
   $\Rightarrow \frac{a}{b} = \frac{1}{9} \text{ (or) } \frac{a}{b} = \frac{9}{1} \Rightarrow a:b = 9:1$

COORDINATE GEOMETRY

9 STRAIGHT LINES

1 OMQ + 1 SAQ + 1 LAQ [1 M + 4M +8 M = 13 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. The equation of the straight line making an intercept of 3 units on the Y-axis and included at 45° to the X – axis is **[BMP2]** [2]
   1) $y = x - 1$ **2) $y = x + 3$** 3) $45x + 3$ 4) $y = x + 45$
2. The angle made by the line joining (5, 2), (6, –15) at (0, 0) is [3]
   1) $\pi / 6$ 2) $\pi / 4$ **3) $\pi / 2$** 4) π
3. The line $2x + 3y = 6$, $2x + 3y = 8$ cut the X-axis at A, B respectively a line 'l' drawn through the point (2, 2) meets the X-axis is 'C' in such a way that abscissae of A, B, C are in arithmetic progression then the equation of the line 'l' is [1]
   1) $2x + 3y = 10$ 2) $3x + 2y = 10$ 3) $2x - 3y = 10$ 4) $3x - 2y = 10$
4. The area (in sq. m) of the triangle formed by the lines $x = 0$; $y = 0$ and $3x + 4y = 12$ is [3]
   1) 3 2) 4 **3) 6** 4) 12
5. The area of the triangle formed by the axes and the line $x \cos\alpha + y \sec\alpha = 2$
   1) 4 2) 3 **3) 2** 4) 1 [3]
6. If the area of the triangle formed by the lines $x=0$; $y=0$; $3x + 4y = a(a > 0)$ is 1; then a= [2]
   1) $\sqrt{6}$ **2) $2\sqrt{6}$** 3) $4\sqrt{6}$ 4) $6\sqrt{2}$
7. Equation of the straight line passing through the image of (3,6) in the line $2x-y=5$ and perpendicular to the line $3x+4y=15$ is [4]
   1) $4x - 3y = 10$ 2) $4x - 3y = 7$ 3) $4x - 3y = 5$ **4) $4x - 3y = 16$**
8. A straight line through the point A(3, 4) is such that its intercept between the axes bisected at A. Its equation is [1]
   1) $4x + 3y = 24$ 2) $3x + 4y = 25$ 3) $x + y = 7$ 4) $3x - 4y + 7 = 0$
9. If the straight lines $y = 4 - 3x$; $ay = x + 10$ and $2y + bx + 9 = 0$ represent the three consecutive sides of a rectangle, then ab= [1]
   1) 18 2) –3 3) 1/2 4) – 1/3
10. The ends of a rod of length 'l' moves on the co-ordinate axes the locus of the point on the rod which divides it in the ratio 1 : 2 is [3]
    1) $36x^2 + 9y^2 = 4l^2$ 2) $36x^2 + 9y^2 = l^2$
    3) $9x^2 + 36y^2 = 4l^2$ 4) $9x^2 + 36y^2 = l^2$

11. Two equal sides of an isosceles triangle are $7x - y + 3 = 0$, $x + y - 3 = 0$ and its third side passes through the point $(1, -10)$ the equation of the third side is [1]

1) $3x + y + 7 = 0$ 2) $x - 3y + 29 = 0$ 3) $3x + y + 3 = 0$ 4) $3x + y = 0$

12. The perpendicular distance from $(1, 2)$ to the straight line $12x + 5y = 7$ is [1]

1) 15/13 2) 12/13 3) 5/13 4) 7/13

13. If p and q are the perpendicular distance from the origin to the straight lines $x \sec\theta - y \operatorname{cosec}\theta = a$ and $x \cos\theta + y \sin\theta = a \cos 2\theta$ then. [1]

1) $4p^2 + q^2 = a^2$ 2) $p^2 + q^2 = a^2$ 3) $p^2 + 2q^2 = a^2$ 4) $4p^2 + q^2 = 2a^2$

14. The equation of the line parallel to $5x + 12y = 1$ and at distance of 3 units from $(1, 0)$ is [1]

1) $5x + 12y + 34 = 0$ 2) $12x - 5y + 34 = 0$

3) $12x - 5y - 44 = 0$ 4) $5x + 12y + 44 = 0$

15. The area (in sq. units) of the circle which touches the lines $4x + 3y = 15$ and $4x + 3y = 5$ is [4]

1) 4π 2) 3π 3) 2π **4) π**

16. $A(2, -1)$ and $B(6, 5)$ are two points then the ratio in which the foot of the perpendicular from $(4, 1)$ to AB divides it is [2]

1) 8 : 15 **2) 5 : 8** 3) –5 : 8 4) –8 : 5

17. A straight line which makes equal intercepts on positive X and Y axes and which is at a distance of 1 unit from the origin intersects the straight line $y = 2x + 3 + \sqrt{2}$ at (x_0, y_0) then $2x_0 + y_0 =$ [2]

1) $3 + \sqrt{2}$ **2) $\sqrt{2} - 1$** 3) 1 4) 0

18. If a, b, c are AP the lines $ax + by + c = 0$ passes through the fixed point [3]

1) $(1, 2)$ 2) $(-1, 2)$ **3) $(1, -2)$** 4) $(-1, -2)$

19. If a, b, c are AP then the lines $ax + by + c = 0$ [1]

1) Passes through a fixed point 2) form an equilateral triangle

3) form a Rhombus 4) form a square

20. The point on the line $2x - 3y = 5$ which is equidistant from $(1, 2)$ and $(3, 4)$ is [2]

1) $(2, 3)$ **2) $(4, 1)$** 3) $(1, -1)$ 4) $(4, 6)$

[☞ Answers for MCQ are kept in **bold font**]

KEY & HINTS FOR MCQ

1. **(2)** Slope of the line is $m = \tan 45° = 1$; y - intercept is $c = 3$

Equation of the line is $y = mx + c \Rightarrow y = 1(x) + 3 \Rightarrow y = x + 3$

2. **(3)** Slope of $OA = \frac{2}{5}$, slope of $OB = \frac{-15}{6} = -\frac{5}{2}$

Product of slopes$= -1 \therefore \angle AOB = \pi/2$

3. **(1)** $2x + 3y = 6$ cuts the x-axis at $A = (3, 0)$; $2x + 3y = 8$ cuts the x -axis at $B = (4, 0)$.

C is a point on x-axis $\Rightarrow C = (c, 0)$. 3, 4, c are in A.P $\Rightarrow c + 3 = 8 \Rightarrow c = 5 \Rightarrow C = (5, 0)$.

Also the given point is P(2,2) Slope $= \frac{2-0}{2-5} = -\frac{2}{3}$.

Equation of line is $y - 2 = -\frac{2}{3}(x-2) \Rightarrow 2x + 3y - 10 = 0$

4. **(3)** $3x+4y-12=0 \Rightarrow a=3, b=4, c=-12$ $\therefore$ Area of triangle$=\frac{c^2}{2|ab|} = \frac{(-12)^2}{2|(3)(4)|} = 6$ sq.units

5. **(3)** Area of triangle$=\frac{(-2)^2}{2|\cos\alpha \cdot \sec\alpha|} = \frac{4}{2(1)} = 2$

6. **(2)** Area $=1 \Rightarrow \frac{(-a)^2}{2|(3)(4)|} = 1 \Rightarrow a^2 = 24 \Rightarrow a = 2\sqrt{6}$.

7. **(4)** As in Page 30/30, we get the image of (3,6) w.r. to $2x-y-5=0$ as (7,4)

From the L.H.S of given options we have $4x-3y=4(7)-3(4)=28-12=16$. Hence, option (4)

8. **(1)** From Page 15/35 we have $\frac{x}{2p} + \frac{y}{2q} = 2 \Rightarrow \frac{x}{3} + \frac{y}{4} = 2 \Rightarrow \frac{4x+3y}{12} = 2 \Rightarrow 4x + 3y = 24$

9. **(1)** Lines $y = 4 - 3x$, $2y + bx + 9 = 0$ are parallel $\Rightarrow m_1=m_2 \Rightarrow b/3 = 2/1 \Rightarrow b = 6$

Lines $y = 4 - 3x$, $ay = x + 10$ are $\perp$r $\Rightarrow m_1m_2=-1 \Rightarrow (-3)(1/a) = -1 \Rightarrow a = 3 \therefore ab = (3)(6) = 18$.

10. **(3)** Let ends of the rod be A (a,0), B(0,b) ; Length of rod $= l \Rightarrow a^2 + b^2 = l^2$

Let $P(x_1,y_1)$ divides the join of A (a,0), B(0,b) in the ratio 1:2.

$$\Rightarrow (x_1, y_1) = \left(\frac{2a}{3}, \frac{b}{3}\right) \Rightarrow a = \frac{3x_1}{2}; b = 3y_1 \therefore a^2 + b^2 = l^2 \Rightarrow \left(\frac{3x_1}{2}\right)^2 + (3y_1)^2 = l^2 \Rightarrow 9x_1^2 + 36y_1^2 = 4l^2$$

11. **(1)** **Shortcut solution:** (1,–10) is satisfied by $3x + y + 7 = 0$.

12. **(1)** The perpendicular distance from (1, 2) to the line $12x + 5y - 7 = 0$ is $\frac{|12+10-7|}{\sqrt{144+25}} = \frac{15}{13}$

13. **(1)** Ref. Page No. 23/15

14. **(1)**Line parallel to given line is $5x + 12y + k = 0$

Distance from (1, 0) to this line $= 3 \Rightarrow \frac{|5+k|}{13} = 3 \Rightarrow k + 5 = \pm 39 \Rightarrow k = 34 (\text{or}) -44 (\times)$

Equation of the line is $5x + 12y + 34 = 0$

15. **(4)**Diameter, $2r=\frac{|15-5|}{\sqrt{4^2+3^2}}=\frac{10}{5}=2\Rightarrow r=1$ $\therefore$ Area $=\pi r^2=\pi(1)=\pi$

16. **(2)** Slope of $AB=\frac{5+1}{6-2}=\frac{6}{4}=\frac{3}{2}\Rightarrow$ Slope of its perpendicular $=\frac{-2}{3}$; Equation of line is $y-1=\frac{-2}{3}(x-4)$

$\Rightarrow$ L: $2x+3y-11=0$ divides A(2,–1), B(6,5) in the ratio $-L_{11}:L_{22}=-(-10):16=5:8$

17. **(2)** Line with equal intercepts is x+y =a....(1) Its distance from O(0,0) is 1. $\Rightarrow\frac{|a|}{\sqrt{1^2+1^2}}=1\Rightarrow a=\sqrt{2}$

P.I of L_1: x+y=$\sqrt{2}$ and L_2: $2x-y+(3+\sqrt{2})=0$ is $(-1,\sqrt{2}+1)$

$\therefore\ 2x_0+y_0=2(-1)+\sqrt{2}+1=\sqrt{2}-1$

18. **(3)** a, b, c are in A.P $\Rightarrow$ 2b = a + c $\Rightarrow$ a–2b+c=0$\Rightarrow$ a(1) + b(–2) + c = 0. Fixed point is (1, –2)

19. **(1)** Same as above.

20. **(2)** Let P(α, β) be a point on the line 2x–3y = 5

$\Rightarrow 2\alpha-3\beta=5$....(1) ; A=(1,2), B=(3,4)

$PA=PB\Rightarrow PA^2=PB^2\Rightarrow\alpha+\beta=5$.......(2) By solving (1) & (2) we get P=(4,1)

10 CONIC SECTIONS

1 OMQ + 1 VSAQ+ 1 SAQ + 1 LAQ [1 M + 2M+4M +8 M = 15 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

$1\times1 = 1$ Mark

CIRCLES

1. The diameters of a circle are along $2x + y - 7 = 0$ and $x + 3y - 11 = 0$. Then the equation of this circle, which also passes through (5, 7) is [3]
   1) $x^2 + y^2 - 4x - 6y - 16 = 0$
   2) $x^2 + y^2 - 4x - 6y - 20 = 0$
   3) $x^2 + y^2 - 4x - 6y - 12 = 0$
   4) $x^2 + y^2 + 4x + 6y - 12 = 0$

2. Consider the circle $x^2 + y^2 - 4x - 2y + c = 0$ whose centre is A(2, 1). If the point P(10,7) is such that the line segment PA meets the circle Q with PQ = 5 then c = [4]
   1) -15
   2) 20
   3) 30
   4) -20

3. The absissae of two points A and B are the roots of the equation $x^2 + 2ax - b^2 = 0$ and their ordinates are the roots of the equation $y^2 + 2py - q^2 = 0$. The radius of the circle with AB as diameter is [1]
   1) $\sqrt{a^2+b^2+p^2+q^2}$
   2) $\sqrt{a^2+p^2}$
   3) $\sqrt{b^2+q^2}$
   4) $\sqrt{a^2+b^2-p^2+q^2}$

4. The equation of the circle concentric with the circle $x^2 + y^2 - 6x + 12y + 15 = 0$ and of double its area is [1]
   1) $x^2 + y^2 - 6x + 12y - 15 = 0$
   2) $x^2 + y^2 - 6x + 12y - 30 = 0$
   3) $x^2 + y^2 + 6x + 12y - 25 = 0$
   4) $x^2 + y^2 - 6x + 12y - 20 = 0$

5. A square is inscribed in the circle $x^2 + y^2 - 2x + 4y + 3 = 0$ its sides are parallel to the co-ordinate axes then one vertex of the square is [4]
   1) $(1+\sqrt{2},-2)$
   2) $(1-\sqrt{2},-2)$
   3) $(1,-2+\sqrt{2})$
   4) None

6. The equation of circle with centre $(\cos\alpha, \sin\alpha)$ and radius 1 is [2]
   1) $x^2 + y^2 = 1$
   2) $x^2 + y^2 - 2x\cos\alpha - 2y\sin\alpha = 0$
   3) $x^2 + y^2 + 2x\cos\alpha + 2y\sin\alpha = 0$
   4) $x^2 + y^2 - 2x\cos\alpha - 1 = 0$

7. If r_1 and r_2 are radii of the circles $x^2 + y^2 - 4x - 8y - 44 = 0$ and $x^2+y^2+6x+8y-96 = 0$ respectively then $r_1 : r_2$ is [1]
   1) 8 : 11
   2) 9 : 11
   3) 16 : 21
   4) 64 : 123

8. The radius of the circle touching the lines $3x - 4y + 5 = 0$; $6x - 8y - 9 = 0$ is [4]
   1) 1
   2) $\frac{23}{15}$
   3) $\frac{20}{19}$
   4) $\frac{19}{20}$

9. The perimeter of the circle $3(x^2 + y^2) = 16$ is [3]
   1) $\frac{4}{\sqrt{3}}\pi$
   2) $\frac{16}{\sqrt{3}}\pi$
   3) $\frac{8}{\sqrt{3}}\pi$
   4) $\frac{1}{\sqrt{3}}\pi$

10. The radius of circle $3(x^2 + y^2) - 3x + 9y + 10 = 0$ [BMP1] [4]
    1) $\sqrt{\frac{15}{2}}$
    2) $\frac{5}{\sqrt{2}}$
    3) $\sqrt{\frac{15}{3}}$
    4) Not defined

[☞ Answers for MCQ are kept in **bold font**]

PARABOLA

1. Parabola has the origin as its focus and the line $x = 2$ as the directrix. Then the vertex of the parabola is at [1]

   1) (1, 0) 2) (0, 1) 3) (2,0) 4) (0,2)

2. If the focus of a parabola is (0,–3) and its directrix is $y = 3$ then its equation is [1]

   1) $x^2 = -12y$ 2) $x^2 = 12y$ 3) $y^2 = -12x$ 4) $y^2 = 12x$

3. If the parabola $y^2 = 4ax$ passes through the point (3, 2) then the length of its latus rectum is [2]

   1) 2/3 2) 4/3 3) 1/3 4) 4

4. If the vertex of a parabola is the point (–3, 0) and the directrix is the line $x + 5 = 0$ then its equation is [1]

   1) $y^2 = 8(x + 3)$ 2) $x^2 = 8(y + 3)$ 3) $y^2 = -8(x + 3)$ 4) $y^2 = 8(x + 5)$

ELLIPSE

1. The eccentricity of an ellipse, when its centre at the origin is 1/2. If one of the directrices is $x = 4$ then the equation of the ellipse is [4]

   1) $3x^2 + 4y^2 = 1$ 2) $4x^2 + 3y^2 = 1$ 3) $4x^2 + 3y^2 = 12$ 4) $3x^2 + 4y^2 = 12$

2. The equation of the ellipse whose focus is at (4, 0) and whose ecccentricity 4/5 is [2]

   1) $\frac{x^2}{3^2}+\frac{y^2}{5^2}=1$ 2) $\frac{x^2}{5^2}+\frac{y^2}{3^2}=1$ 3) $\frac{x^2}{5^2}+\frac{y^2}{4^2}=1$ 4) $\frac{x^2}{4^2}+\frac{y^2}{5^2}=1$

3. The ellipse $x^2 + 4y^2 = 4$ inscribed in a rectangular (rectangle) aligned with the co-ordinate axes which in turn is inscribed in another the equation of the ellipse is [1]

   1) $x^2 + 12y^2 = 16$ 2) $4x^2 - 8y^2 = 48$ 3) $4x^2 + 64y^2 = 48$ 4) $x^2 + 16y^2 = 16$

4. If focus of an ellipse is at the origin the directrix is the line $x = 4$ and the eccentricity is 1/2 .Then the length of the semi-major axis is [4]

   1) 2/3 2) 4/3 3) 5/3 4) 8/3

5. The major axes of an ellipse is three times the minor axis, then the eccentricity is [1]

   1) $\frac{2\sqrt{2}}{3}$ 2) $\frac{2}{3}$ 3) $\frac{\sqrt{2}}{3}$ 4) $\frac{1}{3}$

6. The eccentricity of ellipse $x^2 + 3y^2 = 6$ is [2]

   1) $\frac{2}{3}$ 2) $\sqrt{\frac{2}{3}}$ 3) $\frac{\sqrt{3}}{2}$ 4) $\frac{2}{\sqrt{3}}$

HYPERBOLA

1. The equation of the conic with focus at (1, –1) directrix along $x - y + 1 = 0$ and with eccentricity $\sqrt{2}$ is [3]

1) $x^2 - y^2 = 1$ 2) $xy = 1$

3) $2xy - 4x + 4y + 1 = 0$ 4) $2xy + 4x - 4y + 1 = 0$

2. If one of the foci of the hyperbola is origin and the corresponding directrix is $3x + 4y + 1 = 0$ and the eccentricity of the hyperbola is $\sqrt{5}$. The equation of the hyperbola is [1]

1) $4x^2 + 11y^2 + 24xy + 6x + 8y + 1 = 0$ 2) $8x^2 + 9y^2 + 24y + 6x + 6y + 1 = 0$

3) $8x^2 + 9y^2 + 24xy + 6x + 8y + 1 = 0$ 4) $8x^2 + 9y^2 - 24xy + 6x + 8y + 1 = 0$

3. The vertices of the hyperbola are (2, 0), (–2, 0) and the foci are (3, 0), (–3,0) the equation of the hyperbola is [2]

1) $\frac{x^2}{5}-\frac{y^2}{4}=1$ **2) $\frac{x^2}{4}-\frac{y^2}{5}=1$** 3) $\frac{x^2}{5}-\frac{y^2}{2}=1$ 4) $\frac{x^2}{2}-\frac{y^2}{5}=1$

4. The foci of the hyperbola $9y^2 - 4x^2 = 36$ are the points [1]

1) $(0, \pm\sqrt{13})$ 2) $(\pm 3, 0)$ 3) $(0, \pm 3)$ 4) $(\pm 13, 0)$

5. The distance between the foci of the hyperbola $x^2 - 3y^2 - 4x - 6y - 11 = 0$ is [3]

1) 4 2) 6 **3) 8** 4) 10

6. The equation $\frac{x^2}{9-c}+\frac{y^2}{5-c}=1$ represents a hyperbola if c [1]

1) lies between 5 and 9 2) does not lie between 5 and 9

3) lies between 0 and 5 4) lies between 0 and 9

7. If e and e' are the eccentricities of the ellipse $5x^2 + 9y^2 = 45$ and the hyperbola $5x^2 - 4y^2 = 45$ respectively then ee' = [4]

1) 9 2) 5 3) 4 **4) 1**

8. If the foci of the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$ the hyperbola $\frac{x^2}{4}-\frac{y^2}{b^2}=1$ coincide then b^2 =

1) 4 **2) 5** 3) 8 4) 9 [2]

9. For the hyperbola $\frac{x^2}{\cos^2\alpha}-\frac{y^2}{\sin^2\alpha}=1$ which of the following remains constant when α varies? [4]

1) Eccentricity 2) Directrix 3) Abscissae of vertices **4) Abscissae of foci**

KEY & HINTS FOR MCQ

CIRCLES

1. **(3)** Point of intersection of diameters $2x + y - 7 = 0$, $x + 3y - 11 = 0$ is centre C(2, 3).

Also P(5, 7) $\Rightarrow$ Radius = $CP = \sqrt{(5-2)^2+(7-3)^2} = \sqrt{9+16} = 5$

$\therefore$ Equation of the circle is $(x-2)^2 + (y-3)^2 = 5^2 \Rightarrow x^2 + y^2 - 4x - 6y - 12 = 0$.

2. **(4)** Centre of the circle $x^2 + y^2 - 4x - 2y + c = 0$ is A = (2, 1) and P = (10, 7).

PA meets the circle in Q with PQ = 5.

$PA = \sqrt{(10-2)^2+(7-1)^2} \Rightarrow PQ + QA = \sqrt{64+36} \Rightarrow 5 + r = 10 \Rightarrow r = 5$

$\Rightarrow \sqrt{4+1-c} = 5 \Rightarrow \sqrt{5-c} = 5 \Rightarrow 5 - c = 25 \Rightarrow c = -20$

3. **(1)** Let $A = (x_1, y_1)$, $B = (x_2, y_2)$. x_1, x_2 are the roots of $x^2 + 2ax - b^2 = 0$

$\Rightarrow x^2 + 2ax - b^2 = (x - x_1)(x - x_2)$

y_1, y_2 are the roots of $y^2 + 2py - q^2 = 0 \Rightarrow y^2 + 2py - q^2 = (y - y_1)(y - y_2)$

Equation of the circle with AB as diameter is $x^2 + 2ax - b^2 + y^2 + 2py - q^2 = 0$

$\Rightarrow x^2 + y^2 + 2ax + 2py - b^2 - q^2 = 0$.

Radius of the circle $= \sqrt{a^2+p^2+(b^2+q^2)} = \sqrt{a^2+b^2+p^2+q^2}$

4. **(1)** Equation of the given circle is $x^2 + y^2 - 6x + 12y + 15 = 0$.

Radius $r_1 = \sqrt{9+36-15} = \sqrt{30}$. Area of the given circle = 30π.

Equation of the required circle is $x^2 + y^2 - 6x + 12y + k = 0$).

Radius $r_2 = \sqrt{9+36-k} = \sqrt{45-k}$. Area of the required circle = $(45 - k)\pi$.

Given that $(45 - k)\pi = 2(30\pi) \Rightarrow k = -15$.

Equation of the required circle is $x^2 + y^2 - 6x + 12y - 15 = 0$

5. **(4)** Centre of the circle is (1, –2). Radius of the circle is $\sqrt{1+4-3} = \sqrt{2}$

Since the sides of the square are parallel to the coordinate axes, vertices of the square do not lie on horizontal and vertical lines through (1, –2). The given points are not the vertices.

6. **(2)** Equation of the circle with centre $(\cos\alpha, \sin\alpha)$ and radius 1

is $(x - \cos\alpha)^2 + (y - \sin\alpha)^2 = (1)^2 \Rightarrow x^2 + y^2 - 2x\cos\alpha - 2y\sin\alpha + (\cos^2\alpha + \sin^2\alpha) = 1$

$\Rightarrow x^2 + y^2 - 2x\cos\alpha - 2y\sin\alpha = 0$. $[\because \cos^2\alpha + \sin^2\alpha = 1]$

7. **(1)** Radius of $x^2 + y^2 - 4x - 8y - 44 = 0$ is $r_1 = \sqrt{4+16+44} = \sqrt{64} = 8$

Radius of $x^2 + y^2 + 6x + 8y - 96 = 0$ is $r_2 = \sqrt{9+16+96} = \sqrt{121} = 11$ $\therefore r_1 : r_2 = 8 : 11$

8. **(4)** If r is the radius of the circle touching the parallel lines $3x - 4y + 5 = 0$, $6x - 8y - 9 = 0$ then

$2r = \frac{|10+9|}{\sqrt{36+64}} = \frac{19}{10} \Rightarrow r = \frac{19}{20}$.

9. **(3)** Equation of the given circle is $3(x^2+y^2)=16 \Rightarrow x^2+y^2=\frac{16}{3} \Rightarrow r=\frac{4}{\sqrt{3}}$

Perimeter of the circle $=2\pi r=2\pi\left(\frac{4}{\sqrt{3}}\right)=\frac{8}{\sqrt{3}}\pi$

10. **(4)** Equation of given circle is $3(x^2+y^2)-3x+9y+10=0 \Rightarrow x^2+y^2-x+3y+\frac{10}{3}=0$

Radius of the circle $\sqrt{\frac{1}{4}+\frac{9}{4}-\frac{10}{3}}=\sqrt{\frac{3+27-40}{12}}=\sqrt{\frac{-10}{12}}$,which is not defined.

PARABOLA

1. **(1)** $S=(0,0), Z=(2,0) \Rightarrow A=\left(\frac{0+2}{2},\frac{0+0}{2}\right)=(1,0)$

2. **(1)** **Shortcut Solution:** Focus $(0,-a)=(0,-3) \Rightarrow a=3 \Rightarrow 4a=12$; directrix $y=3$ is above x-axis.

$\therefore$ Equation of the parabola is $x^2=-12y$.

3. **(2)** Parabola $y^2=4ax$ passes through $(3, 2) \Rightarrow (2)^2=4a(3) \Rightarrow 4a=\frac{4}{3}$.

4. **(1)** **Shortcut Solution:** Vertex lies on the parabola. Among the given options $(-3, 0)$ is satisfied by $y^2=8(x+3)$. $\left[\because 0^2=8(-3+3)\right]$

ELLIPSE

1. **(4)** Centre = (0, 0), eccentricity $e=1/2$ and directrix is $x=4 \Rightarrow a/e=4 \Rightarrow a=4e=4(1/2)=2$

$b^2=a^2(1-e^2)=4\left(1-\frac{1}{4}\right)=3$ Equation of the ellipse is $\frac{x^2}{4}+\frac{y^2}{3}=1 \Rightarrow 3x^2+4y^2=12$

2. **(2)** $e=4/5$, $(ae, 0)=(4, 0) \Rightarrow ae=4 \Rightarrow a=5$. $b^2=25\left(1-\frac{16}{25}\right)=9$

$\therefore$ Equation of ellipse $\frac{x^2}{25}+\frac{y^2}{9}=1$

3. **(1)** Given ellipse is $x^2+4y^2=4 \Rightarrow \frac{x^2}{4}+\frac{y^2}{1}=1 \Rightarrow a=2, b=1$

Corner of the rectangle in 1st quadrant = (2, 1).

Ellipse circumscribing the rectangle passes through (4, 0). Its equation is $\frac{x^2}{16}+\frac{y^2}{b^2}=1$

A(2, 1) lies on the above ellipse $\Rightarrow \frac{4}{16}+\frac{1}{b^2}=1 \quad \Rightarrow \frac{1}{b^2}=1-\frac{1}{4}=\frac{3}{4} \Rightarrow b^2=\frac{4}{3}$

Equation of the ellipse is $\frac{x^2}{16}+\frac{3}{4}y^2=1 \Rightarrow x^2+12y^2=16$

4. **(4)** Given S = (0, 0), e = 1/2 equation of directrix is x – 4 = 0.

We have $CZ=\frac{a}{e}\Rightarrow CS+SZ=\frac{a}{e}$ $\Rightarrow ae+SZ=\frac{a}{e}\Rightarrow SZ=\frac{a}{e}-ae$

$\Rightarrow$ Distance from focus to directrix$=a\left(\frac{1}{e}-e\right)\Rightarrow|0-4|=a\left(2-\frac{1}{2}\right)\Rightarrow a\left(\frac{3}{2}\right)=4\Rightarrow a=\frac{8}{3}$

$\therefore$ Length of the semi-major axis is a=8/3

5. **(1)** $2a=3(2b)\Rightarrow a=3b$ $\quad\therefore\ e^2=\frac{a^2-b^2}{a^2}=\frac{8b^2}{9b^2}=\frac{8}{9}\Rightarrow e=\frac{2\sqrt{2}}{3}$.

6. **(2)** Given ellipse is $x^2+3y^2=6\Rightarrow\frac{x^2}{6}+\frac{y^2}{2}=1$; $\quad e=\sqrt{\frac{a^2-b^2}{a^2}}=\sqrt{\frac{6-2}{6}}=\sqrt{\frac{4}{6}}=\sqrt{\frac{2}{3}}$

HYPERBOLA

1. **(3)** Focus S = (1, –1) eccentricity $e=\sqrt{2}$, $\quad$ directrix is x – y + 1 = 0

Now SP = ePM $\Rightarrow$ $SP^2=e^2\,PM^2\Rightarrow(x-1)^2+(y+1)^2=2\left|\frac{x-y+1}{\sqrt{2}}\right|^2$

$\Rightarrow x^2+y^2-2x+2y+2=x^2+y^2+1-2xy-2y+2x\ =2xy-4x+4y+1=0$

2. **(1)** Let $P(x_1, y_1)$ be a point on the hyperbola. $\qquad$ OP= $\sqrt{x_1^2+y_1^2}$

The distance from P to the directrix is $\frac{|3x_1+4y_1+1|}{5}$

$\therefore\sqrt{x_1^2+y_1^2}=\sqrt{5}\left|\frac{3x_1+4y_1+1}{5}\right|\Rightarrow 5(x_1^2+y_1^2)=(3x_1+4y_1+1)^2$

$\Rightarrow 5x_1^2+5y_1^2=9x_1^2+6y_1^2+1+24x_1y_1+6x_1+8y_1\Rightarrow 4x_1^2+24x_1y_1+11y_1^2+6x_1+8y_1+1=0$

$\therefore$ The equation to the hyperbola is $4x^2+24xy+11y^2+6x+8y+1=0$

3. **(2)** Vertices of the hyperbola = (± 2, 0) ⇒ a = 2

Foci of the hyperbola $=(\pm3,0)\Rightarrow ae=3\Rightarrow 2e=3\Rightarrow e=\frac{3}{2}$

$b^2=a^2(e^2-1)\Rightarrow b^2=4\left(\frac{9}{4}-1\right)\Rightarrow b^2=5$ $\qquad$ Equation of the hyperbola is $\frac{x^2}{4}-\frac{y^2}{5}=1$

4. **(1)** Given hyperbola is $9y^2-4x^2=36\Rightarrow\frac{y^2}{4}-\frac{x^2}{9}=1$; $e=\sqrt{\frac{a^2+b^2}{b^2}}=\sqrt{\frac{9+4}{4}}=\frac{\sqrt{13}}{2}$

Foci of the hyperbola $=(0,\pm be)=\left(0,\pm2\left(\frac{\sqrt{13}}{2}\right)\right)=(0,\pm\sqrt{13})$

5. **(3)** $x^2-3y^2-4x-6y-11=0 \Rightarrow (x^2-4x+4)-3(y^2+2y+1)=12 \Rightarrow (x-2)^2-3(y+1)^2=12$

$$\Rightarrow \frac{(x-2)^2}{12}-\frac{(y+1)^2}{4}=1 \Rightarrow a^2=12, b^2=4 \Rightarrow e=\frac{\sqrt{a^2+b^2}}{a}=\frac{\sqrt{12+4}}{\sqrt{12}}=\frac{4}{\sqrt{3}}=\frac{2}{\sqrt{3}}$$

Distance between foci $=2ae=2\sqrt{12}\left(\frac{2}{\sqrt{3}}\right)=8$

6. **(1)** $\frac{x^2}{9-c}+\frac{y^2}{5-c}=1$ represents a hyperbola if $9-c>0,\ 5-c<0 \Rightarrow 9>c,\ 5<c$

$\Rightarrow 5<c,\ c<9 \Rightarrow 5<c<9.$

7. **(4)** $5x^2+9y^2=45 \Rightarrow \frac{x^2}{9}+\frac{y^2}{5}=1 \Rightarrow e=\frac{\sqrt{9-5}}{3}=\frac{2}{3}.$

$5x^2-4y^2=45 \Rightarrow \frac{x^2}{9}-\frac{y^2}{45/4}=1 \Rightarrow e'=\frac{\sqrt{9+45/4}}{3}=\frac{\sqrt{81}}{2(3)}=\frac{9}{6}=\frac{3}{2}$ $\quad \therefore ee'=\frac{2}{3}\times\frac{3}{2}=1$

8. **(2)** Eccentricity of the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1$

$\sqrt{\frac{a^2-b^2}{a^2}}=\sqrt{\frac{25-16}{25}}=\frac{3}{5}$ .Foci are (3, 0), (–3, 0).

Eccentricity of the hyperbola $\frac{x^2}{4}-\frac{y^2}{b^2}=1=\sqrt{\frac{4+b^2}{4}}$. Foci are $(\sqrt{4+b^2},0), (-\sqrt{4+b^2},0)$

Given that $\sqrt{4+b^2} \Rightarrow 9=4+b^2 \Rightarrow b^2=5$

9. **(4)** $\frac{x^2}{\cos^2\alpha}-\frac{y^2}{\sin^2\alpha}=1$

We have $\sin^2\alpha=\cos^2\alpha(e^2-1) \Rightarrow \tan^2\alpha=e^2-1 \Rightarrow e^2-1 \Rightarrow e^2=\sec^2\alpha \Rightarrow e=\sec\alpha$ ......(1)

Equation of directrix is $x=\frac{a}{e} \Rightarrow x=\frac{\cos\alpha}{\sec\alpha} \Rightarrow x=\cos^2\alpha$ ....(2)Vertices $=(\pm\cos\alpha, 0)$ ....(3)

Foci $=(\pm ae, 0)=(\pm\cos\alpha\sec\alpha, 0)=(\pm 1, 0)$ ....(4)

Abscissae of foci are constant.

11 3D-GEOMETRY

1 OMQ + 1 VSAQ [1 M + 2M = 3 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. The co-ordinates of the foot of the perpendicular from a point P(6, 7, 8) on the y-axis are [2]
   1) (6,0,0) **2) (0,7, 0)** 3) (0, 0, 8) 4) (0, 7, 8)
2. The length of the perpendicular drawn from the point P(13, 5, 12) on the x - axis is **[BMP1]** [1]
   1) 13 2) $2\sqrt{13}$ 3) $\sqrt{194}$ 4) $\sqrt{313}$
3. If a parallelepiped is formed by planes drawn through the points (1, 2, 5) and (4, 5, 8) parallel to the co-ordinate planes, then the length of the diagonal of the parallelepiped is [4]
   1) $2\sqrt{2}$ 2) 3 3) $\sqrt{3}$ **4) $3\sqrt{3}$**
4. The Locus of the point for which y = 0 is [3]
   1) xy - plane 2) yz - plane **3) zx-plane** D) None of these
5. If the distance between the points P(0, a, 3) and Q(3, 0, 7) is $\sqrt{41}$ then a = [3]
   1) –4 2) 4 **3) ± 4** 4) None of these
6. The ratio in which the line joining (2, 4, 5) and (3, 5, –9) is divided by the yz -plane [3]
   1) 2 : 3 2) 3 : 2 **3) –2 : 3** 4) 4 : –3
7. The points (1, 1, 1), (4, 1, 1), (4, 5, 1) and (1, 5, 1) are the vertices of [1]
   1) a rectangle 2) a square 3) parallelogram 4) None of these
8. What is the locus of a point for which y = 0, z = 0 ? [1]
   1) x-axis 2) y-axis 3) z-axis 4) yz-plane
9. XOZ-plane divides the join of (2, 3, 1) and (6, 7, 1) in the ratio **[MAR-26]** [3]
   1) 3 : 7 2) 2 : 7 **3) –3 : 7** 4) –2 : 4
10. The co-ordinates of the foot of the perpendicular drawn from the point P(3, 4, 5) on the YZ plane are [2]
    1) (3, 4, 0) **2) (0, 4, 5)** 3) (3, 0, 5) 4) (3, 0, 0)
11. Statement-1 (Assertion): Point $(3, a^2 - 1, a^2 - 3a + 2)$ lies on the x-axis if a = 1 [1]
    Statement-2 (Reason): On x-axis, y and z co-ordinates of every point are each equal to zero
    1) Statement-1 and statement-2 are true, statement 2 is a correct explanation for statement - 1
    2) Statement -1 and statement - 2 are true, statement - 2 is not a correct explanation for statement
    3) Statement - 1 is true, statement - 2 is false
    4) Statement - 1 is false, statement - 2 is true

KEY & HINTS FOR MCQ

1. **(2)**

Sol: On the y-axis, the x-coordinates and z-coordinates are zeros.

2. **(1)**

Sol: The foot of the perpendicular from P(13, 5, 12) on to the x - axis is Q(13, 0, 0)

$\therefore PQ = \sqrt{(13-13)^2+(5-0)^2+(12-0)^2} = \sqrt{0+25+144} = \sqrt{169} = 13.$

3. **(4)**

Sol: Length of the diagonal $= \sqrt{(4-1)^2+(5-2)^2+(8-5)^2} = \sqrt{9+9+9} = 3\sqrt{3}.$

4. **(3)**

Sol: On the ZX Plane we have y=0

5. **(3)**

Sol: $P(0,a,3),\ Q(3,0,7), PQ=\sqrt{41} \Rightarrow \sqrt{(0-3)^2+(a-0)^2+(3-7)^2} = \sqrt{41}$

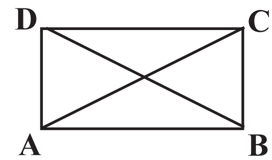
$\Rightarrow 9+a^2+16=41 \Rightarrow a^2=16 \Rightarrow a=\pm 4$

6. **(3)**

Sol: Let $P(2,4,5), Q(3,5,-9)$

PQ divides yz- plane in the ratio $-x_1 : x_2 = -2 : 3$

7. **(1)**



Sol: Mid point of $AC = \left(\frac{1+4}{2}, \frac{1+5}{2}, \frac{1+1}{2}\right) = \left(\frac{5}{2}, 3, 1\right);$

Mid point of $BD = \left(\frac{4+1}{2}, \frac{1+5}{2}, \frac{1+1}{2}\right) = \left(\frac{5}{2}, 3, 1\right)$

Mid points coincide $\rightarrow$ Diagonal bisects . Hence a parallelogram.
Also d.r's of AB = (4–1, 1–1, 1–1)=(3,0,0); d.r's of BC = (4–4, 5–1, 1–1)=(0,4,0)
Verifying the perpendicular condition = 3(0)+0(4)+0(0)=0
Adjacent sides are perpendicular. Hence ABCD forms a Rectangle.

8. **(1)** On the x-axis we have y=0, z=0

9. **(3)**

Sol: XZ - plane divides the join of (2, 3, 1) and (6, 7, 1) in the ratio –3 : 7

10. **(2)**

On the YZ plane, x-coordinate is zero. Hence (0,4,5)

11. **(1)**

Sol: S1: $(3, a^2-1, a^2-3a+2)$ lies on x- axis $\Rightarrow a^2-1=0,\ a^2-3a+2=0$

$\Rightarrow (a+1)(a-1)=0,\ (a-1)(a-2)=0 \Rightarrow a=1.$ $\therefore$ S1 is true.

S2: S2 is true. Further S2 is correct explanation of S1.

12 LIMITS & DERIVATIVES

1 OMQ + 1 VSAQ+ 1 SAQ + 1 LAQ [1 M + 2M+ 4M +8 M = 15M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

$1\times1=$ 1 Mark

1. $\lim\limits_{x\to1}\dfrac{x^2-1}{|x-1|}$ **[BMP1]** [4]

1) 0 2) –2 3) 2 **4) Does not exist**

2. $\lim\limits_{x\to0}\dfrac{1}{x}\cos^{-1}\dfrac{(1-x^2)}{1+x^2}$ [4]

1) 0 2) 1 3) 2 **4) Does not exist**

3. $\lim\limits_{x\to0}(1+\tan^2 x)^{\frac{1}{2x^2}}$ [1]

1) $\mathbf{e^{\frac{1}{2}}}$ 2) e 3) $e^{-\frac{1}{2}}$ 4) 1

4. **If** $\dfrac{-\pi}{2}<\alpha<\dfrac{\pi}{2}$ then $\lim\limits_{x\to2}\dfrac{(\cos\alpha)^x+(\sin\alpha)^x-1}{x-2}$ [3]

1) $\cos^2\alpha\log\cos\alpha$ 2) $\sin^2\alpha\log\sin\alpha$

3) $\mathbf{\cos^2\alpha\,\log\cos\alpha+\sin^2\alpha\,\log\sin\alpha}$ 4) 0

5. **If** $\Delta(x)=\begin{vmatrix} e^x & -1 \\ \sin x-1 & 1\end{vmatrix}$ then $\lim\limits_{x\to0}\dfrac{\Delta(x)}{x}=$ [3]

1) 0 2) 1 **3) 2** 4) –1

6. $\lim\limits_{x\to0}\left(\dfrac{a^x+b^x}{2}\right)^{\frac{1}{x}}=$ [2]

1) $\dfrac{1}{\sqrt{ab}}$ **2)** $\mathbf{\sqrt{ab}}$ 3) $\dfrac{1}{ab}$ 4) ab

7. $\lim\limits_{x\to0}\dfrac{\tan x-\sin x}{x^3}=$ [4]

1) – 1/2 2)0 3) 2 **4) 1/2**

8. **If** $a,b,d>0$ and $\neq1$ then $\lim\limits_{x\to0}\dfrac{a^x-b^x}{d^x-1}$ [1]

1) $\mathbf{\log_d\left(\frac{a}{b}\right)}$ 2) $\log_d\left(\dfrac{b}{a}\right)$ 3) $\log_{\left(\frac{a}{b}\right)} d$ 4) $\log_{\frac{a}{b}} d$

9. $\lim_{x\to 0}\left(\frac{1+\tan x}{1+\sin x}\right)^{\frac{1}{\sin x}}$ [1]

1) 1 2) e^{-1} 3) e^{-2} 4) e

10. $\lim_{x\to 0}\frac{\sqrt{1+2x}-\sqrt{1-2x}}{\sin 2x}$ [3]

1) -1 2) 0 **3) 1** 4) 1/2

11. Assertion (A): $\lim_{x\to 0}\frac{\sin x}{x}=1$ [2]

Reason (R): If $\lim_{x\to a} f(x)=l,\ \lim_{x\to a} g(x)=m$**, then** $\lim_{x\to a} f(x)g(x)=lm$

1) Both A and R are true and R is correct explanation of A

2) Both A and R are true and R is not correct explanation of A

3) A is true R is false

4) A is false R is true

12. Assertion (A): $\lim_{x\to 0}\frac{|x|}{x}=1$ [4]

Reason (R): f:R\{0} → R defined by $f(x)=\frac{|x|}{x}$ **has range {–1,1}**

1) Both A and R are true and R is correct explanation of A

2) Both A and R are true and R is not correct explanation of A

3) A is true R is false

4) A is false R is true

13. Let f(x) = x + [x], x ∈ R then f' '(3/2) is equal to [2]

1) 3/2 **2) 1** 3) 0 4) 5/2

14. If $f(x)=x\cos x$ then $f'\left(\frac{\pi}{2}\right)$ is equal to [1]

1) $\frac{-\pi}{2}$ 2) $\frac{\pi}{2}$ 3) $\frac{\pi}{4}$ 4) π

15. If f(x) = 1 + x + x^2 + x^3 + x^4 +...+x^n then $f'(1)=$ [4]

1) n 2) n + 1 3) n(n + 1) **4)** $\frac{n+n^2}{2}$

KEY & HINTS FOR MCQ

1. **(4)** $\underset{x\to1^+}{Lt}\frac{x^2-1}{|x-1|}=\underset{x\to1^+}{Lt}\frac{x^2-1}{|x-1|}=\underset{x\to1^+}{Lt}(x+1)=2.;\ \underset{x\to1^-}{Lt}\frac{x^2-1}{|x-1|}=\underset{x\to1^-}{Lt}\frac{x^2-1}{|x-x|}=-\underset{x\to1^-}{Lt}(x+1)=-2.$

R.H.L ≠ L.H.L $\therefore$ Limit does not exist.

2. **(4)** $\cos^{-1}\frac{(1-x^2)}{1+x^2}=-2\tan^{-1}x$ if $x<0 \Rightarrow$ L.H.L = –2

$= 2\tan^{-1}x$ if $x>0 \Rightarrow$ R.H.L = 2 $\therefore$ L.H.L ≠ R.H.L doesn't exist

3. **(1)** $\underset{x\to0}{Lt}(1+\tan^2 x)^{\frac{1}{2x^2}}=e^{\underset{x\to0}{Lt}(1+\tan^2 x-1)\cdot\frac{1}{2x^2}}=e^{\underset{x\to0}{Lt}\frac{\tan^2 x}{2x^2}}=e^{\frac{1}{2}\underset{x\to0}{Lt}\left(\frac{\tan x}{x}\right)^2}=e^{\frac{1}{2}(1)}=e^{\frac{1}{2}}$

4. **(3)** **Applying L- Hospital Rule:** $\underset{x\to2}{Lt}\frac{(\cos\alpha)^x+(\sin\alpha)^x-1}{x-2}$

$=\underset{x\to2}{Lt}\frac{(\cos\alpha)^x\log(\cos\alpha)+(\sin\alpha)^x\log(\sin\alpha)}{1}=\cos^2\alpha\log(\cos\alpha)+\sin^2\alpha\log(\sin\alpha)$

5. **(3)** $\Delta(x)=\begin{vmatrix}e^x & -1\\ \sin x-1 & 1\end{vmatrix}=e^x+1(\sin x-1)=e^x+\sin x-1\ \ \underset{x\to0}{Lt}\frac{\Delta(x)}{x}=\underset{x\to0}{Lt}\frac{e^x+\sin x-1}{x}=\underset{x\to0}{Lt}\left(\frac{e^x-1}{x}\right)+\underset{x\to0}{Lt}\frac{\sin x}{x}=1+1=2.$

6. **(2)** $\underset{x\to0}{Lt}\left(\frac{a^x+b^x}{2}\right)^{\frac{1}{x}}=e^{\underset{x\to0}{Lt}\left(\frac{a^x+b^x}{2}-1\right)\frac{1}{x}}=e^{\underset{x\to0}{Lt}\left(\frac{a^x+b^x-2}{2x}\right)}=e^{\frac{1}{2}\underset{x\to0}{Lt}\left(\frac{a^x-1}{x}+\frac{b^x-1}{x}\right)}=e^{\frac{1}{2}(\log a+\log b)}$

7. **(4)** $\underset{x\to0}{Lt}\frac{\tan x-\sin x}{x^3}=\underset{x\to0}{Lt}\frac{\tan x}{x}.\frac{(1-\cos x)}{x^2}=1.\frac{1}{2}=\frac{1}{2}$

8. **(1)** $\underset{x\to0}{Lt}\frac{a^x-b^x}{d^x-1}=\underset{x\to0}{Lt}\frac{\frac{(a^x-1)-(b^x-1)}{x}}{\left(\frac{d^x-1}{x}\right)}=\underset{x\to0}{Lt}\frac{\left(\frac{a^x-1}{x}\right)-\left(\frac{b^x-1}{x}\right)}{\left(\frac{d^x-1}{x}\right)}=\frac{\log a-\log b}{\log d}=\frac{\log(a/b)}{\log d}$

9. **(1)** $\underset{x\to0}{Lt}\left(\frac{1+\tan x}{|1+\sin x|}\right)^{\frac{1}{\sin x}}=e^{\underset{x\to0}{Lt}\left(\frac{1+\tan x}{1+\sin x}-1\right)\frac{1}{\sin x}}=e^{\underset{x\to0}{Lt}\frac{(1+\tan x-1-\sin x)}{(1+\sin x)\sin x}}=e^{\underset{x\to0}{Lt}\frac{(\tan x-\sin x)}{(1+\sin x)\sin x}}=e^0=1$

10. **(3)** **Applying L- Hospital Rule:** $\underset{x\to0}{Lt}\frac{\frac{1}{2\sqrt{1+2x}}(2)-\frac{1}{2\sqrt{1-2x}}(-2)}{2\cos 2x}=\frac{1+1}{2(1)}=\frac{2}{2}=1$

11. **(2)**

12. **(4)** $\underset{x\to0+}{Lt}\frac{|x|}{x}=\underset{x\to0+}{Lt}\frac{x}{x}=\underset{x\to0+}{Lt}(1)=1,\qquad \underset{x\to0-}{Lt}\frac{|x|}{x}=\underset{x\to0-}{Lt}\frac{-x}{x}=\underset{x\to0-}{Lt}(-1)=-1$

L.H.L ≠ R.H.L A is false and R is true.

13. **(2)** If $x\in(1,2)$ the $[x] = 1$ and hence $f(x) = x + 1 \Rightarrow f'(x) = 1$ $\therefore f'(3/2) = 1$

14. **(1)** $f(x) = x\cos x \Rightarrow f'(x) = \cos x - x\sin x \Rightarrow f'(\pi/2) = 0 - (\pi/2)\times1 = -\pi/2.$

15. **(4)** $f(x) = 1 + x + x^2 + x^3 + x^4 +\ldots + x^n \Rightarrow f'(x) = 1 + 2x + 3x^2 + 4x^3 +\ldots + nx^{n-1}$

$\therefore f'(1)=1+2+3+\ldots+n=\frac{n(n+1)}{2}=\frac{n^2+n}{2}$

13 STATISTICS

1 VSAQ + 1 LAQ [2M + 8 M = 10 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

1×1= 1 Mark

1. **The range of the following data (marks scored by 10 students in mathematics) is 15, 20, 31, 62, 13, 6, 41, 86, 21, 74 is** [3]
   1) 68 2) 56 **3) 80** 4) 71

2. **In a test match two batsmen A and B scored 116, 2 and 76, 138 in two innings respectively. Whose score is more scattered** [1]
   1) A 2) B 3) can't stay 4) equal

3. **The formula $\frac{1}{N}\sum_{i=1}^{n} f_i |x_i - \bar{x}|$ is used to calculate which of the following dispersion?** [1]
   1) Mean deviation 2) Standard deviation 3) Range 4) Q.D

4. **Which of the following formula is used to measure mean deviation for grouped about median.** [3]
   1) $\sum_{i=1}^{n} f_i |x_i - \bar{x}|$ 2) $\frac{1}{N}\sum_{i=1}^{n} f_i |x_i - \bar{x}|$ **3)** $\frac{1}{N}\sum_{i=1}^{n} f_i |x_i - M|$ 4) $\frac{1}{N}\sum_{i=1}^{n} |x_i - M|$

5. **Standard deviation of a discrete frequency distribution is measured by using** [3]
   1) $\frac{1}{N}\sqrt{\sum_{i=1}^{n} f_i (x_i - \bar{x})^2}$ 2) $\sqrt{\sum_{i=1}^{n} (x_i - \bar{x})^2}$ **3)** $\sqrt{\frac{1}{N}\sum_{i=1}^{n} f_i (x_i - \bar{x})^2}$ 4) $\sqrt{\frac{1}{N}\sum_{i=1}^{n} f_i (x_i - \bar{x})}$

6. **If each observation is multiplied by a constant k ≠ 0, then variance of the resulting observations becomes_______ times the original variance** [4]
   1) k (remains uncharged) 2) $\sqrt{k}$ 3) k^3 **4)** k^2

7. **If the variance of 20 observations is 5. If each observation is added by 3 then the new variance of the resulting observations.** [1]
   1) 5 2) 8 3) 15 4) 9

8. **Mean of the squares of the deviations from mean is known as** [4]
   1) Mean deviation 2) Standard deviation 3) Quartile deviation **4) Variance**

9. **Relation between Mean deviation and standard deviation is** [2]
   1) $\sigma \geq MD$ **2)** $MD \leq \sigma$ 3) $\sigma \leq \sqrt{MD}$ 4) $\sigma^2 \leq \sqrt{MD}$

10. **The sum of 10 items is 12 and the sum of their squares is 18. The standard deviation is** [2]
    1) 4/5 **2) 3/5** 3) 2/5 4) 1/5

KEY & HINTS FOR MCQ

1. **(3)** In the given data, maximum value = 86, minimum value = 6. $\therefore$ Range = 86 – 6 = 80

2. **(1)** Range of scores of Batsmen A is 116–2=114;
   Range of scores of Batsmen B is 138–76=62;
   Batsmen A has more range and hence his scores are more scattered.

3. **(1)** $\frac{1}{N}\sum_{i=1}^{n} f_i\,|x_i-\bar{x}| =$ the mean deviation about mean.

4. **(3)** For a grouped data, Mean deviation = $\frac{1}{N}\sum_{i=1}^{n} f_i\,|x_i-M|$

5. **(3)** For a discrete frequency distribution, standard deviation = $\sqrt{\frac{1}{N}\sum_{i=1}^{n} f_i(x_i-\bar{x})^2}$

6. **(4)** Let the given values be $X=x_i$ so that Variance $V(X)=\lambda$; Formula: $V(ax+b)=a^2V(x)$
   Now $y_i=kx_i \Rightarrow V(y_i)=V(kx)=k^2V(x)$ $[\because V(ax+b)=a^2V(x)]$

7. **(1)** Let the given values be $X=x_i$, for i= 1,2,...20; Variance V(X) = 5 ;
   Now $y_i=x_i+3 \Rightarrow V(y_i)=V(x+3)=1^2\,V(x)=1(5)=5$ $[\because V(ax+b)=a^2V(x)]$

8. **(4)** Squares of the deviations of mean $=(x_i-\bar{x})^2$

   Now mean of squares of deviations $=\frac{\Sigma(x_i-\bar{x})^2}{n}=\sigma^2=\text{variance}$

9. **(2)** Mean deviation $\bar{x}=\frac{\Sigma(x_i-\bar{x})}{n} \Rightarrow (\bar{x})^2=\frac{\Sigma(x_i-\bar{x})^2}{n^2}$ ....(1)

   Standard deviation $\sigma=\sqrt{\frac{\Sigma(x_i-\bar{x})^2}{n}} \Rightarrow \sigma^2=\frac{\Sigma(x_i-\bar{x})^2}{n}$.....(2)

   From (1) & (2) in the denominators we have $n^2 \geq n$; $\therefore (\bar{x})^2 \leq \sigma^2 \Rightarrow \bar{x} \leq \sigma \Rightarrow \text{M.D} \leq \sigma$

10. **(2)** Given that $\sum_{i=1}^{10} x_i=12; \sum_{i=1}^{10} x_i^2=18$

    $\therefore$ Standard deviation $\sigma=\sqrt{\left(\frac{\Sigma x_i^2}{n}\right)-\left(\frac{\Sigma x_i}{n}\right)^2}=\sqrt{\frac{18}{10}-\left(\frac{12}{10}\right)^2}=\sqrt{\frac{180-144}{100}}=\sqrt{\frac{36}{100}}=\frac{6}{10}=\frac{3}{5}$

14 PROBABILITY

1 OMQ + 1 SAQ + 1 LAQ [1 M + 4M +8 M = 13 M]

MULTIPLE CHOICE Q'S(MCQ)

OMQ'S

$1\times1=$ 1 Mark

1. Let A and B be two events such that P(A) = 0.8, P(B) = 0.7 Then $P(A \cap B)$ [2]
   1) ≤ 0.6 **2) $\ge$ 0.5** 3) ≥ 0.7 4) ≤ 0.4
2. The probability that a leap year selected at random will contain 53 sundays is [2]
   1) 1/7 **2) 2/7** 3) 6/7 4) 5/7
3. If two dice are thrown. Then the probability of getting the same number on both the faces is [4]
   1) 2/6 2) 3/6 3) 5/6 **4) 1/6**
4. Two dice are thrown. Then the probability of getting a total score of seven is[1]
   1) 1/6 2) 2/6 3) 3/6 4) 5/6
5. If A and B are two events of a sample space with $P(A\cup B) = P(A)+P(B)$, then they are [1]
   1) Mutually exclusive 2) Exhaustive
   3) 1 and 2 4) None
6. An integer in picked from 1 to 20 (both inclusive). Then the probability that it is a prime [3]
   1) 3/20 2) 3/5 **3) 2/5** 4) 1/5
7. If P(A) = 0.5 P(B) = 0.3. (given that A and B are mutually exclusive). Then $P(A' \cap B')$ =**[MAR-26]** [4]
   1) 0.6 2) 0.5 3) 0.7 **4) 0.2**
8. One card is drawn from a well shuffled deck of 52 cards. Then the probability that the card will not be a red card is [3]
   1) 2/5 2) 1/5 **3) 1/2** 4) 1/3
9. Which of following is false **[BMP2]** [2]
   1) $P(E) = 0 \Leftrightarrow E$ is an impossible event **2) $0 \le P(E) < 1$**
   3) $P(E) = 1 \Leftrightarrow E$ is a certain event 4) $P(E)+P(\bar{E})=1$
10. Which of the following statement is not correct. P is a probability function of the sample space S [4]
    1) $P(E) > 0 \ \forall\ E \in P(S)$ 2) $P(S) = 1$
    3) $P(\varnothing) = 0$
    4) $P(E_1 \cap E_2) = P(E_1) + P(E_2)$ where E_1, E_2 are mutually exclusive

KEY & HINTS FOR MCQ

1. **(2)** $P(A\cup B) \le 1 \Rightarrow P(A) + P(B) - P(A \cap B) \le 1 \Rightarrow 0.8 + 0.7 - P(A \cap B) \le 1$

   $\Rightarrow 1.5 - 1 \le P(A \cap B) \Rightarrow P(A \cap B) \ge 0.5$.

2. **(2)** Let A be the event of containing 53 Sundays in leap year and S be the sample space.

   A leap year contains 366 days i.e., 52 weeks and 2 days extra.

   The extra two days may be (Sun, Mon) or (Mon, Tues) or (Tues, Wed) or (Weds, Thu) or (Thu, Fri) or (Fri, Sat) or (Sat, Sun). $\therefore$ n(S) = 7, n(A) = 2, $\therefore$ P(A) = 2/7.

3. **(4)** $A = \{(1,1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6)\} \Rightarrow n(A) = 6, n(S) = 36 \quad P(E) = \frac{6}{36} = \frac{1}{6}$

4. **(1)** $A = \{(1,7), (2, 5), (3, 4), (4, 3), (5, 2), (6, 1)\} \Rightarrow n(A) = 6, n(S) = 36 \quad P(E) = \frac{6}{36} = \frac{1}{6}$

5. **(1)** $P(A \cup B) = P(A) + P(B) \Rightarrow P(A) + P(B) - P(A \cap B) = P(A) + P(B) \Rightarrow P(A \cap B) = 0$

   $\Rightarrow$ A and B are mutually exclusive.

6. **(3)** Prime numbers from 1 to 20 are 2, 3, 5, 7, 11, 13, 17, 19 $\Rightarrow n(A) = 8, n(S) = 20$.

   $\therefore P(A) = \frac{n(A)}{n(S)} = \frac{8}{20} = \frac{2}{5}$

7. **(4)** A, B are mutually exclusive $\Rightarrow A \cap B = \varnothing$

   $P(A' \cap B') = P(A \cap B') = 1 - P(A \cup B) = 1 - P(A) - P(B) = 1 - 0.5 - 0.03 = 0.2$

8. **(3)** Number of Red card = 26 $\Rightarrow n(A) = 26, n(S) = 52 \quad \therefore P(A) = \frac{26}{52} = \frac{1}{2}$

   Probability of not getting red card $= P(\bar{A}) = 1 - P(A) = 1 - \frac{1}{2} = \frac{1}{2}$.

9. **(2)** Actually $\mathbf{0 \le P(E) \le 1}$

10. **(4)** $P(E_1 \cup E_2) = P(E_1) + P(E_2)$