Half yearly Answer Key - 2024

1 Marks

1) a) 4
2) a) real and distinct
3) b) not a function
4) b) 18
5) c) 0
6) b) 6
7) d) 4
8) d) (−3, −2)
9) b) $\frac{(e-1)^2}{2e}$
10) d) 3
11) c) $\vec{a}$ and $\vec{b}$ are perpendiculars
12) d) $(a^2-1)^2$
13) d) $\frac{2\hat{i}-\hat{j}}{\sqrt{5}}$
14) d) $\frac{1}{3}$
15) a) 4
16) a) $(a-z)^2$
17) a) 1
18) a) $\sqrt{1-x^2}+\sin^{-1}x+C$
19) a) $\log \sec x + C$
20) d) $\frac{7}{128}$

2 marks

21) $A=\{1,2,3,4\}$
$B=\{3,4,5,6\}$
$n(A\cup B)=6,\ n(A\cap B)=2$
$n(A\Delta B)=4$
$=6\times2\times4=\boxed{48}$

22) $f(x)=4x^2-25$
$4x^2-25=0$
$x^2=\frac{25}{4} \Rightarrow \boxed{x=\pm\frac{5}{2}}$

23) $\tan(45°+A)$
$=\frac{\tan 45°+\tan A}{1-\tan 45°\tan A}$
$=\boxed{\frac{1+\tan A}{1-\tan A}}$

24) BANANA
$=\frac{6!}{3!\times2!}=\boxed{60}$

25) (1, 1) and (−2, 3)
$\frac{y-y_1}{y_2-y_1}=\frac{x-x_1}{x_2-x_1}$
$\frac{y-1}{3-1}=\frac{x-1}{-2-1}$
$2x+3y=5$

26) $\vec{a}=\hat{i}-\hat{j}+5\hat{k}$
$\vec{b}=3\hat{i}-2\hat{k}$
$\vec{a}\cdot\vec{b}=3-10$
$=\boxed{-7}$

27) $y=e^{\sin x}$
$y'=\cos x\cdot e^{\sin x}$

28) $P(A)=\frac{3}{8},\ P(B)=\frac{1}{8}$
(i) $P(\bar{A})=1-P(A)=\boxed{\frac{5}{8}}$
(ii) $P(A\cup B)=P(A)+P(B)$
$=\frac{3}{8}+\frac{1}{8}=\boxed{\frac{1}{2}}$

29) $\lim_{x\to3}(x^3-2x+6)$
$(3)^3-2(3)+6$
$27-6+6 \Rightarrow \boxed{27}$

30) $\int(6x^2+8)\,dx$
$6\left(\frac{x^3}{3}\right)+8x+C$
$2x^3+8x+C$

3 marks

31) $f(x)=\frac{1}{1-3\cos x}$
$-1\le\cos x\le1$
$3\ge-3\cos x\ge-3$
$-3\le-3\cos x\le3$
$1-3\le-3\cos x\le1+3$
$-2\le1-3\cos x\le4$
$\frac{1}{1-3\cos x}\le-\frac{1}{2},\ \frac{1}{1-3\cos x}\ge\frac{1}{4}$
Range is $\left(-\infty,-\frac{1}{2}\right]\cup\left[\frac{1}{4},\infty\right)$

32) $\frac{\log x}{y-z}=\frac{\log y}{z-x}=\frac{\log z}{x-y}$
$\frac{\log x}{y-z}=k \Rightarrow \log x=k(y-z)$
$x=e^{k(y-z)}$
$y=e^{k(z-x)}$
$z=e^{k(x-y)}$
$xyz=e^{k(y-z+z-x+x-y)}$
$=e^{k(0)}=\boxed{1}$

33) $\frac{1}{8!}+\frac{1}{9!}=\frac{n}{10!}$
$\frac{1}{8!}\left(1+\frac{1}{9}\right)=\frac{n}{10\times9\times8!}$
$\boxed{n=100}$

34) $a_1=1,\ a_2=2$
$a_3=3,\ a_4=5,$
$a_5=8,\ a_6=13$

35) (−2, −3), (3, 2) (−1, −8)
Area of $\Delta^{le}=\left|\frac{1}{2}\begin{vmatrix}x_1&y_1&1\\x_2&y_2&1\\x_3&y_3&1\end{vmatrix}\right|$
$=\left|\frac{1}{2}\begin{vmatrix}-2&-3&1\\3&2&1\\-1&-8&1\end{vmatrix}\right|$
$=\left|\frac{1}{2}(-20+12-22)\right| \Rightarrow |-15|$
$=\boxed{15}$ sq. units

36) $3\hat{i}+4\hat{j}-6\hat{k}$
$r=\sqrt{x^2+y^2+z^2}$
$r=\sqrt{61}$
Dir. cosines $\frac{3}{\sqrt{61}},\frac{4}{\sqrt{61}},\frac{-6}{\sqrt{61}}$
Dir. ratios 3, 4, −6

37) $\lim_{x\to1}\frac{\sqrt{x}-1}{x-1}$
$\lim_{x\to1}\frac{\sqrt{x}-1}{(\sqrt{x}-1)(\sqrt{x}+1)} \Rightarrow \lim_{x\to1}\frac{1}{\sqrt{x}+1}$
$\Rightarrow \boxed{\frac{1}{2}}$

38) $f''(x)=12x-6$
$f(1)=30,\ f'(1)=5$
$\int f''(x)=f'(x)=12\frac{x^2}{2}-6x+c_1$
$f'(x)=6x^2-6x+c_1$
$5=6(1)^2-6(1)+c_1$
$\Rightarrow \boxed{c_1=5}$
$\int f'(x)=\frac{6x^3}{3}-\frac{6x^2}{2}+5x+c_2$
$f(x)=2x^3-3x^2+5x+c_2$
$30=2(1)^3-3(1)^2+5(1)+c_2$
$\boxed{c_2=26}$
$f(x)=2x^3-3x^2+5x+26,$

39) $\cos\theta=\frac{2}{3},$
$\sin\theta=\sqrt{5}/3,\ \csc\theta=3/\sqrt{5}$
$\sec\theta=3/2,\ \tan\theta=\sqrt{5}/2$
$\cot\theta=2/\sqrt{5}$

40) $x=at^2,\ y=2at$
$\frac{dy}{dx}=\frac{2a}{2at} \Rightarrow \boxed{\frac{1}{t}}$

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41) a) $f(x) = |x| + x$

$g(x) = |x| - x$

$f(x) = \begin{cases} 2x & \text{if } x \geq 0 \\ 0 & \text{if } x < 0 \end{cases}$

$g(x) = \begin{cases} -2x, & x < 0 \\ 0, & x \geq 0 \end{cases}$

$g \circ f = g(f(x)) = \begin{cases} 0, & x < 0 \\ 0, & x \geq 0 \end{cases}$

$f \circ g = f(g(x)) = \begin{cases} 0, & x < 0 \\ 0, & x \geq 0 \end{cases}$

$g \circ f = f \circ g = 0$

b) $2x^2 - xy - 3y^2 - 6x + 19y - 20 = 0$

$a = 2,\ b = -3,\ h = -\frac{1}{2},$

$g = -3,\ f = \frac{19}{2},\ c = -20$

$bg^2 \neq af^2$

$-27 \neq 38$ (so it's intersecting)

$\tan\theta = \left|\frac{2\sqrt{h^2 - ab}}{a+b}\right|$

$\theta = \tan^{-1}\left|\frac{2\sqrt{1/4 + 6}}{-1}\right|$

$\theta = \tan^{-1}(5)$

42) a) $\frac{x}{(x^2+1)(x-1)(x+2)}$

$\frac{Ax+B}{x^2+1} + \frac{C}{x-1} + \frac{D}{x+2}$

if $x = 1 \Rightarrow C = 1/6$

if $x = -2 \Rightarrow D = \frac{2}{15}$

if $x = 0 \Rightarrow B = 1/10$

$\Rightarrow A = -3/10$

$-\frac{3x+1}{10(x^2+1)} + \frac{1}{6(x-1)} + \frac{2}{15(x+2)}$

b) $5\hat{i} + 6\hat{j} + 7\hat{k}$

$7\hat{i} - 8\hat{j} + 9\hat{k}$

$3\hat{i} + 20\hat{j} + 5\hat{k}$

$5\hat{i} + 6\hat{j} + 7\hat{k} = s(7\hat{i} - 8\hat{j} + 9\hat{k}) + t(3\hat{i} + 20\hat{j} + 5\hat{k})$

$7s + 3t = 5$

$-8s + 20t = 6$

$9s + 5t = 7$

$s = t = 1/2$, satisfies

linear combination, vectors are coplanar.

43) a) $1.2 + 2.3 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3}$

$P(1) = 2 = 2$

P(1) is true

$P(k) = 1.2 + 2.3 + \dots + k(k+1) = \frac{k(k+1)(k+2)}{3}$

$P(k+1) = 1.2 + 2.3 + \dots + (k+1)(k+2) = \frac{(k+1)(k+2)(k+3)}{3}$

$\frac{k(k+1)(k+2)}{3} + (k+1)(k+2)$

$= \frac{(k+1)(k+2)(k+3)}{3}$

b) $\int \frac{3x+5}{x^2+4x+7}\,dx$

$3x + 5 = A\frac{d}{dx}(x^2+4x+7) + B$

$3x + 5 = A(2x+4) + B$

$A = \frac{3}{2},\ B = -1$

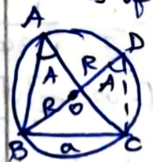
$= \frac{3}{2}\int \frac{2x+4}{x^2+4x+7}\,dx - \int \frac{dx}{x^2+4x+7}$

$= \frac{3}{2}\log|x^2+4x+7| - \int \frac{dx}{(x+2)^2 + (\sqrt{3})^2}$

$= \frac{3}{2}\log|x^2+4x+7| - \frac{1}{\sqrt{3}}\tan^{-1}\left(\frac{x+2}{\sqrt{3}}\right) + C$

44) a) In any triangle, the lengths of the sides are proportional to the sines of opp. angles.

In ΔABC, $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$, R is circum. radius of Δle.



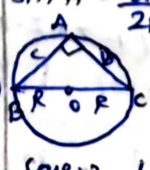
Case 1: $\angle A$ is acute

$\angle BDC = \angle BAC = A$

$\angle BCD = 90°$

$\sin\angle BDC = \frac{BC}{BD}$ (or)

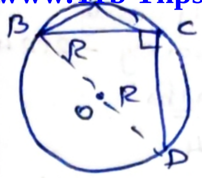
$\sin A = \frac{a}{2R} \Rightarrow \frac{a}{\sin A} = 2R$



Case 2: $\angle A$ is right angle

$\frac{a}{\sin A} = \frac{BC}{\sin 90°}$

$\frac{a}{\sin A} = 2R$



Case 3: $\angle A$ is obtuse

$\angle BDC + \angle BAC = 180°$

$\angle BDC = 180° - A$

$\angle BCD = 90°$

$\sin\angle BDC = \frac{BC}{BD}$

$\sin(180° - A) = \frac{a}{2R}$

$\frac{\sin A}{a} = \frac{1}{2R}$

$\frac{a}{\sin A} = 2R$

Similarly,

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = 2R$

b) $\sqrt{\frac{1-x}{1+x}}$ × & ÷ by $(1-x)$

$\sqrt{\frac{(1-x)(1-x)}{(1+x)(1-x)}}$

$\frac{1-x}{\sqrt{1-x^2}}$

$(1-x)(1-x^2)^{-1/2}$

$(1-x)\left[1 + \frac{1}{2}x^2 + \frac{(\frac{1}{2})(\frac{1}{2}+1)}{2!}(x^2)^2 \dots\right]$

$(1-x)\left[1 + \frac{x^2}{2} + \frac{3}{8}x^4 + \dots\right]$

$\Rightarrow \left(1 - x + \frac{x^2}{2}\right)$

45) a) $\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$

Taking a unit circle,

 → Area $= \frac{\tan\theta}{2}$

 → Area $= \frac{\theta}{2}$

 → Area $= \frac{\sin\theta}{2}$

By area property,

$\frac{\tan\theta}{2} \geq \frac{\theta}{2} \geq \frac{\sin\theta}{2}$

× by $\frac{2}{\sin\theta}$,

$\frac{1}{\cos\theta} \geq \frac{\theta}{\sin\theta} \geq 1$

$\cos\theta \leq \frac{\sin\theta}{\theta} \leq 1$

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$\cos(-\theta) = \cos\theta$

$\dfrac{\sin(-\theta)}{-\theta} = \dfrac{\sin\theta}{\theta}$

Valid for θ in $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

Taking $\lim\limits_{\theta\to 0}$

$\lim\limits_{\theta\to 0} \cos\theta \le \lim\limits_{\theta\to 0} \dfrac{\sin\theta}{\theta} \le \lim\limits_{\theta\to 0} 1$

$1 \le \lim\limits_{\theta\to 0} \dfrac{\sin\theta}{\theta} \le 1$

$\lim\limits_{\theta\to 0} \dfrac{\sin\theta}{\theta} = 1$

b) $n(S) = 36$

(i) P(getting sum 7)

$P(A) = \dfrac{6}{36} = \boxed{\dfrac{1}{6}}$

(ii) P(getting sum 7 or 9)

$P(A \text{ or } B) = P(A\cup B)$

$= P(A)+P(B) = \dfrac{6}{36} + \dfrac{4}{36}$

$= \boxed{\dfrac{5}{18}}$

(iii) P(getting sum 7 or 12)

$= P(A \text{ or } C) = P(A\cup C)$

$= P(A)+P(C)$

$= \dfrac{6}{36} + \dfrac{1}{36} = \boxed{\dfrac{7}{36}}$

46) a) $A^T = \begin{bmatrix} 4 & 5 \\ -1 & 0 \\ 2 & 3 \end{bmatrix}$

$B = \begin{bmatrix} 2 & -1 & 1 \\ 7 & 5 & -2 \end{bmatrix}$

$A = \begin{bmatrix} 4 & -1 & 2 \\ 5 & 0 & 3 \end{bmatrix}$

(i) $(A+B)^T = A^T + B^T$

$A+B = \begin{bmatrix} 6 & -2 & 3 \\ 12 & 5 & 1 \end{bmatrix}$

$\boxed{(A+B)^T = \begin{bmatrix} 6 & 12 \\ -2 & 5 \\ 3 & 1 \end{bmatrix}}$

$B^T = \begin{bmatrix} 2 & 7 \\ -1 & 5 \\ 1 & -2 \end{bmatrix}$

$\boxed{A^T + B^T = \begin{bmatrix} 6 & 12 \\ -2 & 5 \\ 3 & 1 \end{bmatrix}}$

(ii) $(B^T)^T = B$

$(B^T)^T = \begin{bmatrix} 2 & -1 & 1 \\ 7 & 5 & -2 \end{bmatrix}$

$= B$

b) $y = \dfrac{\sin^{-1}x}{\sqrt{1-x^2}}$

$y_1 = \dfrac{\sqrt{1-x^2}\left(\frac{1}{\sqrt{1-x^2}}\right) - \sin^{-1}(x)\left(\frac{1}{2}\right)(1-x^2)^{-1/2}(-2x)}{1-x^2}$

$y_1 = \dfrac{1 + \dfrac{x\sin^{-1}x}{\sqrt{1-x^2}}}{1-x^2}$

$(1-x^2)y_1 = 1 + xy$

$(1-x^2)y_2 + y_1(-2x) = xy_1 + y(1)$

$(1-x^2)y_2 - 3xy_1 - y = 0$

47) a) $\begin{vmatrix} 1 & x^2 & x^3 \\ 1 & y^2 & y^3 \\ 1 & z^2 & z^3 \end{vmatrix} =$

$(x-y)(y-z)(z-x)$

$(xy+yz+zx)$

Sub $x = y$

$|A| = \begin{vmatrix} 1 & y^2 & y^3 \\ 1 & y^2 & y^3 \\ 1 & z^2 & z^3 \end{vmatrix} = 0$

$(x-y)$ is a factor,

sub $y = z$

$|A| = \begin{vmatrix} 1 & x^2 & x^3 \\ 1 & y^2 & y^3 \\ 1 & y^2 & y^3 \end{vmatrix} = 0$

$(y-z)$ is a factor,

ly, $(z-x)$ is a factor.

$m = 5-3 = \boxed{2}$

$\begin{vmatrix} 1 & x^2 & x^3 \\ 1 & y^2 & y^3 \\ 1 & z^2 & z^3 \end{vmatrix} =$

$k(x^2+y^2+z^2) +$

$l(xy+yz+zx) +$

$(x-y)(y-z)(z-x)$

put $x=0, y=1, z=2$

$5k + 2l = 2 \rightarrow (1)$

put $x=0, y=-1, z=1$

$2k - l = -1 \rightarrow (2)$

solving (1) & (2) $k=0$, $l=1$

$= (x-y)(y-z)(z-x)(xy+yz+zx)$

b) $P(A_1) = \dfrac{5}{5+3+2} = \boxed{\dfrac{5}{10}}$

$P(A_2) = \boxed{\dfrac{3}{10}}$

$P(A_3) = \boxed{\dfrac{2}{10}}$

$P(B/A_1) = 0.4$

$P(B/A_2) = 0.5$

$P(B/A_3) = 0.3$

$P(A_2/B) = \dfrac{P(A_2).P(B/A_2)}{P(A_1)P(B/A_1) + P(A_2)P(B/A_2) + P(A_3)P(B/A_3)}$

$= \dfrac{\frac{3}{10}\times 0.5}{\frac{5}{10}\times 0.4 + \frac{3}{10}\times 0.5 + \frac{2}{10}\times 0.3}$

$= \boxed{\dfrac{15}{41}}$

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11 P

Register No.

Half Yearly Examination - 2024
MATHEMATICS

Time : 3.00 Hrs. Marks : 90

PART - I

i) Answer all the questions. **20 x 1 = 20**

1. If $n((A \times B) \cap (A \times C)) = 8$ and $n(B \cap C) = 2$ then $n(A)$ is a) 4 b) 6 c) 8 d) 16
2. If the determinant is positive then the nature of roots are
   a) real and distinct b) real and equal c) no real roots d) none of these
3. Let $x = \{1, 2, 3, 4\}$ $y = \{a, b, c, d\}$ $f = \{(1, a)\ (4, b)\ (2, c)\ (3, d)\ (2, d)\}$. Then f is
   a) an one-to-one function b) not a function c) an onto function d) a function which is not one-to-one
4. The value of $\log_{\sqrt{2}} 512$ is a) 16 b) 18 c) 9 d) 12
5. $\cos 1^0 + \cos 2^0 + \cos 3^0 + ... + \cos 179^0 =$ a) 1 b) –1 c) 0 d) 89
6. In ${}^{2n}C_3 : {}^{n}C_3 = 11 : 1$ then n is a) 5 b) 6 c) 11 d) 7
7. The HM of two positive numbers whose AM and GM are 16, 8 respectively is a) 10 b) 6 c) 5 d) 4
8. The image of the point (2, 3) in the line $y = -x$ is a) (–3, 2) b) (–2, –3) c) (–2, 3) d) (–3, –2)
9. The value of $\frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + ...$ is a) $\frac{e^2+1}{2^e}$ b) $\frac{(e-1)^2}{2e}$ c) $\frac{e^2+1}{2e}$ d) $\frac{(e+1)^2}{2e}$
10. If the point (8, –5) lies on the locus $\frac{x^2}{16} - \frac{y^2}{25} = k$, then the value of k is a) 0 b) 1 c) 2 d) 3
11. If $|\vec{a} + \vec{b}| = |\vec{a} - \vec{b}|$ then
    a) $\vec{a}$ and $\vec{b}$ are parallel b) $\vec{a}$ and $\vec{b}$ are unit vectors c) $\vec{a}$ and $\vec{b}$ are perpendicular d) None of these
12. If $A = \begin{bmatrix} a & x \\ y & a \end{bmatrix}$ and if $xy = 1$, then $\det(AA^T)$ is equal to a) $(a-1)^2$ b) $(a^2+1)^2$ c) $a^2 - 1$ d) $(a^2-1)^2$
13. The unit vector parallel to the resultant of the vectors $\hat{i} + \hat{j} - \hat{k}$ and $\hat{i} - 2\hat{j} + \hat{k}$ is
    a) $\frac{\hat{i} - \hat{j} + \hat{k}}{\sqrt{5}}$ b) $\frac{2\hat{i} + \hat{j}}{\sqrt{5}}$ c) $\frac{2\hat{i} - \hat{j} + \hat{k}}{\sqrt{5}}$ d) $\frac{2\hat{i} - \hat{j}}{\sqrt{5}}$
14. If $\lambda\hat{i} + 2\lambda\hat{j} + 2\lambda\hat{k}$ is a unit vector, then the value of λ is a) $\frac{1}{4}$ b) $\frac{1}{9}$ c) $\frac{1}{2}$ d) $\frac{1}{3}$
15. $\lim_{x \to 0} \frac{\sin 4x}{x}$ a) 4 b) $\frac{1}{4}$ c) 0 d) 1
16. If $y = \frac{1}{a-z}$ then $\frac{dz}{dy}$ is a) $(a-z)^2$ b) $-(z-a)^2$ c) $(z+a)^2$ d) $-(z+a)^2$
17. $\lim_{\theta \to 0} \frac{\sin\sqrt{\theta}}{\sqrt{\sin\theta}}$ a) 1 b) –1 c) 0 d) 2
18. $\int \sqrt{\frac{1-x}{1+x}}\, dx$ is a) $\sqrt{1-x^2} + \sin^{-1}x + c$ b) $\sin^{-1}x - \sqrt{1-x^2} + c$ c) $\sqrt{1-x^2} + \log|x + \sqrt{1-x^2}| + c$
    d) $\log|x + \sqrt{1-x^2}| - \sqrt{1-x^2} + c$
19. $\int \tan x\, dx$ a) log secx + c b) $\sec^2 x + c$ c) secxtanx + c d) logsinx + c
20. Ten coins are tossed the probability of getting atleast 8 heads is a) $\frac{7}{64}$ b) $\frac{7}{32}$ c) $\frac{7}{16}$ d) $\frac{7}{128}$

PART - II

Note : 1) Answer any seven 2) Q.No.30 is compulsory. **7 x 2 = 14**

21. If $A = \{1, 2, 3, 4\}$ and $B = \{3, 4, 5, 6\}$ find $n\{(A \cup B) \times (A \cap B) \times (A \Delta B)\}$
22. Find the zeros of the polynomial function $f(x) = 4x^2 - 25$.
23. Show that $\tan(45^0 + A) = \frac{1+\tan A}{1-\tan A}$
24. Find the number of ways of arranging the letters of the word BANANA.
25. Find the equation of the line passing through the point (1, 1) and (–2, 3)
26. Find $\vec{a}.\vec{b}$ when $\vec{a} = \hat{i} - \hat{j} + 5\hat{k}$, $\vec{b} = 3\hat{i} - 2\hat{k}$
27. Differentiate : $y = e^{\sin x}$

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28. If A and B are mutually exclusive events P(A) = $\frac{3}{8}$ and P(B) = $\frac{1}{8}$ then find (i) $P(\overline{A})$ (ii) P(AUB)

29. Calculate $\lim_{x \to 3} (x^3 - 2x + 6)$

30. $\int (6x^2 + 8)\, dx$ - Integrate.

PART - III

Note : i) Answer any seven 2) Q.No.40 is compulsory. **7 x 3 = 21**

31. Find the range of the function $f(x) = \frac{1}{1 - 3\cos x}$

32. If $\frac{\log x}{y - z} = \frac{\log y}{z - x} = \frac{\log z}{x - y}$ then prove that xyz = 1.

33. Find the value of n if $\frac{1}{8!} + \frac{1}{9!} = \frac{n}{10!}$

34. Write the first 6 terms of the sequences whose n^{th} term $a_n = \begin{cases} 1 & \text{if } n = 1 \\ 2 & \text{if } n = 2 \\ a_{n-1} + a_{n-2}, & \text{if } n > 2 \end{cases}$

35. Find the area of the triangle whose vertices are (–2, –3), (3, 2) and (–1, –8)

36. Find a direction ratio and direction cosines of $3\hat{i} + 4\hat{j} - 6\hat{k}$

37. Compute $\lim_{x \to 1} \frac{\sqrt{x} - 1}{x - 1}$

38. If $f''(x) = 12x - 6$ and $f(1) = 30$, $f'(1) = 5$ find f(x).

39. Find the values of other five trigonometric functions for $\cos\theta = \frac{2}{3}$, θ lies in the I quadrant.

40. Find $\frac{dy}{dx}$ if $x = at^2$, $y = 2at$, $t \neq 0$.

PART - IV

Answer all questions **7 x 5 = 35**

41. a) If f, g : R $\to$ R are defined by f(x) = |x| + x and g(x) = |x| – x. Find fog and gof. **(OR)**

b) Show that the equation $2x^2 - xy - 3y^2 - 6x + 19y - 20 = 0$ represents a pair of interesting lines. Show further that the angle between them is $\tan^{-1}(5)$.

42. a) Resolve into partial fractions : $\frac{x}{(x^2 + 1)(x - 1)(x + 2)}$ **(OR)**

b) Show that the vectors $5\hat{i} + 6\hat{j} + 7\hat{k}$, $7\hat{i} - 8\hat{j} + 9\hat{k}$, $3\hat{i} + 20\hat{j} + 5\hat{k}$ are coplanar.

43. a) Using the mathematical induction, prove that, for $n \geq 1$. $1.2 + 2.3 + 3.4 + ... + n(n + 1) = \frac{n(n+1)(n+2)}{3}$ **(OR)**

b) Evaluate $\int \frac{3x + 5}{x^2 + 4x + 7}\, dx$

44. a) State and prove sine formula. **(OR)** b) Prove that $\sqrt{\frac{1 - x}{1 + x}}$ is approximately equal to $1 - x + \frac{x^2}{2}$ when x is very small.

45. a) Prove that $\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$ **(OR)**

b) When a pair of fair dice is rolled, what are the probabilities of getting the sum i) 7 ii) 7 or 9 iii) 7 or 12?

46. a) If $A^T = \begin{bmatrix} 4 & 5 \\ -1 & 0 \\ 2 & 3 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 & 1 \\ 7 & 5 & -2 \end{bmatrix}$ verify (i) $(A + B)^T = A^T + B^T$ ii) $(B^T)^T = B$ **(OR)**

b) If $y = \frac{\sin^{-1} x}{\sqrt{1 - x^2}}$, show that $(1 - x^2) y_2 - 3xy_1 - y = 0$

47. a) Prove that $\begin{vmatrix} 1 & x^2 & x^3 \\ 1 & y^2 & y^3 \\ 1 & z^2 & z^3 \end{vmatrix} = (x - y)(y - z)(z - x)(xy + yz + zx)$ **(OR)**

b) The chances of A, B and C becoming manager of a certain company are 5 : 3 : 2. The probabilities that the office canteen will be improved if A, B and C become managers are 0.4, 0.5 and 0.3 respectively. If the office canteen has been improved, what is the probability that B was appointed as the manager?

Kindly Send Me Your Key Answer to Our email id - Padasalai.net@gmail.com