# SETHU BHASKARA MATRIC. HR. SEC. SCHOOL, PUDUR

## COMMON QUARTERLY EXAM – SEPTEMBER - 2022

STD : XII

## MATHEMATICS

### PART – A

$20 \times 1 = 20$

| | | | |
|---|---|---|---|
| 1) | b) $-80$ | 11) | b) unique solution |
| 2) | b) $adj(AB) = (adj A)(adj B)$ | 12) | b) $\frac{1}{\sqrt{5}}$ |
| 3) | d) $\lambda = 7, \mu = -5$ | 13) | c) 10 |
| 4) | a) $\frac{3}{2} - 2i$ | 14) | d) 9 |
| 5) | b) Imaginary axis | 15) | a) $2ab$ |
| 6) | c) $x^2 + y^2$ | 16) | c) $(5, -2)$ |
| 7) | a) $-\frac{q}{r}$ | 17) | a) $\lvert\vec{a}\rvert \lvert\vec{b}\rvert \lvert\vec{c}\rvert$ |
| 8) | d) $\lvert k\rvert \geq 6$ | 18) | a) $\frac{\pi}{6}$ |
| 9) | c) $a < 0$ or M.A | 19) | a) 81 |
| 10) | c) $[-2, -\sqrt{2}] \cup [\sqrt{2}, 2]$ or M.A | 20) | b) 1 |

### PART – B

| | Marks | | MARKS |
|---|---|---|---|
| 21) $\lvert A\rvert = 0$ | | 22) Let $z = \frac{10-5i}{6+2i}$ | |
| $\begin{vmatrix} 4 & 3 & 1 \\ -3 & -1 & -2 \\ 6 & \lambda & -1 \end{vmatrix} = 0$ | ½ | $z = \frac{10-5i}{6+2i} \times \frac{6-2i}{6-2i}$ | ½ |
| $4 + 8\lambda - 45 - 3\lambda + 6 = 0$ | | $= \frac{50-50i}{40}$ | 1 |
| $5\lambda = 35$ | ½ | $= \frac{5}{4} - \frac{5}{4}i$ | ½ |
| $\lambda = 7$ | 1 | | |

MARKS

23) $|3z-5+i| = 4$

$|z - \frac{5}{3} + i/3| = 4/3$ — ½

$|z - (\frac{5}{3} - i/3)| = 4/3$ — ½

centre $= 5/3 - i/3$

(or) — ½

$= (5/3, -1/3)$

radius $= 4/3$ — ½

24) $p(x) = x^9 - 5x^8 - 14x^7 = 0$

$+, -, -$

$p(x)$ has one sign changes — ½

$p(x)$ has one positive root — ½

$p(-x) = -x^9 - 5x^8 + 14x^7$

$-, -, +$

$p(x)$ has one sign change — ½

$p(x)$ has one negative root — ½

25) $x^2 + 2(k+2)x + 9k = 0$

It has equal roots

$b^2 - 4ac = 0$

$4(k+2)^2 - 4(1)(9k) = 0$ — ½

$k^2 + 4k + 4 - 9k = 0$

$k^2 - 5k + 4 = 0$ — ½

$k = 1$ or $k = 4$ — 1

26) $\tan^{-1}(\tan(-\pi/6))$ — ½

$= -\frac{\pi}{6} \in (-\frac{\pi}{2}, \frac{\pi}{2})$ — 1½

27) $\sin^{-1}(\sin 10)$

$\sin 10 = \sin(3\pi + (10 - 3\pi))$

$= \sin(\pi + (10 - 3\pi))$

$= -\sin(10 - 3\pi)$

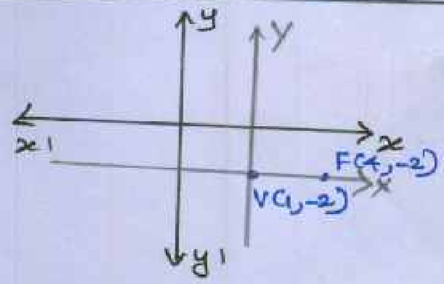
$= \sin(3\pi - 10)$ — 1

$\sin^{-1}(\sin 10) = 10 \notin [-\pi/2, \pi/2]$

$\sin^{-1}(\sin(3\pi - 10))$

$= 3\pi - 10 \in [-\pi/2, \pi/2]$ — 1

28)




— ½

The parabola is open rightwards with vertex $(1, -2)$

$(y+2)^2 = 4a(x-1)$ — ① — ½

$VF = a = 3$ — ½

$\therefore$ The equation of parabola is

$(y+2)^2 = 12(x-1)$ — ½

| | MARKS | | MARKS |
|---|---|---|---|
| 29) $\vec{F_1} = 2\hat{i}+5\hat{j}+6\hat{k}$ <br> $\vec{F_2} = -\hat{i}-2\hat{j}-\hat{k}$ <br> $\vec{F} = \vec{F_1}+\vec{F_2}$ <br> $\vec{F} = \hat{i}+3\hat{j}+5\hat{k}$ | ½ | 30) Let $\vec{a} = x\hat{i}+y\hat{j}+z\hat{k}$ <br> $\vec{a}\cdot\hat{i} = x$, $\vec{a}\cdot\hat{j} = y$, $\vec{a}\cdot\hat{k} = z$ | ½ |
| $\vec{d} = \vec{AB} = \vec{OB}-\vec{OA}$ <br> $\vec{d} = 2\hat{i}+4\hat{j}-\hat{k}$ | ½ | LHS $= \hat{i}\times(\vec{a}\times\hat{i})+\hat{j}\times(\vec{a}\times\hat{j}) + \hat{k}\times(\vec{a}\times\hat{k})$ <br> $= (\hat{i}\cdot\hat{i})\vec{a}-(\vec{a}\cdot\hat{i})\hat{i} + (\hat{j}\cdot\hat{j})\vec{a}-(\vec{a}\cdot\hat{j})\hat{j} + (\hat{k}\cdot\hat{k})\vec{a}-(\vec{a}\cdot\hat{k})\hat{k}$ | ½ |
| Work done $= \vec{F}\cdot\vec{d}$ <br> $= 2+12-5 = 9$ | 1 | $= 3\vec{a}-\vec{a} = 2\vec{a}$ | 1 |

## PART-C

| | MARKS | | MARKS |
|---|---|---|---|
| 31) $A = \begin{bmatrix} 1 & 1 & 1 & 3 \\ 2 & -1 & 3 & 4 \\ 5 & -1 & 7 & 11 \end{bmatrix}$ | | $A^2-3A-7I_2$ <br> $= \begin{bmatrix} 22 & 9 \\ -3 & 1 \end{bmatrix} - \begin{bmatrix} 15 & 9 \\ -3 & -6 \end{bmatrix} - \begin{bmatrix} 7 & 0 \\ 0 & 7 \end{bmatrix}$ | 1 |
| $\sim \begin{bmatrix} 1 & 1 & 1 & 3 \\ 0 & -3 & 1 & -2 \\ 0 & -6 & 2 & -4 \end{bmatrix}$ <br> $R_2 \to R_2-2R_1$ <br> $R_3 \to R_3-5R_1$ | 1 | $= \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix} = O$ <br> $A^{-1} = \frac{1}{\lvert A\rvert}\,\text{adj}\,A$ | ½ |
| $\sim \begin{bmatrix} 1 & 1 & 1 & 3 \\ 0 & -3 & 1 & -2 \\ 0 & 0 & 0 & 0 \end{bmatrix}$ <br> $R_3 \to R_3-2R_2$ | 1 | $A^{-1} = -\frac{1}{7}\begin{bmatrix} -2 & -3 \\ 1 & 5 \end{bmatrix}$ | 1 |
| $\rho(A) = 2$ | 1 | 33) $\lvert z\rvert = 3$ <br> $z_1 = z$, $z_2 = 6-8i$ <br> $\lvert z_1\rvert = 3$ $\lvert z_2\rvert = 10$ | 1 |
| 32) $A = \begin{bmatrix} 5 & 3 \\ -1 & -2 \end{bmatrix}$ | | $\lvert\lvert z_1\rvert-\lvert z_2\rvert\rvert \le \lvert z_1+z_2\rvert \le \lvert z_1\rvert+\lvert z_2\rvert$ <br> $\lvert 3-10\rvert \le \lvert z+6-8i\rvert \le 3+10$ | 1 |
| $A^2 = \begin{bmatrix} 22 & 9 \\ -3 & 1 \end{bmatrix}$ | ½ | $7 \le \lvert z+6-8i\rvert \le 13$ | 1 |

MARKS

34) $\omega^3 = 1$

$$LHS = \frac{a+b\omega+c\omega^2}{b+c\omega+a\omega^2} + \frac{a+b\omega+c\omega^2}{c+a\omega+b\omega^2}$$

$$= \frac{a\omega^3+b\omega+c\omega^2}{a\omega^2+b+c\omega} + \frac{a+b\omega+c\omega^2}{a\omega+b\omega^2+c\omega^3}$$ 1

$$= \omega + \frac{1}{\omega} = \omega + \omega^2$$ 1

$$= \omega + \omega^2 = -1$$ 1

36)

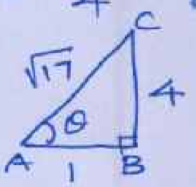
$$\cos^{-1}\left(\frac{1}{2}\right) + \sin^{-1}(-1)$$

$$= \frac{\pi}{3} - \frac{\pi}{2} = \frac{2\pi - 3\pi}{6}$$ 2

$$= -\pi/6$$ 1

37) $\cot^{-1}\left(\frac{1}{4}\right) = \theta$

$$\cot\theta = \frac{1}{4} = \frac{adj}{oppo}$$ ½




½

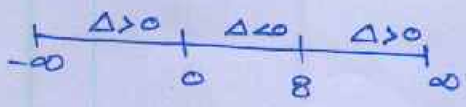
$$AC^2 = AB^2 + BC^2$$
$$= 1 + 16$$ 1
$$AC = \sqrt{17}$$

$$\cos\theta = \frac{adj}{hypo} = \frac{1}{\sqrt{17}}$$ 1

MARKS

35) $2x^2 + kx + k = 0$

$$b^2 - 4ac = k^2 - 8k$$
$$= k(k-8)$$ 1




½

$\Delta = 0$, The roots are real and equal $k=0, k=8$ ½

$\Delta < 0$, The roots are imaginary $0<k<8$ ½

$\Delta > 0$, The roots are real and distincts ½
$-\infty < k < 0,\ 8 < k < \infty$

38)

$$2x^2 + 2y^2 - 6x + 4y + 2 = 0$$
$\div 2$
$$x^2 + y^2 - 3x + 2y + 1 = 0$$
$2g = -3 \qquad 2f = 2,\ c = 1$ 1
$g = -3/2 \qquad f = 1$

centre $= (-g, -f)$
$= (3/2, -1)$ 1

radius $= \sqrt{g^2+f^2-c}$
$= \sqrt{\frac{9}{4}+1-1}$ 1
$= \frac{3}{2}$

MARKS

39)

$l_1 = 5m+2, \; m_1 = -5, \; n_1 = 1$ — 1

$l_2 = 1, \; m_2 = 2m, \; n_2 = 3$

Given Lines are $\perp^r$

$l_1 l_2 + m_1 m_2 + n_1 n_2 = 0$

$5m + 2 - 10m + 3 = 0$ — 1

$-5m = -5$

$m = 1$ — 1

MARKS

40) $\left.\begin{aligned} \vec{b} &= \hat{i} + 2\hat{j} - 2\hat{k} \\ \vec{n} &= 6\hat{i} + 3\hat{j} + 2\hat{k} \end{aligned}\right\}$ — ½

$\vec{b} \cdot \vec{n} = 6 + 6 - 4 = 8$ — ½

$\left.\begin{aligned} |\vec{b}| &= \sqrt{9} = 3 \\ |\vec{n}| &= \sqrt{49} = 7 \end{aligned}\right\} \longrightarrow$ 1

$\sin\theta = \left| \dfrac{\vec{b} \cdot \vec{n}}{|\vec{b}|\,|\vec{n}|} \right|$

$\theta = \sin^{-1}\left(\dfrac{8}{21}\right)$ — 1

## PART – IV

41) a)

$$[A, B] = \begin{bmatrix} 1 & 2 & 1 & 7 \\ 1 & 1 & \lambda & \mu \\ 1 & 3 & -5 & 5 \end{bmatrix}$$

$$\sim \begin{bmatrix} 1 & 2 & 1 & 7 \\ 0 & 1 & -6 & -2 \\ 0 & 0 & \lambda - 7 & \mu - 9 \end{bmatrix}$$ — 2

$R_2 \to R_2 - R_1, \; R_3 \to R_3 - R_1$

$R_3 \to R_3 + R_2$

(i) no solution:

$\lambda = 7$ and $\mu \neq 9$ — 1

(ii) unique solution

$\lambda \neq 7, \; \mu \in \mathbb{R}$ — 1

(iii) an Infinite number of solutions — 1

$\lambda = 7$ and $\mu = 9$

41) (b)

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 6 & -4 & 5 \\ 5 & 2 & 2 \end{bmatrix}$$

$|A| = 27 \neq 0$ — ½

$$\text{adj}A = \begin{bmatrix} -18 & 0 & 9 \\ 13 & -3 & 1 \\ 32 & 3 & -10 \end{bmatrix}$$ — 1½

$A^{-1} = \dfrac{1}{|A|} \text{adj}A$

$X = A^{-1} B$

$$X = \frac{1}{27} \begin{bmatrix} 81 \\ -54 \\ 27 \end{bmatrix}$$ — 2

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 3 \\ -2 \\ 1 \end{bmatrix}$$

$x = 3, \; y = -2, \; z = 1$ — 1

MARKS

42) a) $\frac{2z+1}{iz+1} = \frac{2(x+iy)+1}{ix-y+1}$ 1

$= \frac{(2x+1)+i2y}{(1-y)+ix} \times \frac{(1-y)-ix}{(1-y)-ix}$ 1

$Im\left[\frac{2z+1}{iz+1}\right] = 0$

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

$-2x^2-x+2y-2y^2=0$ 1

(−)

$2x^2+2y^2+x-2y=0$ 1

43) a)

$6x^4-35x^3+62x^2-35x+6=0$

| | | | | | |
|---|---|---|---|---|---|
| 2 | 6 | −35 | 62 | −35 | 6 |
| | 0 | 12 | −46 | 32 | −6 |
| 1/2 | 6 | −23 | 16 | −3 | 0 |
| | 0 | 3 | −10 | 3 | |
| 3 | 6 | −20 | 6 | 0 | |
| | 0 | 18 | −6 | | |
| | 6 | −2 | 0 | | |

1 1 1 1

$\therefore\ x=2,\ x=\frac{1}{2}$

$x=3,\ x=\frac{1}{3}$ 1

MARKS

42) (b) $z^3+8i=0$

$z^3=-8i$

$z=-2\left[\cos\frac{\pi}{2}+i\sin\frac{\pi}{2}\right]^{1/3}$ 1

$z=-2\left[cis\left(2k\pi+\frac{\pi}{2}\right)\right]^{1/3}$ ½

$z=-2\ cis\left(\frac{4k\pi+\pi}{6}\right)$ ½

$k=0,1,2$

$\underline{\underline{k=0}}$

$z=\sqrt{3}-i$ or $-2\ cis\ \frac{\pi}{6}$ 1

$\underline{k=1}$ $z=2i=-2\ cis\ \frac{5\pi}{6}$ 1

$k=2$ $z=-\sqrt{3}-i$

$z=-2\ cis\ \frac{9\pi}{6}$ 1

43) b) $lx^2+nx+n=0$

$p+q=\frac{-n}{l},\quad pq=\frac{n}{l}$ 1

$LHS=\sqrt{\frac{p}{q}}+\sqrt{\frac{q}{p}}+\sqrt{\frac{n}{l}}$

$=\frac{\sqrt{p}}{\sqrt{q}}+\frac{\sqrt{q}}{\sqrt{p}}+\frac{\sqrt{n}}{\sqrt{l}}$ 1

$=\frac{p+q}{\sqrt{pq}}+\sqrt{\frac{n}{l}}$ 1

$=-\sqrt{\frac{n}{l}}+\sqrt{\frac{n}{l}}$ 1

$=0$ 1

MARKS

44) a

$\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = \pi$

$\cos^{-1}x + \cos^{-1}y = \pi - \cos^{-1}z$ 1

$\cos^{-1}\left[xy - \sqrt{1-x^2}\sqrt{1-y^2}\right] = \cos^{-1}(-z)$ 1

$\Rightarrow xy - \sqrt{1-x^2}\sqrt{1-y^2} = -z$

$xy + z = \sqrt{1-x^2}\sqrt{1-y^2}$ 1

$x^2y^2 + z^2 + 2xyz = 1 - y^2 - x^2 + x^2y^2$ 1

$x^2 + y^2 + z^2 + 2xyz = 1$ 1

45) a)

$x^2 + y^2 + 2gx + 2fy + c = 0$ ½

at (1, 0) ½

$2g + c = -1$ — (1)

at (−1, 0)

$-2g + c = -1$ — (2) ½

at (0, 1)

$2f + c = -1$ — (3) ½

Solve (1), (2), (3)

$g = 0, \quad f = 0, \quad c = -1$ 2

∴ The equation of circle 1

$x^2 + y^2 = 1$

MARKS

44) b)

$\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$ 1

$\tan^{-1}\left[\frac{x+y}{1-xy}\right] = \pi - \tan^{-1}(z)$ 1

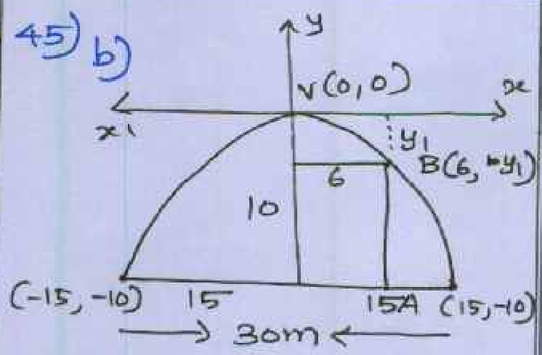
$\tan^{-1}\left[\frac{x+y}{1-xy}\right] = \tan^{-1}(-z)$ 1

$\frac{x+y}{1-xy} = -z$ 1

$x + y = -z + xyz$ 1

$x + y + z = xyz$

45) b)




1

$x^2 = -4ay$ ½

at (15, −10) 1

$a = \frac{45}{8}$ ½

$x^2 = -\frac{45}{2}y$

at (6, $-y_1$) 1

$y_1 = 1.6\,m$

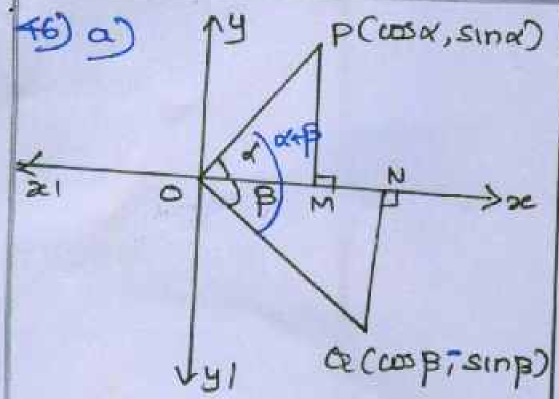
The required height is

$AB = 10 - 1.6$ 1

$= 8.4\,m$

MARKS

46) a)




1

$\overrightarrow{OP} = \cos\alpha\,\hat{i} + \sin\alpha\,\hat{j}$ 1

$\overrightarrow{OQ} = \cos\beta\,\hat{i} - \sin\beta\,\hat{j}$ 1

By the definition

$\overrightarrow{OQ} \times \overrightarrow{OP} = \sin(\alpha+\beta)\,\hat{k}$ —(1) 1

By the value

$\overrightarrow{OQ} \times \overrightarrow{OP} = [\sin\alpha\cos\beta + \cos\alpha\sin\beta]\,\hat{k}$ 1 —(2)

from (1) and (2)

$\sin(\alpha+\beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta$

MARKS

46) (b)

$$\left.\begin{aligned}\vec{a} &= -\hat{i}+2\hat{j}+0\hat{k}\\ \vec{b} &= 2\hat{i}+2\hat{j}-\hat{k}\\ \vec{v} &= \hat{i}+\hat{j}-\hat{k}\end{aligned}\right\} \longrightarrow$$ 1

P.V.E

$\vec{r} = \vec{a} + t(\vec{b}-\vec{a}) + s\vec{v}$

$\vec{r} = (-\hat{i}+2\hat{j}+0\hat{k})$
$+t(3\hat{i}+0\hat{j}-\hat{k})$ 1
$+s(\hat{i}+\hat{j}-\hat{k})$

C.E

$$\begin{vmatrix} x+1 & y-2 & z-0 \\ 3 & 0 & -1 \\ 1 & 1 & -1 \end{vmatrix} = 0$$ 1

$1(x+1) + 2(y-2) + 3z = 0$

$x + 2y + 3z - 3 = 0$ 1

N.P.V.E

$\vec{r}\cdot(\hat{i}+2\hat{j}+3\hat{k}) = 3$ 1

| | MARKS | | MARKS |
|---|---|---|---|
| 47) a) | | 47) (b) | |
| $\cos\alpha + \cos\beta + \cos\gamma = 0$ | | $\Delta = \begin{vmatrix} 3 & -4 & -2 \\ 1 & 2 & 1 \\ 2 & -5 & -4 \end{vmatrix} = -15$ | 1 |
| $\sin\alpha + \sin\beta + \sin\gamma = 0$ | | | |
| $a+b+c=0$ | | $\Delta a = \begin{vmatrix} 1 & -4 & -2 \\ 2 & 2 & 1 \\ -1 & -15 & -4 \end{vmatrix}$ | |
| $\Rightarrow a^3+b^3+c^3 = 3abc$ | | | |
| $a = e^{i\alpha}$, $b = e^{i\beta}$, $c = e^{i\gamma}$ | 1 | $= -15$ | 1 |
| $a+b+c=0$ | 1 | $\Delta b = \begin{vmatrix} 3 & 1 & -2 \\ 1 & 2 & 1 \\ 2 & -1 & -4 \end{vmatrix}$ | |
| then | | | |
| $a^3+b^3+c^3 = 3abc$ | | $= -5$ | 1 |
| $e^{i3\alpha} + e^{i3\beta} + e^{i3\gamma}$ $= 3e^{i(\alpha+\beta+\gamma)}$ | 1 | $\Delta c = \begin{vmatrix} 3 & -4 & 1 \\ 1 & 2 & 2 \\ 2 & -5 & -1 \end{vmatrix}$ | |
| | | $= -5$ | 1 |
| (i) $\cos 3\alpha + \cos 3\beta + \cos 3\gamma$ $= 3\cos(\alpha+\beta+\gamma)$ | 1 | $a=1$, $b=\frac{1}{3}$, $c=\frac{1}{3}$ | ½ |
| | | $x=1$, $y=3$, $z=3$ | ½ |
| (ii) $\sin 3\alpha + \sin 3\beta + \sin 3\gamma$ | 1 | TEACHER'S NAME & Signature | |
| $= 3\sin(\alpha+\beta+\gamma)$ | 1. | MRS. LAVANYA BALA. K | |
| | 2. | MR. S. GOPI 26/09/22 | |
| | 3. | MR. R. PRABHAHARAN | |
| | 4. | MR. T. MATHAN | |
| | 5. | MR. B. PURUSHOTHAMAN 26/09 | |
| | 6. | MRS. K. SUNDARI | |