Joint SEE Preparatory Examination- 2078

Time: 3:00 hrs **Optional Mathematics** **F.M. :** 100

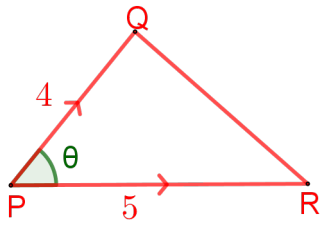
Attempt all the questions. All the working must be shown.

Group 'A' $[5 \times (1+1) = 10]$

1. (a) If $f = \{-3, 2\}$, what is f^{-1} ?
   (b) If $(x-m)$ is a factor of polynomial $a(x)$, What is the value of $a(m)$?
2. (a) Write down the notational representation of right hand limit.
   (b) Under what condition, the inverse of a matrix is possible?
3. (a) Define parabola with example.
   (b) If A (x_1, y_1) and $B(x_2, y_2)$ are the ends of the diameter then what is the equation of the such circle.
4. (a) Convert $cos2A$ in terms of $sinA$.
   (b) If $P+Q+R = \pi^c$, express $\sin(P+Q)$ in terms of angle R
5. (a) What do m and n represent in the section formula $\overrightarrow{OP} = \dfrac{m\vec{b} + n\vec{a}}{m+n}$
   (b) Find the single transformation under the reflection on x-axis is followed by y-axis.

Group 'B' $[13 \times 2 = 26]$

6. (a) If $f : x \to 2x + 3$, find the value of $f^{-1}(x)$.
   (b) Find the 20^{th} term from the end of an arithmetic sequence $3, 7, 11, ...407$.
   (c) Show inequatity $4x + 5y > -2$ in a graph.
7. (a) If $M = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix}$, find M^{-1}.
   (b) If the inverse of matrix $A = \begin{bmatrix} 1 & -2 \\ 0 & x \end{bmatrix}$ is the matrix $B = \begin{bmatrix} 1 & 4 \\ y & 2 \end{bmatrix}$, determine the value of x and y.
8. (a) If the straight lines $2x + 3y + 6 = 0$ and $ax = 5y - 20$ are perpendicular to each other, find the value of a.
   (b) Find the value of m when the centre of the circle with equation $x^2 + y^2 - mx + 6y - 12 = 0$ is $(-2, -3)$.
9. (a) Prove that: $\dfrac{1 + \cos 2\theta + \sin 2\theta}{1 - \cos 2\theta + \sin 2\theta} = \cot\theta$
   (b) Prove that: $2\cos 70°.\cos 20° = \cos 50°$
   (c) Solve: $\sin x = \sin 2x [0 \le x \le \dfrac{\pi^c}{2}]$
10. (a) In the given triangle ΔPQR, if $\overrightarrow{PQ}.\overrightarrow{PR} = 10$ then find the value of θ.



   (b) Point C divides the live AB internally in the ratio of 3:1. If the position vectors of A and B are $\vec{i} - 3\vec{j}$ and $2\vec{i} - 5\vec{j}$ respectively, find $|\overrightarrow{AB}|$ and the position vector of point C.
   (c) In a data $Q_1 = 31$ and $Q_3 = 57$, then find the quartile deviation and its coefficient.

Group 'C' $[11 \times 4 = 44]$

11. If $h(x) = 2x + 1$ and $hog(x) = 2x - 1$ then find the value of $g^{-1}(-3)$
12. Solve graphically: $x^2 - x - 2 = 0$.
13. Prove that the thiven function is continuous at $x = 2$

$$f(x) = \begin{cases} 2x - 1 & \text{for } x < 2 \\ 3 & \text{for } x = 2 \\ x + 1 & \text{for } x > 2 \end{cases}$$

14. Solve by matrix method : $3x + 5y = 24$ and $5x = 9 + 2y$

15. Find the equation of pair of lines which are perpendicular to the lines represented by $x^2+3xy+2y^2=0$ and passing through the origin.

16. If $P+Q+R=180°$, Prove that:

$$\sin P-\sin Q+\sin R=4\sin\frac{P}{2}\cos\frac{Q}{2}\sin\frac{R}{2}$$

17. Solve: $(0° \leq \theta \leq 360°)$

$$\sqrt{3}\sin\theta+\cos\theta=\sqrt{2}$$

18. The angle of elevation of the top of an incomplete house as observed from the point on the ground is 30°. If the height of an incomplete house is 30 m. How high the house must be raised so that the angle of elevation of the top of the complete house as observed from the same point on the ground is 45° ?

19. The vertices of ΔABC are $A(2,5), B(-1,3)$ and $C(4,1)$. ΔABC is rotated through negative quarter turn about the origin and the image so obtained is enlarged by taking origin as the center and scale factor 2. Hence, find the co-ordinates of the vertices of the images of ΔABC and show the object and image on the same graph.

20. From the following data, find mean deviation from mean and its coefficient.

Class Interval	2 - 4	2 - 6	2 - 8	2 - 10	2 - 12
Frequency	7	12	16	22	30

21. Find the standard deviation of the data given below.

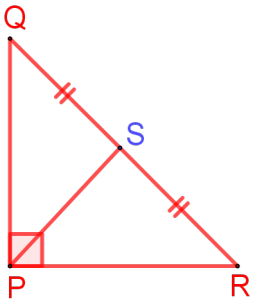
Class Interval	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Frequency	3	5	7	6	7

Group 'D' $[4 \times 5 = 20]$

22. The product of the first five terms of a geometric series is 243. If the of the geometric series is equal to the tenth term of an A.S. Find the sum of the first 19 terms of the arithmetic series

23. Find the equation of the circle which passes through the point (1, 4) and whose equations of two diameters are $x-y=1$ and $2x+3y=7$.

24. In the given triangle POR, QPR = 90 and S is a mid-point of QR, Prove by the P vector method that SP = SQ= SR



25. Find a 2×2 matrix which transform a unit square $OABC$ to a parallelogram $O_1A_1B_1C_1$ with vertices $O_1(0,0), A_1(3,0), B_1(4,1)$ and $C_1(1,1)$.

Good Luck