

SOS HERMANN GMEINER SCHOOLS, NEPAL
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 × (1 + 1) = 10]

1. (a) State the factor theorem.
(b) Find the inequality whose boundary line is $3x + 7y = 10$ and the solution set does not contain $(-2, 3)$.
2. (a) At which point the function $f(x) = \frac{2}{2x - 3}$ is discontinuity?
(b) Find the value of x , if $\begin{vmatrix} 4 & 5 \\ x & 15 \end{vmatrix} = 0$
3. (a) Write a single equation which represents both the axes.
(b) Which conic section is form if a plane intersects a cone parallel to its base?
4. (a) Express $\cos 3\lambda$ in terms of $\cos \lambda$.
(b) Express as sum or difference form: $\cos 48^\circ \cdot \sin 32^\circ$
5. (a) In which transformation does the point $(4, 5)$ map to $(-5, 4)$?
(b) Write the formula to find the angle between vectors \vec{a} and \vec{b}

Group 'B' [13 × 2 = 26]

6. (a) If $f : x \rightarrow 2x - 3$, find the value of $f^{-1}(2)$.
(b) Find the remainder when a polynomial $3x^2 - 4x + 6$ is divided by $(x + 2)$.
(c) Find the vertex of parabola $y = x^2 + 4x - 5$
7. (a) Find the inverse of matrix $\begin{pmatrix} 5 & -2 \\ 6 & 4 \end{pmatrix}$

(b) If $\begin{pmatrix} -5 & 2 \\ m & 4 \end{pmatrix}$ is a singular matrix, find the value of m .

8. (a) If the lines $3x - 4y = 12$ and $6x + py + 5 = 0$ are parallel to each other, find the value of p .
(b) Find the angle between the lines represented by $x^2 - 5xy + 4y^2 = 0$.
9. (a) Prove that: $\sin 70^\circ + \cos 70^\circ = \sqrt{2} \cos 25^\circ$
(b) If $\sin \frac{A}{3} = \frac{2}{5}$, find the value of $\sin A$.
(c) If $\sin \theta - \cos \theta = 0$, find the value of θ under $0^\circ \leq \theta \leq 360^\circ$.
10. (a) In a parallelogram $PQRS$, if $\vec{PS} = 2\vec{i} + 3\vec{j}$ and $\vec{PQ} = 4\vec{i} - 5\vec{j}$. Find \vec{PR} .
(b) If $\vec{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ and $\vec{b} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$, find the angle between \vec{a} and \vec{b} .
(c) In a continuous series $N = 30, \Sigma fm = 870$ and $\Sigma f(m - \bar{x})^2 = 11070$ then find the standard deviation and its coefficient.

Group 'C' [11 × 4 = 44]

11. Solve: $2x^3 + 6 - 3x^2 - 11x = 0$
12. Solve graphically: $x^2 - x - 2 = 0$.
13. Examine the continuity of the function

$$f(x) = \begin{cases} 1 + x & \text{for } x \leq 2 \\ 5 - x & \text{for } x > 2 \end{cases} \text{ at } x = 2$$

14. Solve by Cramer's rule

$$\frac{2}{x} + \frac{5}{y} = 1; \quad \frac{3}{x} + \frac{2}{y} = \frac{19}{20}$$

15. Find the equation of the straight lines passing through the point $(-1, 4)$ and making an angle of 45° with the line $3x + 4y = 12$.

16. Prove that: $\sin \theta \cdot \sin(60^\circ + \theta) \cdot \sin(60^\circ - \theta) = \frac{1}{4} \sin 3\theta$

17. In any triangle ABC, prove that:

$$\sin(B+C-A) + \sin(C+A-B) + \sin(A+B-C) = 4 \sin A \sin B \sin C$$

18. The angle of elevation of the top of a tower from a point was observed to be 45° and walking 60 m towards the tower it was found to be 60° . Find the height of the tower.

19. Find a 2x2 transformation matrix which transforms a unit square into the parallelogram $\begin{bmatrix} 0 & 3 & 4 & 2 \\ 0 & 1 & 3 & 2 \end{bmatrix}$.

20. Calculate the mean deviation from mean and its coefficient.

Class Interval	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Frequency	6	7	13	4	10

21. Find the standard deviation and its coefficient from the data given bellow:

Class Interval	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
Frequency	8	12	10	13	7

Group 'D'

[4 × 5 = 20]

22. The sum of three numbers in A.P. is 9. If 4 is added to third term then the resulting numbers are in G.P. Find the numbers.

23. Find the equation of the circle passing through the points (4, 10) and (6, 5) and having its centre on the line $4x + y = 16$.

24. Prove vectorially that the diagonals of rectangle are equal.

25. A triangle with vertices A(4, 6), B(3, 1) and C(6, 4) is reflected on the line $x = 4$ and then the image so formed is rotated about origin through positive quarter turn. Find stating the coordinates of vertices of image triangles on the same graph.
