PABSON
SEE PRE BOARD EXAM - 2077

Time: 3 Hrs. **Full Marks:** 100

Subject: Additional Mathematics (Optional - I)

Canditates are required to write their answers according to the instructions given.
Attempt all the questions.

. **Group"A"** $5 \times (1+1) = 10$

1. (a) Define constant function with an example.
   (b) If $3, a, 27$ and 81 are in G.P., find the value of a.

2. (a) What is the point of discontinuity of a function $f(x) = \dfrac{x+1}{x-1}$?
   (b) Find the value of k if $\begin{vmatrix} 4 & 1+k \\ 6 & 5 \end{vmatrix} = \begin{vmatrix} 2 & 4 \\ k & 3 \end{vmatrix}$

3. (a) If the lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ are parallel to each other, then show that $a_1b_2 = a_2b_1$.
   (b) If the intersection plane is parallel to the axis of cone then what conic does it form?

4. (a) Write the formula for $2\sin A.\sin B$.
   (b) Solve: $3\tan^2\theta - 1 = 0$ $[0° \leq \theta \leq 90°]$

5. (a) If $\vec{a} = \vec{i} - 2\vec{j}$ and $\vec{b} = -6\vec{i} - 3\vec{j}$, then prove that $\vec{a}$ is perpendicular to $\vec{b}$.
   (b) If a point $P(-4, 3a-5)$ has its image $P'(7-a, 4)$ under the reflection in the line $y = -x$, find the value of a.

. **Group"B"** $[13 \times 2 = 26]$

6. (a) If $g(x+5) = x + 20$ then find $g(x)$ and $gog(x)$.
   (b) If $x - \sqrt{2}$ is a factor of $ax^3 - 6x + 2\sqrt{2}$, then find the value of a.
   (c) What is the common difference of an AP whose first term and sum of first 15 terms are 100 and 450 respectively?

7. (a) If $P = \begin{bmatrix} 2 & -1 \\ -4 & 5 \end{bmatrix}$ and $Q = \begin{bmatrix} -3 \\ 3 \end{bmatrix}$, find the matrix R such that $PR = Q$.
   (b) According to Cramer's rule, find the values of D_x and D_y for $x + y = 5$ and $x - y = 3$.

8. (a) If the acute angle between two straight lines $2x - y + 6 = 0$ and $3x + ky + 4 = 0$ is $45°$, find the value of k.
   (b) Show that the lines $y + \sqrt{3}x + 4 = 0$ and $x - \sqrt{3}y = 5$ are perpendicular to each other.

9. (a) Prove : $\cot 2A + \tan A = \text{ cosec } 2A$
   (b) Prove: $2\cos 105°.\cos 15° + \dfrac{1}{2} = 0$
   (c) Solve: $\tan^2\dfrac{\theta}{3} - \dfrac{2}{\sqrt{3}}\tan\dfrac{\theta}{3} + \dfrac{1}{2} = 0.$

10. (a) If $\vec{a} + \vec{b} + \vec{c} = 0, |\vec{a}| = 6, |\vec{b}| = 7 and |\vec{c}| = \sqrt{127}$, find the angle between $\vec{a}$ and $\vec{b}$.

(b) In $\Delta ABC, \overrightarrow{OA} = 2\vec{i} + 3\vec{j}, \overrightarrow{OB} = \vec{i} - 2\vec{j}$ and position vector of centroid G of ΔABC is $\overrightarrow{OG} = 3\vec{i} + 4\vec{j}$, then find $\overrightarrow{OC}$.

(c) In a data, the first quartile and the quartile deviation are 17.5 and 20 respectively. Find the third quartile and the co-officient of quartile deviation.

. **Group"C"** $[11 \times 4 = 44]$

11. Solve: $3x^3 - 13x^2 + 16 = 0$

12. The sum of three numbers in AP is 18. If 1, 2 and 7 are added to them respectively, the numbers will be in G.P., then find the numbers.

13. If

$$f(x) = \begin{cases} x + 2 & \text{if } 1 \leq x < 0 \\ 3x - 2 & \text{if } x \geq 2 \end{cases}$$

Then,

(a) Find $f(x)$ if $x = 1.99$.

(b) Find $f(x)$ if $x = 2.01$.

(c) Is $\lim\limits_{x \to 2^-} f(x) = \lim\limits_{x \to 2^+} f(x)$?

(d) Is $f(x)$ continuous at $x = 2$?

14. Solve by matrix method: $4x - \dfrac{9}{y} + 11 = 0$ and $\dfrac{6}{y} - 3x = 8$.

15. Find the single equation of the pair of straight lines passing through $(3, -1)$ and perpendicular to the pair of lines represented by $x^2 - xy - 2y^2 = 0$.

16. Prove that:
$\sin^4 \dfrac{\pi^c}{8} + \sin^4 \dfrac{3\pi^c}{8} + \sin^4 \dfrac{5\pi^c}{8} + \sin^4 \dfrac{7\pi^c}{8} = \dfrac{3}{2}$

17. If $A + B + C = \pi^c$ then prove that: $\dfrac{\cos A}{\sin B . \sin C} + \dfrac{\cos B}{\sin C \sin A} + \dfrac{\sin C}{\sin A \sin B}$

18. A ladder of length 20 feet is leaned on the top of a wall which makes an angle of 60° with the ground. The ladder slides 7.32 feet below the top along the wall, find the new angle that the ladder makes with ground.

19. Find the inversion point of the given point $A(5, 4)$ with respect to the circle $x^2 + y^2 - 6x - 4y + 9 = 0$.

20. Find the mean deviation from median and its coefficient from the following frequency table.

Marks	$0 \leq x < 10$	$10 \leq x < 20$	$20 \leq x < 30$	$30 \leq x < 40$	$40 \leq x < 50$
Number of students	5	2	9	2	2

21. Compute standard deviation and it's coefficient from the the following data.

Marks	0 - 10	0 - 20	0 - 30	0 - 40	0 - 50
Number of students	9	15	19	31	40

. **Group - D** $[4 \times 5 = 20]$

22. Maximize and minimise the the objective function $F = 6x + 5y$ subject to the constraints $x + y \leq 6, x - y \geq -2, x \geq 0$ and $y \geq 0$.

23. Find the the equation of a circle with centre (3,2) and passing through the centre of the circle $x^2 + y^2 - 2x + 4y - 4 = 0$.

24. Prove by vector method that the midpoint of hypotenuse of a right angle triangle is equidistant from its vertices.

25. E denotes enlargement [(0,0),2] and R denotes the reflection on the the line $y = -x$. If ΔPQR with vertices $P(-4, 6), Q(-6, -10)$ and $R(12, -8)$ mapped to form $\Delta P''Q''R''$ under the enlargement EoR then find the coordinates of $\Delta P''Q''R''$ and plot the the triangles on the same graph .