



FIRST TERM EXAMINATION – 2070

Grade: XI
Time: 3:00 hrs.

Subject: Mathematics

F.M.:100
P.M.:40

Set-A

Group ‘A’

[5×3×2=30]

Attempt all the questions.

1.
 - a) Write the truth table for $p \vee (\sim q)$
 - b) Rewrite the inequality $\frac{1}{3} \leq x \leq \frac{1}{2}$ using absolute value sign.
 - c) If A and B are the subsets of U, prove that $A - B = \bar{B} - \bar{A}$

2.
 - a) Examine whether the function $f(x): \mathbb{R} \rightarrow \mathbb{R}$, defined by $f(x) = x^2 - 2$ is one-one, onto, both or neither.
 - b) If $\cos^{-1} x + \cos^{-1} y = \frac{\pi}{2}$, prove that $x^2 + y^2 = 1$
 - c) Solve: $\sec x \cdot \tan x = \sqrt{2}$

3.
 - a) Solve: $\sin \theta - \sqrt{3} \cos \theta = 2$
 - b) If in a triangle ABC, $\angle A = 60^\circ$, show that $b + c = 2a \cos\left(\frac{B-C}{2}\right)$
 - c) In a triangles ABC, if $a = \sqrt{6}$, $b = 2$ and $c = \sqrt{3} - 1$, find the largest angle.

4.
 - a) If $A = \begin{pmatrix} 2 & 1 \\ 4 & -1 \end{pmatrix}$, evaluate $A^2 - 6A$.
 - b) If $(3 - 4i)(x + iy) = 3\sqrt{5}$, show that $5x^2 + 5y^2 = 9$.
 - c) Find the multiplicative inverse of $(3 + i)^2$

5.
 - a) Is the function $f(x) = \frac{1}{1-x}$ continuous at the point $x = 1$?
 - b) Find the derivative of $\frac{ax+b}{x}$
 - c) Solve by Cramer's rule: $-x + y = 9$ and $x - 3y = -5$.

Group B

[5×2×4=40]

6.
 - a) If $x \in \mathbb{R}$ and a is any positive real number, then $|x| < a$ iff $-a < x < a$
 - b) If $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \pi$, prove that: $x\sqrt{1-x^2} + y\sqrt{1-y^2} + z\sqrt{1-z^2} = 2xyz$

7.
 - a) Solve: $\tan\left(\theta + \frac{\pi}{3}\right) + \tan\left(\theta + \frac{2\pi}{3}\right) = 4$
 - b) If $\frac{\cos A + 2 \cos C}{\cos A + 2 \cos B} = \frac{\sin B}{\sin C}$, prove that the triangle ABC is either isosceles or right angled.

8.
 - a) In a triangle ABC, $C = 30^\circ$, $b = \sqrt{3}$ and $a = 1$. Find the other angles and the sides.
 - b) Prove that $\begin{pmatrix} 1 & -2 & 3 \\ 0 & -1 & 4 \\ -2 & 2 & 1 \end{pmatrix}$ and $\begin{pmatrix} -9 & 8 & -5 \\ -8 & 7 & -4 \\ -2 & 2 & 1 \end{pmatrix}$ are inverse of each other.

9.
 - a) Find the square roots of the complex number $\frac{(8, -15)}{(0, 1)}$
 - b) What is the condition for the limit of a function to exist at a point? Evaluate: $\lim_{x \rightarrow \theta} \frac{x \tan \theta - \theta \tan x}{x - \theta}$

10.
 - a) Find, from first principle, the derivative of $\sqrt{x+2}$
 - b) Solve by using inverse matrix method: $x + 2y - 3z = 9$; $2x - y + 2z = -8$; $3x - y - 4z = 3$

Group C**[5×6=30]**

11. Define domain and Range of a function. Find the domain and range of the function given by $f(x) = \sqrt{x^2 - 2x - 8}$
12. Define the negation of a statement. If p and q be any two statement; prove that: $\sim(p \wedge q) \Leftrightarrow [(\sim p) \vee (\sim q)]$
13. Prove that:
$$\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ yz & zx & xy \end{vmatrix} = (x - y)(y - z)(z - x)(xy + yz + zx)$$
14. Solve for z using De Moivre's theorem such that $z^6 - 1 = 0$.
15. Find the derivative of $\frac{1}{\sqrt{ax + b}}$ by the method of definition.

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Set-B

Group ‘A’

[5×3×2=30]

Attempt all the questions.

1.
 - a) Write the truth table for $\sim p \wedge \sim q$
 - b) Rewrite the inequality $-4 \leq x \leq -1$ using absolute value sign.
 - c) If A and B are the subsets of U, prove that $A - \bar{B} = A \cap B$
2.
 - a) Examine whether the function $f(x): \mathbb{R} \rightarrow \mathbb{R}$, defined by $f(x) = x^3 + 1$ is one-one, onto, both or neither.
 - b) Prove that: $\sec^2(\tan^{-1} 2) + \operatorname{cosec}^2(\cot^{-1} 3) = 15$
 - c) Solve: $\tan x + \sec x = \sqrt{3}$
3.
 - a) Solve: $\sin 2x + \sin 4x + \sin 6x = 0$
 - b) In a triangle ABC, if $\angle B = 60^\circ$, prove that: $(a + b + c)(a - b + c) = 3ca$.
 - c) In a triangles ABC, if $a = \sqrt{6}$, $b = 2$ and $c = \sqrt{3} - 1$, find the smallest angle.
4.
 - a) If $A = \begin{pmatrix} 2 & 1 \\ 4 & -1 \end{pmatrix}$, prove that $(A - 3I)(A + 2I) = 0$
 - b) If $x + iy = \frac{1-i}{1+i}$, prove that $x^2 + y^2 = 1$.
 - c) If \bar{z} be the conjugate of the complex number z, prove that $\operatorname{Arg}(\bar{z}) = 2\pi - \operatorname{Arg}(z)$.
5.
 - a) Is the function $f(x) = \frac{1-x^2}{1-x}$ continuous at the point $x = 1$?
 - b) Find the derivative of $x + \sqrt{x}$
 - c) Solve by Cramer's rule: $2x - y = 5$ and $x - 2y = 1$

Group B

[5×2×4=40]

6.
 - a) Let $A = [-3, 2)$ and $B = (-2, 3)$. Perform the indicated operations, (i) $A \cup B$ (ii) $A \cap B$ (iii) $A - B$ (iv) $B - A$.
 - b) Prove that: $\cos^{-1} x = 2 \sin^{-1} \sqrt{\frac{1-x}{2}} = 2 \cos^{-1} \sqrt{\frac{1+x}{2}}$
7.
 - a) Solve: $\tan \theta + \tan 2\theta + \tan 3\theta = 0$
 - b) If $\frac{\sin(A-B)}{\sin(A+B)} = \frac{a^2-b^2}{a^2+b^2}$, prove that the triangle ABC is either isosceles or right angled.
8.
 - a) In a triangle ABC, $A = 30^\circ$, $B = 45^\circ$ and $a = 6\sqrt{2}$. Find the angle and the sides.
 - b) If $A = \begin{pmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 2 & 3 & 0 \end{pmatrix}$, $B = \begin{pmatrix} -1 & 2 & 1 \\ 3 & 0 & -1 \\ 2 & 1 & 0 \end{pmatrix}$;
prove that $(AB)^T = B^T A^T$
9.
 - a) Find the square roots of the complex number $\frac{(5, 12)}{(3, -4)}$
 - b) Define limit of a function at a point. Evaluate:
 $\lim_{x \rightarrow \infty} \sqrt{x} (\sqrt{x} - \sqrt{x-a})$
10.
 - a) Find, from first principle, the derivative of $\frac{1}{\sqrt{x}}$
 - b) Solve by using inverse matrix method:
 $x + 2y - z = -5$; $2x - y + z = 6$; $x - y - 3z = -3$

Group C [5×6=30]

11. Define domain and Range of a function. Find the domain and range of the function given by $f(x) = \sqrt{21 - 4x - x^2}$

12. If p and q be any two statement; prove that
 $[p \Rightarrow (q \wedge \sim q)] \Leftrightarrow [\sim q \wedge (p \Rightarrow q)]$

13. Prove that:
$$\begin{vmatrix} a+b+c & -c & -b \\ -c & a+b+c & -a \\ -b & -a & a+b+c \end{vmatrix} = 2(a+b)(b+c)(c+a)$$

14. Solve for z using De Moivre's theorem such that $z^5 + 1 = 0$.

15. Find the derivative of $\frac{ax+b}{\sqrt{x}}$ by the method of first principle.

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