



FIRST TERM EXAMINATION – 2071

Grade: XI
Time: 3:00 hrs.

Subject: Mathematics

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

Set-A

Group ‘A’

[5×3×2=30]

1. a) Define symmetric difference. Write the power set of $\{\phi\}$.
 b) If $A \cup B = \phi$ then prove that $A = \phi$.
 c) Define compound statement. Construct a truth table $\sim (p \wedge q)$.
2. a) Construct a truth table of $p \Leftrightarrow q$.
 b) Given $A = [-3, 5]$ and $B = [2, 6)$. Compute $A \cup B$ and $A \cap B$.
 c) Write by using modulus sign $-3 \leq x \leq 4$
3. a) If $z = 2 + 3i$, $w = 3 - 2i$ find $\overline{z \cdot w}$ and $\frac{\overline{z}}{w}$
 b) If w be a complex cube roots of unity. Find the value of $(3 + 3w + 5w^2)^6 - (2 + 6w + 2w^2)^3$
 c) Form a quadratic equation whose one root is $-2 + i$.
4. a) If the roots of quadratic equation are $p + q$ and $p - q$, find the quadratic equation.
 b) If the roots of $lx^2 + mx + n = 0$ be in the ratio 3:4 show that $12m^2 = 49ln$.
 c) Evaluate: $\lim_{x \rightarrow 1} \frac{\sqrt{2x} - \sqrt{3-x^2}}{x-1}$

5. a) Evaluate: $\lim_{x \rightarrow y} \frac{\tan x - \tan y}{x - y}$
 b) Evaluate: $\lim_{x \rightarrow 1} \frac{x - \sqrt{2-x^2}}{2x - \sqrt{2+2x^2}}$.
 c) A function is defined as $f(x) = \begin{cases} 3x^2 + 2 & x < 1 \\ 2x + 3 & x \geq 1 \end{cases}$.
 Find $\lim_{x \rightarrow 1} f(x)$.

Group ‘B’

[5×2×4=40]

6. a) State and prove De-morgan’s laws’.
 b) Define tautology. So that $(p \wedge q) \Leftrightarrow (q \wedge p)$ is a tautology.
7. a) Let x be any real number and a be any positive real number, then prove that $|x| < a \Leftrightarrow -a < x < a$
 b) If one root of the equation $ax^2 + bx + c = 0$ be the square of the other then prove that $b^3 + a^2c + ac^2 = 3abc$
8. a) Find the square roots of $z = 7 - 24i$
 b) If $x = a + b$, $y = aw + bw^2$, $z = aw^2 + bw$, prove that $x^2 + y^2 + z^2 = 6ab$, where w be a complex cube roots of unity.
9. a) Evaluate: $\lim_{x \rightarrow \theta} \frac{x \cos \theta - \theta \cos x}{x - \theta}$
 b) Show that the function $f(x) = \begin{cases} \frac{\sin^2 ax}{x^2} & \text{if } x \neq 0 \\ 1 & \text{if } x = 0 \end{cases}$ is a discontinuous at $x = 0$. Redefine the function in such a way that it becomes continuous at $x = 0$.

10. a) Find from first principle, the derivative of $y = \frac{1}{\sqrt{3x-4}}$.
- b) Find the derivative of
- (i) $\sqrt[3]{x^2 - 2x + 1}$ (ii) $\sqrt{\frac{1+x}{1-x}}$

Group 'C'

[6×5=30]

11. Find the condition for two given quadratic equations $a_1x^2 + b_1x + c_1 = 0$ and $a_2x^2 + b_2x + c_2 = 0$ may have one root common and two roots common.
12. Find cube roots of unity. Also discuss the properties of cube roots of unity.
13. For all rational value of n ; prove that $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}$.
14. Define continuity of a function at a point. Find from first principle the derivative of $\sqrt{\cos 2x}$.
15. Find $\frac{dy}{dx}$ when
- i) $x^3 + y^3 = 3axy$
- ii) $y = \frac{1}{x - \sqrt{a^2 + x^2}}$
- iii) $y = 3u^2 - 7u + 5$ and $u = \sqrt{3 - 2x}$

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Set-B

Group ‘A’

[5×3×2=30]

1. a) Define power set. Write down the power set of $A = \{a, b, c\}$
- b) If $A \subset B$ prove that $\bar{B} \subset \bar{A}$.
- c) Define disjunction of two statement. Construct a truth table $\sim (p \vee q)$.
2. a) Form a truth table for the given compound statement $P \Rightarrow (\sim p) \wedge (\sim q)$.
- b) Given $A = [-2, 4]$ and $B = (2, 5]$ compute $A \cup B$ and $A \cap B$
- c) Write down by using the modulus sign $-1 \leq x \leq 5$
3. a) If $z = 3 + 4i$ and $w = 2 + i$, find $|zw|$ and $\left| \frac{z}{w} \right|$
- b) If w be a complex cube roots of unity. Find the value of $(1 - w + w^2)^4 (1 + w - w^2)^4$
- c) Form a quadratic equation whose one root is $3 + 4i$.
4. a) If one root of the equation $ax^2 + bx + c = 0$ ($a \neq 0$) be twice the other show that $2b^2 = 9ac$
- b) For what value of p will be equation $5x^2 + px + 45 = 0$ have equal roots.
- c) Evaluate: $\lim_{x \rightarrow \infty} (\sqrt{x} - \sqrt{x-3})$

5. a) Evaluate: $\lim_{x \rightarrow 0} \frac{1 - \cos px}{1 - \cos qx}$
- b) Does the limit of the function $f(x) = \begin{cases} 2x+1 & \text{for } x \geq 1 \\ 4x^2 - 1 & \text{for } x < 1 \end{cases}$ of $x = 1$ exist?
- c) Evaluate: $\lim_{x \rightarrow 0} \frac{\sin x^\circ}{x}$

Group ‘B’

[5×2×4=40]

6. a) If A, B, C are subsets of a universal set \cup . Prove that $A - (B \cap C) = (A - B) \cup (A - C)$
- b) Write the truth value of $[p \Rightarrow (q \wedge \sim q)] \Leftrightarrow \sim p$, hence draw a conclusion from truth value.
7. a) Define absolute value of a real number. For any two real numbers x and y prove that: $|x + y| \leq |x| + |y|$
- b) Find the condition for two quadratic equations $ax^2 + bx + c = 0$ and $a_1x^2 + b_1x + c_1 = 0$ may have one root common.
8. a) Find the square roots of $z = -7 + 24i$.
- b) If $x = a + b, y = aw + bw^2$ and $z = aw^2 + bw$ then prove that $xyz = a^3 + b^3$. Where w be a complex cube roots of unity.
9. a) Evaluate: $\lim_{x \rightarrow \theta} \frac{x \sin \theta - \theta \sin x}{x - \theta}$
- b) Test the continuity of the function $f(x) = \begin{cases} x & \text{when } 0 \leq x < \frac{1}{2} \\ 1 & \text{when } x = \frac{1}{2} \\ 1-x & \text{when } \frac{1}{2} < x < 1 \end{cases}$ at $x = \frac{1}{2}$. Also write how it could be made continuous.

10. a) Find from first principle the derivative of $x + \sqrt{x}$
b) Find the derivative of
- (i) $\sqrt{ax^2 + bx + c}$
(ii) $\sqrt{\frac{1-x}{1+x}}$

Group 'C'

[6×5=30]

11. The quadratic equation $ax^2 + bx + c = 0$ ($a \neq 0$) has exactly two roots. Prove it.
12. Define absolute value of a complex number with example. Also prove that $|z| + |w| \geq |z + w|$
13. Prove geometrically: $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$.
14. Define derivative. Find from first principle the derivative of $\sqrt{\sin 4x}$.
15. Find $\frac{dy}{dx}$ when
- i) $x^3 + y^3 = 3x^2y$
ii) $y = \frac{1}{\sqrt{a^2 + x^2} - x}$
iii) $y = 2t^2 + t + 3$ and $t = x(x^2 + 3)$.

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