

BOARD QUESTION PAPER : MARCH 2015

Notes:

- All questions are compulsory.
- Figures to the right indicate full marks.
- Answer to every question must be written on a new page.
- L.P.P. problem should be solved on graph paper.
- Log table will be provided on request.
- Write answers of Section – I and Section – II in one answer book.

Section – I

Q.1. Attempt any SIX of the following:

[12]

- Express the following statement in symbolic form and write its truth value.
“If 4 is an odd number, then 6 is divisible by 3.” (2)
- Find the values of x and y , if
$$2 \begin{bmatrix} 1 & 3 \\ 0 & x \end{bmatrix} + \begin{bmatrix} y & 0 \\ 1 & 2 \end{bmatrix} = \begin{bmatrix} 5 & 6 \\ 1 & 8 \end{bmatrix}$$
 (2)
- Find the value of ‘ k ’ if the function
$$f(x) = \frac{\tan 7x}{2x}, \quad \text{for } x \neq 0$$
$$= k, \quad \text{for } x = 0$$
is continuous at $x = 0$ (2)
- Find $\frac{dy}{dx}$ if $y = \cos^{-1}(\sqrt{x})$ (2)
- The price P for demand D is given as $P = 183 + 120D - 3D^2$.
Find D for which the price is increasing. (2)
- Evaluate: $\int \frac{1}{x(3 + \log x)} dx$ (2)
- If $A = \begin{bmatrix} 2 & 1 \\ 1 & 1 \end{bmatrix}$ show that $A^2 - 3A + I = 0$ (2)
- Evaluate: $\int x \cos x dx$. (2)

Q.2. (A) Attempt any TWO of the following:

[6][14]

- Prove that the following statement pattern is equivalent:
 $(p \vee q) \rightarrow r$ and $(p \rightarrow r) \wedge (q \rightarrow r)$ (3)
- Examine the continuity of the following function:
$$f(x) = \begin{cases} x^2 - x + 9, & \text{for } x \leq 3 \\ 4x + 3, & \text{for } x > 3 \end{cases}$$
 at $x = 3$ (3)
- Find $\frac{dy}{dx}$ if $y = \tan^{-1} \left(\frac{6x}{\sqrt{1-5x^2}} \right)$ (3)

) **Attempt any TWO of the following:** [8]

i. Find the inverse of the following matrix by elementary row transformations if it exists.

$$A = \begin{bmatrix} 1 & 2 & -2 \\ 0 & -2 & 1 \\ -1 & 3 & 0 \end{bmatrix} \quad (4)$$

ii. Find area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ (4)

iii. The expenditure E_c of a person with income I is given by $E_c = (0.000035)I^2 + (0.045)I$. Find marginal propensity to consume (MPC) and marginal propensity to save (MPS) when $I = 5000$. Also find A (average) PC and A (average) PS. (4)

Q.3. (A) Attempt any TWO of the following: [6][14]

i. Express the truth of each of the following statements by Venn diagram:

- Some hardworking students are obedient.
- No circles are polygons.
- All teachers are scholars and scholars are teachers. (3)

ii. If 'f' is continuous at $x = 0$, then find $f(0)$.

$$f(x) = \frac{15^x - 3^x - 5^x + 1}{x \tan x}, x \neq 0 \quad (3)$$

iii. Find $\frac{dy}{dx}$ if $x = e^{2t}$, $y = e^{t\sqrt{t}}$ (3)

(B) Attempt any TWO of the following: [8]

i. Evaluate: $\int \frac{(1 + \log x)}{x(2 + \log x)(3 + \log x)} dx$ (4)

ii. Evaluate: $\int_0^{\frac{\pi}{2}} \frac{dx}{1 + \cot x}$ (4)

iii. A firm wants to maximize its profit. The total cost function is $C = 370Q + 550$ and revenue is $R = 730Q - 3Q^2$. Find the output for which profit is maximum and also find the profit amount at this output. (4)