Class: XII
Time Allowed: 3 Hours

Subject: Business Mathematics
Maximum Marks: 80

General Instructions:

1. This question paper contains four sections: A, B, C and D.
2. Section A - questions 1 to 10 - comprises of 10 multiple choice questions of 1 mark each.
3. Section B - questions 11 to 20 - comprises of 10 very short answer type questions of 2 marks each.
4. Section C - questions 21 to 28 - comprises of 8 short answer type questions of 4 marks each.
5. Section D - questions 29 to 31 - comprises of 3 long answer questions of 6 marks each.

SECTION A

Q1. $\lim\limits_{x \to 1} \dfrac{x^2-1}{x-1} =$

    (a) 0   (c) 2

    (b) 1   (d) 3

Q2. Which of the following functions is not continuous at $x = 2$?

    (a) x^3 (c) x

    (b) $\dfrac{1}{x-2}$ (d) 7

Q3. The order of the differential equation $\dfrac{d^3y}{dx^3} - 7\dfrac{d^2y}{dx^2} + 6\dfrac{dy}{dx} - 11 = 0$ is

    (a) 1   (c) 3

    (b) 2   (d) 4

Q4. The degree of the differential equation $\left(\dfrac{d^3y}{dx^3} + y\right)^{\frac{2}{3}} = 1$ is

    (a) 1   (c) 3

    (b) 2   (d) 4

Q5. If the function f is such that $f(-x) = -f(x), \forall x \in \mathbb{R}$, then $\int_{-1}^{1} f(x)\,dx =$

    (a) -1   (c) 1

    (b) 0   (d) 2

Q6. $\int_0^1 (x^3 + 1)\,dx =$

    (a) $\dfrac{1}{4}$ (c) $\dfrac{4}{5}$

    (b) $\dfrac{1}{3}$ (d) $\dfrac{5}{4}$

Q7. If $R(x)$ denotes the total revenue, then the marginal revenue is given by

    (a) $R^2(x)$ (c) $\dfrac{dR(x)}{dx}$

    (b) $R^3(x)$ (d) $\int R(x)\,dx$

Q8. If the cost function is given by $C(x) = 2x^2 + 6x + 3$, then the average cost is

(a) $xC(x) = 2x^3 + 6x^2 + 3x$

(b) $x + C(x) = 2x^2 + 7x + 3$

(c) $C(x) - x^2 = x^2 + 6x + 3$

(d) $\frac{C(x)}{x} = 2x + 6 + \frac{3}{x}$

Q9. What is a computer incapable of doing?

(a) Performing complex calculations

(b) Processing large amounts of data

(c) Displaying genuine emotions and creativity

(d) Automating repetitive tasks

Q10. What is a problem algorithm?

(a) A type of software

(b) A step-by-step solution

(c) A random process

(d) A hardware component

SECTION B

Q11. Find the sum of matrices $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$.

Q12. Evaluate $\lim\limits_{x \to 0} \frac{\sin 7x}{\sin 5x}$.

Q13. Give an example of a function that is not continuous.

Q14. Using the fact that $\lim\limits_{n \to \infty} \left(1 + \frac{1}{n}\right)^n = e$, evaluate $\lim\limits_{n \to \infty} \left(1 + \frac{3}{n}\right)^n$.

Q15. Find the first derivative of $(x + 1)e^x$.

Q16. Evaluate $\int (\cos x + \sin x)\, dx$.

Q17. Check if $y = e^x$ a solution to the differential equation $\frac{dy}{dx} = \frac{d^2y}{dx^2}$.

Q18. Integrate the function e^{7x+3} with respect to x.

Q19. Define marginal cost.

Q20. Give an example of an algorithm that you use in your day-to-day life.

SECTION C

Q21. Find A^2 if $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

Q22. Differentiate $\dfrac{x}{x-5}$.

Q23. Using a suitable substitution, evaluate $\int \dfrac{e^x}{e^x+1}\,dx$.

Q24. Solve the linear differential equation $\dfrac{dy}{dx} + \dfrac{y}{x} = 1$.

Q25. Solve the differential equation $\dfrac{dy}{dx} = \dfrac{x^3+1}{y^2+y}$ as a variable separable differential equation.

Q26. Show that $\int_0^a f(x)\,dx = \int_0^a f(a-x)\,dx$.

Q27. The marginal cost function is $C_M = 2 + 5e^x$. Find C if $C(0) = 100$.

Q28. Write a brief note on how the use of computers can save us both effort and time.

SECTION D

Q29. Solve the following system of linear equations by determinants or Cramer's rule:

$$x + y + z = 3$$
$$x - y + z = 1$$
$$x + y - z = 1$$

OR

If $A = \begin{bmatrix} 1 & 3 & 2 \\ 2 & 0 & -1 \\ 1 & 2 & 3 \end{bmatrix}$, then show that $A^3 - 4A^2 - 3A + 11I = 0$.

Q30. Using the ab-initio rule (or the first principal), find $\dfrac{d\sin x}{dx}$.

OR

Differentiate $\log x$ from the first principal.

Q31. Evaluate $\int \dfrac{2x+3}{x^2-3x+2}\,dx$ using partial fraction.

OR

Integrate the function $\dfrac{2x+3}{\sqrt{x^2+6x+9}}$ with respect to x.