CUET (UG) – MATHEMATICS

Chapter Test - Unit III: Calculus - Applications of Derivatives

General Instructions

1. Total Questions: **20**
2. Duration: **60 Minutes**
3. All questions are compulsory.
4. Each question carries **5 marks**.
5. For each correct answer: **+5 marks**.
6. For each incorrect answer: **-1 mark**.
7. No negative marking for unanswered questions.
8. Use of calculator or electronic devices is strictly prohibited.
9. Choose the most appropriate answer from the given options.

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1. The total revenue in Rupees received from the sale of x units of a product is given by $R(x) = 13x^2 + 26x + 15$. The marginal revenue when $x = 7$ is:
   (A) 108
   (B) 126
   (C) 208
   (D) 190

2. A cylindrical tank of radius 10 m is being filled with wheat at the rate of 314 cubic metre per hour. Then the depth of the wheat is increasing at the rate of:
   (A) 1 m/h
   (B) 0.1 m/h
   (C) 1.1 m/h
   (D) 0.5 m/h

3. The function $f(x) = x^2 - 4x + 6$ is strictly decreasing in the interval:
   (A) $(-\infty, 2)$
   (B) $(2, \infty)$
   (C) $(-\infty, \infty)$
   (D) $(-2, 2)$

4. The normal to the curve $x^2 + y^2 = 25$ at the point $(3, 4)$ has a slope of:
   (A) 3/4
   (B) 4/3
   (C) $-3/4$
   (D) $-4/3$

5. The interval in which $y = x^2 e^{-x}$ is increasing is:
   (A) $(-\infty, \infty)$
   (B) $(-2, 0)$
   (C) $(2, \infty)$
   (D) $(0, 2)$

6. The maximum value of $[\frac{1}{x}]^x$ is:
   (A) e
   (B) $e^{1/e}$
   (C) $(1/e)^e$
   (D) 1

7. A ladder 5 m long is leaning against a wall. The bottom of the ladder is pulled along the ground, away from the wall, at the rate of 2 cm/s. How fast is its height on the wall decreasing when the foot of the ladder is 4 m away from the wall?
   (A) 8/3 cm/s
   (B) 4/3 cm/s
   (C) 2/3 cm/s
   (D) 1 cm/s

8. The point on the curve $y = x^2$ where the tangent makes an angle of 45° with the x-axis is:
   (A) $(1/2, 1/4)$
   (B) $(1/4, 1/2)$
   (C) $(1, 1)$
   (D) $(0, 0)$

9. The function $f(x) = \sin x - \cos x$ is strictly increasing in:
   (A) $(0, \pi)$

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(B) $(-\pi/4, 3\pi/4)$
(C) $(\pi/4, 5\pi/4)$
(D) $(0, \pi/2)$

10. If the volume of a sphere is increasing at the rate of 4.5 cubic cm/s, then the rate of change of its radius when the radius is 3 cm is:
(A) $1/8\pi$ cm/s
(B) $1/4\pi$ cm/s
(C) $3/8\pi$ cm/s
(D) 2π cm/s

11. The slope of the normal to the curve $y = 2x^2 + 3\sin x$ at $x = 0$ is:
(A) 3
(B) 1/3
(C) -3
(D) -1/3

12. Which of the following functions is strictly decreasing on $(0, \pi/2)$?
(A) $\sin 2x$
(B) $\tan x$
(C) $\cos 3x$
(D) $\cos x$

13. The maximum area of a rectangle inscribed in a circle of radius r is:
(A) r^2
(B) $2r^2$
(C) $\sqrt{2}r^2$
(D) πr^2

14. The rate of change of the volume of a sphere with respect to its surface area when the radius is 2 cm is:
(A) 1
(B) 2
(C) 3
(D) 4

15. At what point on the curve $y = x^2 - 4x + 5$ is the tangent perpendicular to the line $2y + x - 7 = 0$?
(A) $(3, 2)$
(B) $(1, 2)$
(C) $(2, 1)$
(D) $(3, 1)$

16. The local maximum value of $f(x) = x^3 - 3x$ is:
(A) 2
(B) -2
(C) 0
(D) 1

17. The smallest value of the polynomial $x^3 - 18x^2 + 96x$ in the interval $[0, 9]$ is:
(A) 126
(B) 0
(C) 160
(D) 135

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18. The two positive numbers x and y such that $x + y = 60$ and xy^3 is maximum are:
    (A) $x = 30, y = 30$
    (B) $x = 15, y = 45$
    (C) $x = 45, y = 15$
    (D) $x = 20, y = 40$

19. If $f(x) = \frac{x}{\log x}$, then $f(x)$ is increasing in:
    (A) $(0, 1)$
    (B) $(1, e)$
    (C) (e, ∞)
    (D) $(-\infty, e)$

20. The distance between the origin and the tangent to the curve $y = e^{2x} + x^2$ at $x = 0$ is:
    (A) $1/\sqrt{5}$
    (B) $2/\sqrt{5}$
    (C) $1/\sqrt{2}$
    (D) 2

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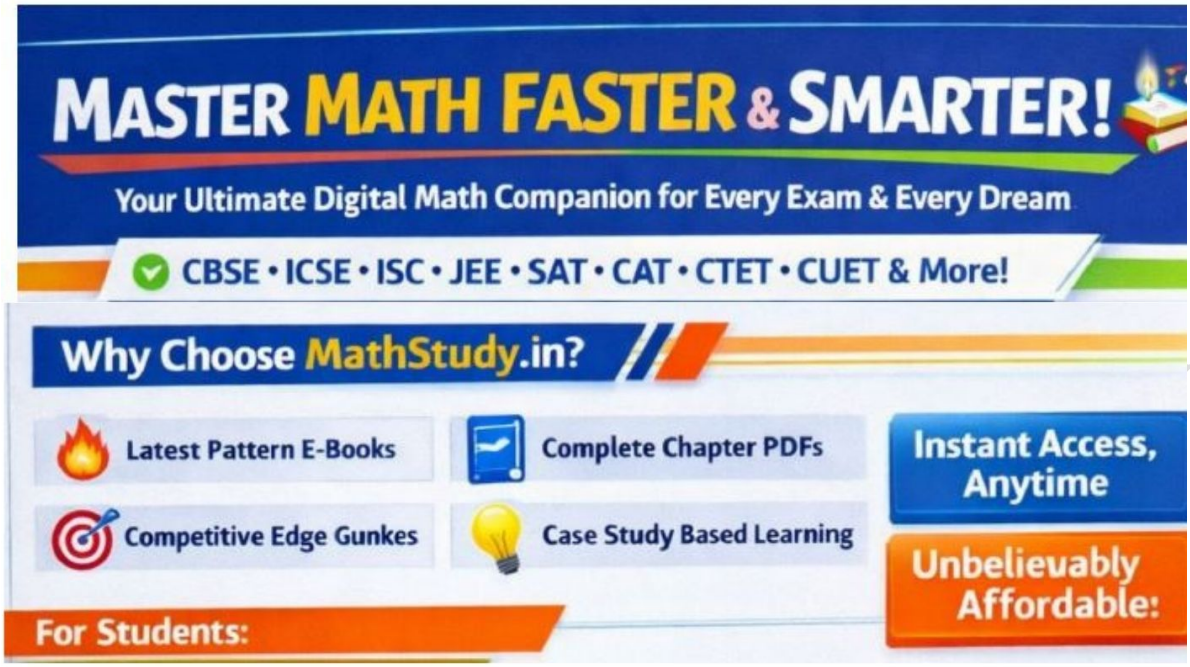

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