CUET Mathematics Test

Chapter: 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.

1. A balloon which always remains spherical is being inflated by pumping in 900 cubic centimeters of gas per second. Find the rate at which the radius of the balloon is increasing when the radius is 15 cm.
   (A) $1/\pi$ cm/s
   (B) $1/(2\pi)$ cm/s
   (C) $2/\pi$ cm/s
   (D) $3/\pi$ cm/s

2. The total revenue in Rupees received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$. The marginal revenue when $x = 5$ is:
   (A) 66
   (B) 36
   (C) 96
   (D) 126

3. The function $f(x) = 2x^3 - 3x^2 - 36x + 7$ is strictly decreasing in the interval:
   (A) $(-2, 3)$
   (B) $(-\infty, -2)$
   (C) $(3, \infty)$
   (D) $(-\infty, 3)$

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

5. The least value of the function $f(x) = ax + b/x$ (where $a, b, x > 0$) is:
   (A) $\sqrt{ab}$
   (B) $2\sqrt{ab}$
   (C) ab
   (D) $2ab$

6. The slope of the tangent to the curve $y = x^3 - x + 1$ at the point whose x-coordinate is 2 is:
   (A) 10
   (B) 11
   (C) 12
   (D) 13

7. Find the point on the curve $y = x^2$ where the tangent is parallel to the x-axis.
   (A) $(1, 1)$
   (B) $(0, 0)$
   (C) $(2, 4)$
   (D) $(-1, 1)$

8. The maximum value of $\sin x + \cos x$ is:
   (A) 1
   (B) 2
   (C) $\sqrt{2}$
   (D) $\sqrt{3}$

9. At what point on the curve $y = e^x$ is the tangent parallel to the line $y = x$?
   (A) $(0, 1)$
   (B) $(1, e)$

(C) $(-1, 1/e)$
(D) $(0, 0)$

10. A stone is dropped into a quiet lake and waves move in circles at a speed of 4 cm/s. At the instant when the radius of the circular wave is 10 cm, how fast is the enclosed area increasing?
(A) 40π sq. cm/s
(B) 60π sq. cm/s
(C) 80π sq. cm/s
(D) 100π sq. cm/s

11. The function $f(x) = \tan x - x$ is:
(A) Always increasing
(B) Always decreasing
(C) Increasing in $(0, \pi/2)$
(D) Decreasing in $(0, \pi/2)$

12. The maximum value of $(1/x)^x$ is:
(A) e
(B) $e^{1/e}$
(C) $(1/e)^e$
(D) e^e

13. The point on the curve $x^2 = 2y$ which is nearest to the point $(0, 5)$ is:
(A) $(2\sqrt{2}, 4)$
(B) $(2, 2)$
(C) $(0, 0)$
(D) $(2, 4)$

14. If $f(x) = x^3 - 6x^2 + 9x + 15$, then the value of x for which $f(x)$ has a local maximum is:
(A) 1
(B) 3
(C) -3
(D) 0

15. The rate of change of the area of a circle with respect to its radius r at $r = 6$ cm is:
(A) 10π
(B) 12π
(C) 8π
(D) 11π

16. The line $y = x + 1$ is a tangent to the curve $y^2 = 4x$ at the point:
(A) $(1, 2)$
(B) $(2, 1)$
(C) $(1, -2)$
(D) $(-1, 2)$

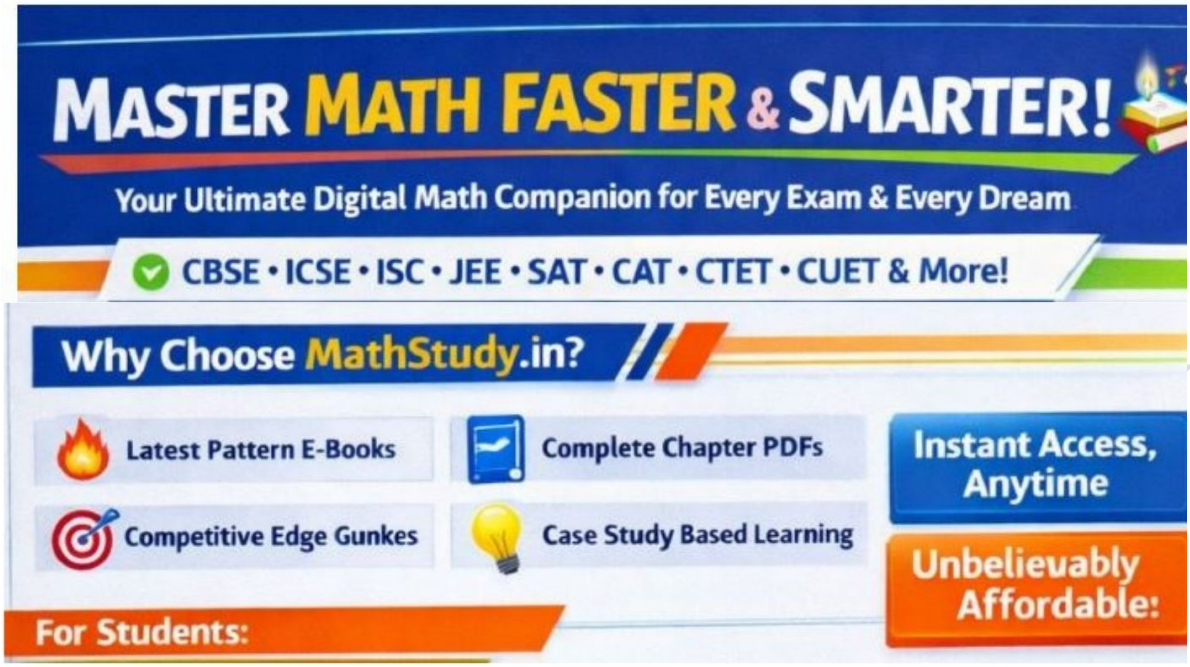
17. The smallest value of the polynomial $x^3 - 18x^2 + 96x$ in $[0, 9]$ is:
(A) 126
(B) 0
(C) 135
(D) 160

18. The distance s moved by a particle in time t is $s = t^3 - 6t^2 + 12t - 8$. The velocity when acceleration is zero is:

(A) 1
(B) 0
(C) 2
(D) 3

19. If the function $f(x) = kx - \sin x$ is increasing for all x, then the value of k must satisfy:
(A) $k > 1$
(B) $k < 1$
(C) $k \geq 1$
(D) $k \leq -1$

20. The coordinates of the point on the curve $y = \sqrt{x}$ where the rate of change of y is twice the rate of change of x are:
(A) $(1/16, 1/4)$
(B) $(1/4, 1/2)$
(C) $(4, 2)$
(D) $(1, 1)$



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