CUET Mathematics Test

Chapter: Unit III: Calculus (Applied Mathematics)

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. If $y = e^{ax} \sin bx$, then the value of $\frac{d^2y}{dx^2} - 2a\frac{dy}{dx} + (a^2 + b^2)y$ is:
   (A) 0
   (B) 1
   (C) e^{ax}
   (D) $e^{ax} \cos bx$

2. The total cost function of a firm is $C(x) = \frac{1}{3}x^3 - 5x^2 + 30x + 10$. The marginal cost is minimum when x is:
   (A) 2
   (B) 3
   (C) 5
   (D) 6

3. If the revenue function is $R(x) = 20x - 0.5x^2$, the marginal revenue when $x = 10$ is:
   (A) 10
   (B) 5
   (C) 15
   (D) 20

4. The function $f(x) = x^3 - 6x^2 + 12x - 5$ is:
   (A) Strictly increasing on $\mathbb{R}$
   (B) Strictly decreasing on $\mathbb{R}$
   (C) Increasing for $x > 2$ only
   (D) Decreasing for $x < 2$ only

5. The maximum value of the function $f(x) = x(1 - x)^2$ on the interval $[0, 1]$ is:
   (A) 4/27
   (B) 2/9
   (C) 1/4
   (D) 1/27

6. The demand function for a product is $p = 50 - 2x$. The consumer surplus when the market price is $p_0 = 30$ is:
   (A) 50
   (B) 100
   (C) 150
   (D) 200

7. The supply function is $p = 10 + 3x$. The producer surplus when $x_0 = 4$ is:
   (A) 24
   (B) 48
   (C) 12
   (D) 36

8. The value of the integral $\int_1^2 \frac{1}{x(1+x^2)} dx$ is:
   (A) $\log(4/5)$
   (B) $\frac{1}{2}\log(8/5)$
   (C) $\log(2/5)$
   (D) $\frac{1}{2}\log(2/5)$

9. The solution of the differential equation $\frac{dy}{dx} = \frac{y}{x} + \frac{y^2}{x^2}$ is:
   (A) $y = \frac{x}{c - \log x}$
   (B) $y = x \log x + c$
   (C) $y = \frac{c}{1 - \log x}$
   (D) $x = y(c - \log x)$

10. A population grows at a rate proportional to the population present. If the population doubles in 50 years, the growth constant k is:
    (A) $\frac{\log 2}{50}$
    (B) $\frac{50}{\log 2}$
    (C) $\log(1/2) \cdot 50$
    (D) $2/50$

11. If the marginal revenue is $MR = 20 - 4x - 3x^2$, the total revenue function $R(x)$ (assuming $R(0) = 0$) is:
    (A) $20x - 2x^2 - x^3$
    (B) $20x - 4x^2 - 3x^3$
    (C) $20 - 2x^2 - x^3$
    (D) $20x - x^2 - x^3$

12. The interval in which $f(x) = 2x^3 - 15x^2 + 36x + 1$ is strictly decreasing is:
    (A) $(2, 3)$
    (B) $(-\infty, 2)$
    (C) $(3, \infty)$
    (D) $(-\infty, 3)$

13. For the function $f(x) = x + \frac{1}{x}$, the local minimum value is:
    (A) 2
    (B) -2
    (C) 0
    (D) 1

14. If $\int_0^a \frac{1}{1+4x^2} dx = \frac{\pi}{8}$, then the value of a is:
    (A) 1/2
    (B) 1
    (C) 1/4
    (D) 2

15. The degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^2 + \left(\frac{dy}{dx}\right)^3 = x \sin\left(\frac{dy}{dx}\right)$ is:
    (A) 2
    (B) 3
    (C) 1
    (D) Not defined

16. The marginal cost function is $MC = 4 + 0.1x$. If fixed costs are 50, the total cost of producing 10 units is:
    (A) 95
    (B) 45
    (C) 105
    (D) 150

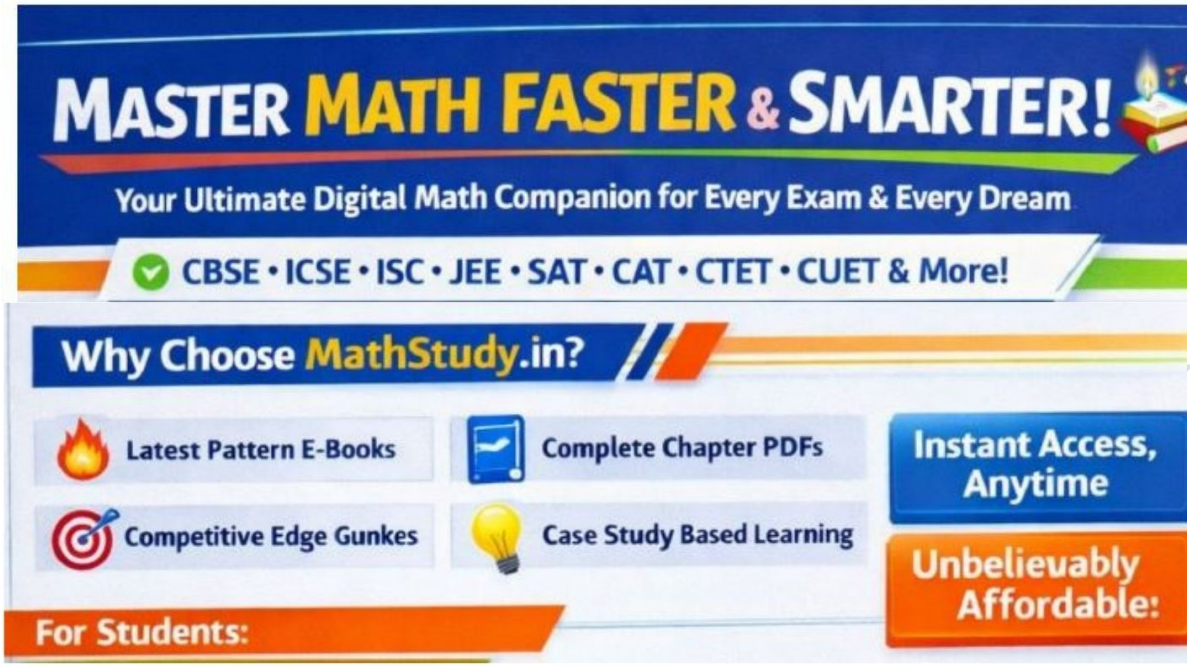
17. The area bounded by $y = x^2$ and $y = x$ is:
    (A) 1/6
    (B) 1/3
    (C) 1/2
    (D) 1

18. A radioactive substance decays at a rate proportional to its amount. If half-life is T, the amount $A(t)$ is given by:
    (A) $A_0 e^{-(t \log 2)/T}$

(B) $A_0 e^{t/T}$
(C) $A_0(1/2)^{T/t}$
(D) $A_0 e^{-Tt}$

19. If $f(x) = \int_1^x \sqrt{2-t^2}dt$, then $f'(x)$ at $x = 1$ is:
(A) 1
(B) 0
(C) $\sqrt{2}$
(D) 1/2

20. The point of inflection for $f(x) = x^3 - 3x^2 + 5x$ is:
(A) $(1, 3)$
(B) $(1, 0)$
(C) $(0, 0)$
(D) $(3, 1)$



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