CUET Mathematics Test

Chapter: Calculus (Derivatives and Applications)

General Instructions

1. Total Questions: **15**
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 $y = \log(\log x)$, then the value of $\frac{d^2y}{dx^2}$ is:
   (A) $-\frac{(1+\log x)}{(x \log x)^2}$
   (B) $-\frac{1}{(x \log x)^2}$
   (C) $\frac{(1+\log x)}{(x \log x)^2}$
   (D) $\frac{1}{x^2 \log x}$

2. The function $f(x) = x^x$ has a stationary point at:
   (A) $x = e$
   (B) $x = 1/e$
   (C) $x = 1$
   (D) $x = \sqrt{e}$

3. If $y = e^{a \sin^{-1} x}$, then $(1 - x^2)y_2 - xy_1$ is equal to:
   (A) $a^2 y$
   (B) $-a^2 y$
   (C) ay
   (D) 0

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

5. The maximum value of $\left(\frac{1}{x}\right)^x$ is:
   (A) e
   (B) $e^{1/e}$
   (C) e^e
   (D) $(1/e)^e$

6. If $f(x) = kx - \sin x$ is monotonically increasing for all $x \in \mathbb{R}$, then:
   (A) $k < 1$
   (B) $k > 1$
   (C) $k < -1$
   (D) $k > -1$

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

8. The second order derivative of $f(x) = \tan x$ at $x = \pi/4$ is:
   (A) 2
   (B) 4
   (C) 1
   (D) 0

9. The function $f(x) = 2x^3 - 3x^2 - 12x + 5$ has a local maximum at:
   (A) $x = 2$
   (B) $x = -1$
   (C) $x = 1$
   (D) $x = -2$

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) $40\pi\,\text{cm}^2/\text{s}$
    (B) $80\pi\,\text{cm}^2/\text{s}$
    (C) $100\pi\,\text{cm}^2/\text{s}$
    (D) $60\pi\,\text{cm}^2/\text{s}$

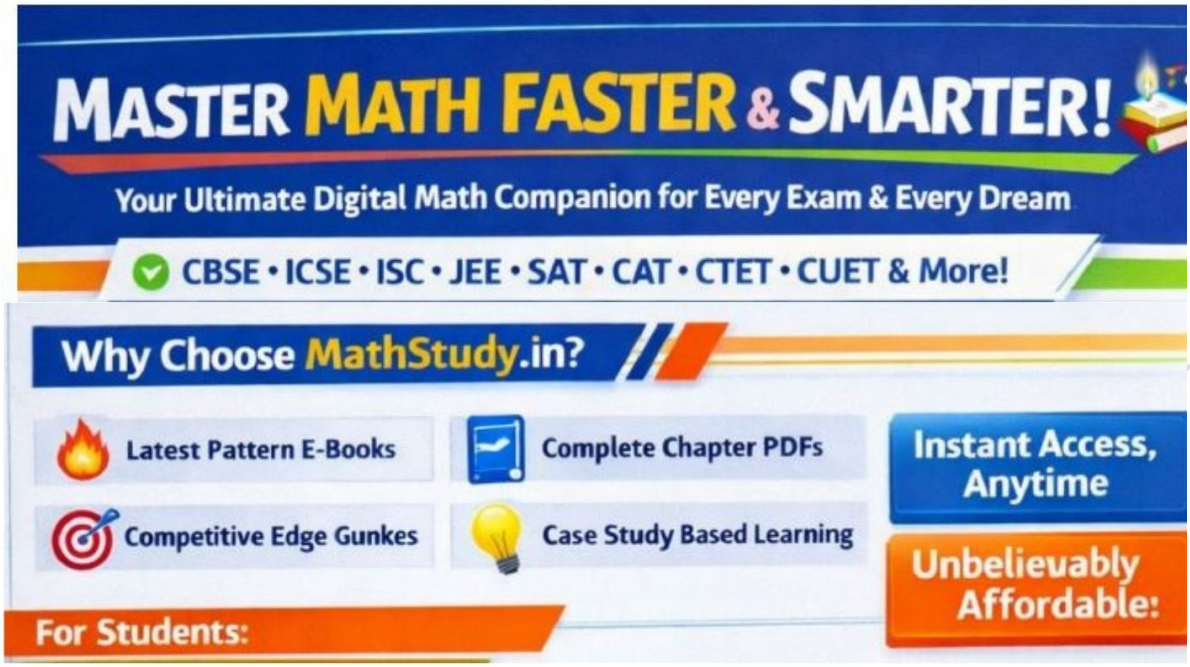
11. The value of x for which the function $f(x) = \log x/x$ is maximum is:
    (A) 1
    (B) e
    (C) $1/e$
    (D) 2

12. If $y = \sin(m \sin^{-1} x)$, then the value of $(1 - x^2)y'' - xy'$ is:
    (A) m^2y
    (B) $-m^2y$
    (C) my
    (D) 0

13. The minimum value of $2x + 3y$ subject to $xy = 6$ $(x, y > 0)$ is:
    (A) 12
    (B) 10
    (C) 6
    (D) 8

14. The function $f(x) = \cos x - 2px$ is monotonically decreasing for all $x \in \mathbb{R}$ if:
    (A) $p < 1/2$
    (B) $p > 1/2$
    (C) $p > -1/2$
    (D) $p < 2$

15. If $f(x) = x^3 - 6x^2 + 9x + 15$, then the point of inflection is:
    (A) $x = 1$
    (B) $x = 2$
    (C) $x = 3$
    (D) $x = 0$



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