CUET (UG) – MATHEMATICS

Chapter Test - Unit III: Calculus - Continuity and Differentiability

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. The derivative of $\cos^{-1}(2x^2 - 1)$ with respect to $\cos^{-1} x$ is:
   (A) 2
   (B) x
   (C) 1/2
   (D) -2

2. If $y = \log \sqrt{\frac{1-\sin x}{1+\sin x}}$, then $\frac{dy}{dx}$ is:
   (A) $\sec x$
   (B) $-\sec x$
   (C) $\csc x$
   (D) $-\csc x$

3. If $f(x) = \begin{cases} \frac{k \cos x}{\pi - 2x} & \text{if } x \neq \pi/2 \\ 3 & \text{if } x = \pi/2 \end{cases}$ is continuous at $x = \pi/2$, then k is:
   (A) 3
   (B) 6
   (C) 12
   (D) 3/2

4. If $x^m y^n = (x + y)^{m+n}$, then $\frac{dy}{dx}$ is always:
   (A) x/y
   (B) y/x
   (C) 1
   (D) m/n

5. The derivative of $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$ with respect to $\tan^{-1} x$ is:
   (A) 1
   (B) 1/2
   (C) 2
   (D) x

6. If $y = a^x + x^a$, then $\frac{dy}{dx}$ at $x = a$ is:
   (A) $a^a(1 + \log a)$
   (B) $2a^a$
   (C) $a^a \log a$
   (D) $a^a(1 + a \log a)$

7. If $x = a(\theta + \sin \theta)$ and $y = a(1 - \cos \theta)$, then $\frac{d^2y}{dx^2}$ at $\theta = \pi/2$ is:
   (A) $1/a$
   (B) $1/2a$
   (C) $-1/a$
   (D) $2/a$

8. If $y = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right)$, then $\frac{dy}{dx}$ is:
   (A) $\frac{3}{1+9x^2}$
   (B) $\frac{3}{1+x^2}$
   (C) $\frac{1}{1+3x^2}$
   (D) $\frac{3x^2}{1+x^2}$

9. If $y = \log(x + \sqrt{x^2 + a^2})$, then $\frac{dy}{dx}$ is:
   (A) $\frac{1}{\sqrt{x^2+a^2}}$
   (B) $\frac{1}{x+\sqrt{x^2+a^2}}$

(C) $\sqrt{x^2 + a^2}$

(D) $\frac{x}{\sqrt{x^2+a^2}}$

10. If $e^x + e^y = e^{x+y}$, then $\frac{dy}{dx}$ is:

(A) e^{y-x}

(B) $-e^{y-x}$

(C) e^{x-y}

(D) $-e^{x-y}$

11. The derivative of $\sin^2 x$ with respect to $(\log x)^2$ is:

(A) $\frac{x \sin 2x}{2 \log x}$

(B) $\frac{\sin 2x}{x \log x}$

(C) $\frac{x \cos^2 x}{\log x}$

(D) $\frac{x \sin x \cos x}{\log x}$

12. If $y = \sin(m \sin^{-1} x)$, then $(1 - x^2)y_2 - xy_1$ is equal to:

(A) $m^2 y$

(B) $-m^2 y$

(C) my

(D) 0

13. If $y = \cos^{-1}\left(\frac{1-x^{2n}}{1+x^{2n}}\right)$, then $\frac{dy}{dx}$ is:

(A) $\frac{2nx^{n-1}}{1+x^{2n}}$

(B) $\frac{nx^{n-1}}{1+x^{2n}}$

(C) $\frac{2nx^{2n-1}}{1+x^{2n}}$

(D) $\frac{2}{1+x^{2n}}$

14. If $f(x) = \log_e(\log_e x)$, then the value of $f'(e)$ is:

(A) e

(B) $1/e$

(C) 1

(D) 0

15. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, then $\frac{dy}{dx}$ is:

(A) $\frac{1}{(1+x)^2}$

(B) $-\frac{1}{(1+x)^2}$

(C) $\frac{1}{1+x^2}$

(D) $\frac{x}{1+x}$

16. The derivative of x^x at $x = e$ is:

(A) e^e

(B) $2e^e$

(C) $e^e \log e$

(D) 0

17. If $y = \sin^{-1} x + \sin^{-1}\sqrt{1-x^2}$, for $0 < x < 1$, then $\frac{dy}{dx}$ is:

(A) $\frac{2}{\sqrt{1-x^2}}$

(B) 0

(C) $\frac{1}{\sqrt{1-x^2}}$

(D) 1

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18. If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots \infty$, then $\frac{dy}{dx}$ is:
    (A) y
    (B) $y - 1$
    (C) e^x
    (D) Both (A) and (C)

19. If $y = \tan^{-1}\left(\frac{a-x}{1+ax}\right)$, then $\frac{dy}{dx}$ is:
    (A) $\frac{1}{1+a^2} - \frac{1}{1+x^2}$
    (B) $-\frac{1}{1+x^2}$
    (C) $\frac{1}{1+x^2}$
    (D) $\frac{a}{1+x^2}$

20. If $f(x) = |\cos x|$, then $f'(\frac{3\pi}{4})$ is:
    (A) $1/\sqrt{2}$
    (B) $-1/\sqrt{2}$
    (C) 1
    (D) $\sqrt{2}$

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