CBSE NCERT Based Chapter wise Questions (2025-2026)

Class-XII

Subject: Mathematics

Total : 11 Marks (expected) [MCQ-1 Mark, VSA-2 Marks, SA-3 Marks, LA-5 Marks]

Chapter Name : *Differential Calculus* (Chap : 5 & 6)

Level 1 & 2 Combined

SECTION – A

MCQ Type (1 mark each):

1. If y = f(x) is a differentiable function of f(x). Then

Ⓐ $f(x + \Delta x) = f'(x).\Delta x$ Ⓑ $f(x + 4x) = f(x) + f'(x)\Delta x$ Ⓒ $f(x + 4x) = f(x) + \Delta x$ Ⓓ none of these

[Hints : Rate change]

2. The differential of log sin x is

Ⓐ cot x Ⓑ – tan x dx Ⓒ cot x dx Ⓓ tan x dx

[Hints : Rate change]

3. If the function f(x) is differentiable at x = a, then it is increasing at x = a when

Ⓐ $f'(a) > 0$ Ⓑ $f'(a) < 0$ Ⓒ $f'(a) \geq c$ Ⓓ $f'(a) \leq 0$

[Hints : Increasing and decreasing function]

4. The minimum value of the function $f(x) = x^2 - x + 2$ is

Ⓐ $\frac{1}{2}$ Ⓑ $-\frac{1}{2}$ Ⓒ $-\frac{7}{4}$ Ⓓ $\frac{7}{4}$

[Hints : Maxima and minima]

5. f : [–1, 1] → R is defined by f(x) = |x+ is not differentiable at

Ⓐ x = –1 Ⓑ x = 0 Ⓒ x = 1 Ⓓ none of these

[Hints : Differentiability]

6. The function $f(x) = x^K$ is continuous at x = K, when

Ⓐ $K \neq 0$ Ⓑ $K < 0$ Ⓒ $K \leq 0$ Ⓓ $K \geq 0$

[Hints : Continuity and Differentiability]

7. The points of discontinuities of the function $f(x) = \frac{x + 2}{2x^2 - x - 1}$

Ⓐ $\frac{1}{2}, -1$ Ⓑ $-\frac{1}{2}, -1$ Ⓒ $1, -\frac{1}{2}$ Ⓓ $\frac{1}{2}, 1$

[Hints : Continuity and Differentiability]

SECTION – B

Very Short Answer (VSA) (2 marks each questions):

1. Show that the function f(x) = 2x – |x| is continuous at x = 0.

[Hints : Continuity and Differentiability]

2. If a function has a finite derivative at a given point, prove that it is continuous at that point. Is the convers true? Justify your answer.

[Hints : Continuity and Differentiability]

3. Find the derivative w.r.t. x : $y = \cot^{-1}\sqrt{\frac{1-\sin x}{1+\sin x}}\left(0 < x < \frac{\pi}{2}\right)$

[Hints : Differentiation]

4. Let V and S be the volume and surface respectively of a sphere of radius r. Prove that, $2\frac{dv}{dt} = r.\frac{ds}{dt}$.

[Hints : Rate change]

5. If $x > \frac{1}{2}$ show that the function $f(x) = x(4x^2 - 3)$ is increasing.

[Hints : Increasing and decreasing function]

6. Show that the function $f(x) = \sin x \left(\frac{\pi}{2} \le x \le \pi\right)$ is decreasing.

[Hints : Increasing and decreasing function]

7. Show that, the maximum value of the function $f(x) = \left(x + \frac{1}{x}\right)$ is less than its minimum value.

SECTION – C

Short Answer (SA) (3 marks each questions):

1. Prove that, the greatest rectangle inscribed in a given circle is a square.

[Hints : Maxima & Minima]

2. Find the maximum value of $x^{\frac{1}{x}}$.

[Hints : Maxima and Minima]

3. Find the intervals in which the function $f(x) = x^3 - 6x^2 + 9x + 15$ is decreasing.

[Hints : Increasing and decreasing function]

4. Find the interval in which the function $f(x) = \sin x - \cos x$ where $0 < x < 2\pi$ is increasing.

[Hints : Increasing and decreasing function]

5. If $y = x^4 - 12$ and if x changes from 2 to 1.99, what is the approximate change in y?

[Hints : Rate change]

6. If $\sqrt{1-x^2} + \sqrt{1-y^2} = a(x - y)$, show that $\frac{dy}{dx} = \frac{\sqrt{1-y^2}}{\sqrt{1-x^2}}$.

[Hints : Differentiation]

7. If g(x) is the inverse of f(x) and $f'(x) = \frac{1}{1+x^3}$, show that $g'(x) = 1 + \{g(x)\}^3$.

SECTION – D

Long Answer (LA) (5 marks each questions):

1. Prove that the function $f(x) = \sin \pi|x|$ is continuous at x = 0 but not differentiable at the same point.

[Hints : Continuity and differentiability]

2. If $x = \sec\theta - \cos\theta$ and $y = \sec^n\theta - \cos^n\theta$, show that $(x^2 + 4)\left(\frac{dy}{dx}\right)^2 = n^2(y^2 + 4)$

[Hints : Differentiation]

3. If a triangle ABC inscribed in a fixed circle be slightly varied in such a way that its vertices are always on the circle, show that, $\frac{da}{\cos A} + \frac{db}{\cos B} + \frac{dc}{\cos C} = 0$

[Hints : Rate change]

4. Use the function $f(x) = x^{\frac{1}{x}}$; $x > 0$, to determine the bigger of the two numbers e^π and π^e.

[Hints : Increasing and decreasing function]

5. Show that the semi-vertical angle of a cone of maximum volume and given slant height is $\tan^{-1}\left(\sqrt{2}\right)$.

[Hints : Maxima and minima]

6. Determine a point on the parabola $x^2 = 8y$ which is nearest to the point (2, 4).

[Hints : Maxima and minima]

7. Find the coordinates of the point on the curve $y = \frac{x}{1 + x^2}$ where the tangent to the curve has the greatest slope.

[Hints : Maxima and minima]

ANSWER

SECTION – A

1. Ⓑ
2. Ⓒ
3. Ⓐ
4. Ⓓ
5. Ⓑ
6. Ⓓ
7. Ⓒ

SECTION – B

3. $\frac{1}{2}$

SECTION – C

2. $e^{\frac{1}{e}}$
3. (1, 3)
4. $\left(0, \frac{3\pi}{4}\right) \cup \left(\frac{7\pi}{4}, 2\pi\right)$
5. 0.32

SECTION – D

4. $e^\pi > \pi^e$
6. (4, 2)
7. (0, 0)