

Application of Derivatives — CBSE Pattern Test 1

Class 12 Maths · 90 minutes · 40 marks · Sections A–D with answer key · Narayan Gurukul Academy

Test 1 — CBSE Pattern (90 minutes, 40 marks)

Class 12 Maths · Application of Derivatives · Narayan Gurukul Academy (ClassApna)

General Instructions: (1) This paper has four sections — Section A (1×10), Section B (2×4), Section C (3×4) and Section D (5×2) — total 40 marks. Time allowed: 90 minutes.

(2) All questions are compulsory. No overall choice is given; internal choice, where allowed, is clearly marked.

(3) For MCQ questions choose the single correct option; for VSA answers write a single line.

(4) Take $g = 10 \text{ m/s}^2$. All symbols carry their usual meaning. Use of a calculator is not permitted.

Section A — MCQ & VSA ($10 \times 1 = 10$ marks)

1. The slope of the tangent to $y = f(x)$ at a point is

- (A) $f'(x)$
- (B) $f(x)$
- (C) $1/f'(x)$
- (D) $f''(x)$

2. The tangent is horizontal where

- (A) $dy/dx = 0$
- (B) $dy/dx = 1$
- (C) $dy/dx = \infty$
- (D) $y = 0$

3. A function f is increasing on an interval if

- (A) $f'(x) \geq 0$
- (B) $f'(x) \leq 0$
- (C) $f'(x) = 0$
- (D) $f''(x) = 0$

4. A function f is decreasing on an interval if

- (A) $f'(x) \leq 0$
- (B) $f'(x) \geq 0$
- (C) $f'(x) > 0$
- (D) $f''(x) > 0$

5. At a maximum point, $f'(x) = 0$ and $f''(x)$ is

- (A) negative
- (B) positive
- (C) zero
- (D) undefined

6. At a minimum point, $f'(x) = 0$ and $f''(x)$ is

- (A) positive
- (B) negative
- (C) zero
- (D) undefined

7. The approximation formula is $f(x + \Delta x) \approx$

- (A) $f(x) + f'(x)\Delta x$

(B) $f(x) - f'(x)\Delta x$

(C) $f(x)\Delta x$

(D) $f(x)/\Delta x$

8. For a rectangle of fixed perimeter, the area is maximum when it is a

(A) square

(B) long thin rectangle

(C) right triangle

(D) circle

9. Write the slope of the tangent to $y = f(x)$ at a point.

10. State the condition for a function to be increasing.

Section B — Short Answer I ($4 \times 2 = 8$ marks)

11. Where is the tangent horizontal?

12. What are critical points?

13. State the condition for a local maximum.

14. For a fixed perimeter, when is the area of a rectangle maximum?

Section C — Short Answer II ($4 \times 3 = 12$ marks)

15. Find the slope of the tangent to $y = x^2$ at $x = 1$.

16. Find the interval in which $f(x) = x^2 - 4x + 3$ is increasing.

17. Find the local maximum and minimum of $f(x) = x^2 - 4x + 3$.

18. Use linear approximation to find $(1.01)^3$.

Section D — Long Answers ($2 \times 5 = 10$ marks)

19. Find the intervals in which $f(x) = x^3 - 3x^2 - 9x + 5$ is increasing or decreasing.

20. Find the local maxima and minima of $f(x) = 2x^3 - 3x^2 - 12x + 5$. Find two positive numbers whose sum is 15 and the sum of whose squares is minimum.

Answer Key (Marking Scheme)

Q1 — (A) $f'(x)$. Q2 — (A) $dy/dx = 0$. Q3 — (A) $f'(x) \geq 0$. Q4 — (A) $f'(x) \leq 0$.

Q5 — (A) negative. Q6 — (A) positive. Q7 — (A) $f(x) + f'(x)\Delta x$. Q8 — (A) square.

Q9 — $f'(x)$.

Q10 — $f'(x) \geq 0$.

Q11 — Where $dy/dx = 0$.

Q12 — Where $f'(x) = 0$ or f' is undefined.

Q13 — $f'(x) = 0$ and $f''(x) < 0$.

Q14 — When it is a square.

Q15 — 2.

Q16 — $(2, \infty)$.

Q17 — Minimum at $x = 2$.

Q18 — 1.03.

Q19 — Increasing on $(-\infty, -1) \cup (3, \infty)$; decreasing on $(-1, 3)$.

Q20 — Local max at $x = -1$, local min at $x = 2$; numbers 7.5 and 7.5.