PRACTICE PAPER 01 (2026-27)
CHAPTER 06 : APPLICATION OF DERIVATIVES

SUBJECT: MATHEMATICS	**MAX. MARKS:** 40
CLASS: XII	**DURATION:** 1½ hrs

General Instructions:

(i) All questions are compulsory.

(ii) This question paper contains 20 questions divided into five Sections A, B, C, D and E.

(iii) Section A comprises 10 MCQs of 1 mark each (Q9 and Q10 are Assertion–Reason questions). Section B comprises 4 questions of 2 marks each. Section C comprises 3 questions of 3 marks each. Section D comprises 1 question of 5 marks with an internal choice. Section E comprises 2 case study based questions of 4 marks each, with internal choice in the last sub-part.

(iv) There is no overall choice. Internal choices have been provided where indicated.

(v) Use of calculators is not permitted.

SECTION – A

Questions 1 to 10 carry 1 mark each.

1. The radius of a circular plate is increasing at the rate of 2 cm/s. The rate at which its area is increasing when the radius is 5 cm is

(a) 10π cm²/s (b) 20π cm²/s (c) 25π cm²/s (d) 5π cm²/s

2. The function $f(x) = x^3 - 3x^2$ is strictly decreasing in the interval

(a) $(-\infty, 0)$ (b) $(2, \infty)$ (c) $(-\infty, \infty)$ (d) $(0, 2)$

3. The slope of the normal to the curve $y = x^2 - 4x$ at the point $(3, -3)$ is

(a) 2 (b) -2 (c) $-1/2$ (d) $1/2$

4. Using differentials, the approximate value of $\sqrt{36.1}$ is

(a) 6.0083 (b) 6.083 (c) 6.0166 (d) 6.0016

5. The minimum value of $f(x) = x^2 - 6x + 11$ is

(a) 11 (b) 3 (c) 2 (d) 6

6. Which of the following functions is strictly increasing on $\mathbb{R}$?

(a) x^2 (b) $\sin x$ (c) e^{-x} (d) $x^3 + x$

7. For $x > 0$, the function $f(x) = x + 4/x$ has a local minimum at $x =$

(a) 2 (b) 4 (c) 1 (d) -2

8. The side of a cube is increasing at 3 cm/s. When the side is 4 cm, the volume is increasing at the rate of

(a) 48 cm³/s (b) 36 cm³/s (c) 144 cm³/s (d) 96 cm³/s

For Q9 and Q10, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct answer out of the following choices.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

9. Assertion (A): The function $f(x) = x^3$ has neither a local maximum nor a local minimum.

Reason (R): At every point where $f'(x) = 0$, a function has a local maximum or a local minimum.

10. Assertion (A): The function $f(x) = \cos x$ is strictly decreasing on $(0, \pi)$.

Reason (R): $f'(x) = -\sin x < 0$ for every x in $(0, \pi)$.

SECTION – B

Questions 11 to 14 carry 2 marks each.

11. Find the intervals in which the function $f(x) = x^2 - 4x + 6$ is strictly increasing or strictly decreasing.

12. Using differentials, find the approximate value of $(65)^{1/3}$.

13. The radius of a spherical balloon is increasing at 0.5 cm/s. How fast is its surface area increasing when the radius is 6 cm?

14. Find the point on the curve $y = x^2 - 2x + 3$ at which the tangent is parallel to the line $4x - y + 5 = 0$.

SECTION – C

Questions 15 to 17 carry 3 marks each.

15. Find the local maximum and local minimum values of $f(x) = x^3 - 6x^2 + 9x + 5$.

16. Show that the function $f(x) = x^3 - 3x^2 + 6x - 5$ is strictly increasing on $\mathbb{R}$.

17. Find the equations of the tangent and the normal to the curve $y = x^3 - 2x + 1$ at the point (2, 5).

SECTION – D

Question 18 carries 5 marks.

18. An open tank with a square base and vertical sides is to be made to hold 32 m^3 of water. Find the dimensions of the tank for which the area of sheet metal used is minimum, and find this minimum area.

OR

Find the absolute maximum and absolute minimum values of $f(x) = 2x^3 - 15x^2 + 36x + 1$ on the interval [1, 5].

SECTION – E (Case Study Based Questions)

Questions 19 and 20 carry 4 marks each.

19. A small company makes and sells x hundred units of a product every month. Its monthly profit (in ₹ thousand) is given by $P(x) = -x^2 + 40x - 150$.

Based on the above information, answer the following questions:

(i) Find dP/dx. (1)

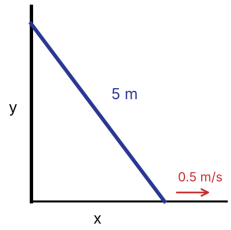
(ii) For how many hundred units is the profit maximum? (1)

(iii) Find the maximum profit and verify, using the second derivative, that it is a maximum. (2)

OR

(iii) Find the intervals in which the profit function is increasing and decreasing. (2)

20. A 5 m long ladder rests against a vertical wall. The foot of the ladder is pulled away from the wall along the ground at 0.5 m/s. Let x m be the distance of the foot from the wall and y m the height of the top of the ladder on the wall at time t seconds.



Based on the above information, answer the following questions:

(i) Write the relation between x and y. (1)

(ii) Find y when x = 3 m. (1)

(iii) How fast is the top of the ladder sliding down the wall when x = 3 m? (2)

OR

(iii) Find the rate at which the area of the triangle formed by the ladder, the wall and the ground is changing when x = 3 m. (2)

— End of Question Paper —