

Application of Derivatives — Assignment 1

Class 12 Maths · Topic-wise question bank covering every concept of the chapter · Narayan Gurukul Academy

Instructions: (1) Attempt all questions. This worksheet walks through every concept of the chapter, topic by topic.
(2) The interactive MCQ version of these questions (with instant answer reveal) is available on the notes page.
(3) Universal values: $g = 10 \text{ m/s}^2$ unless stated. Give answers with correct SI units.

Rate of Change and Tangents

MCQ Questions (choose the correct option)

- The slope of the tangent to $y = f(x)$ at a point is
 - $f'(x)$
 - $f(x)$
 - $1/f'(x)$
 - $f''(x)$
- The rate of change of y with respect to x is
 - dy/dx
 - dx/dy
 - xy
 - $x + y$
- The tangent is horizontal where
 - $dy/dx = 0$
 - $dy/dx = 1$
 - $dy/dx = \infty$
 - $y = 0$
- If the radius of a circle increases, the rate of change of area is
 - $2\pi r(dr/dt)$
 - πr^2
 - $2\pi r$
 - $\pi r(dr/dt)$

1 Mark Questions

- Write the slope of the tangent to $y = f(x)$ at a point.
- Define the rate of change of a quantity.
- Where is the tangent horizontal?

2 Mark Questions

- Find the slope of the tangent to $y = x^2$ at $x = 1$.
- The radius of a circle increases at 0.1 cm/s . Find the rate of increase of area when $r = 5 \text{ cm}$.

3 Mark Questions

- Find the equation of the tangent to $y = x^3$ at $x = 1$.
- The volume of a cube is increasing at $9 \text{ cm}^3/\text{s}$. Find the rate of increase of its side when the side is 10 cm .

Increasing and Decreasing Functions

MCQ Questions (choose the correct option)

1. A function f is increasing on an interval if
 - (A) $f'(x) \geq 0$
 - (B) $f'(x) \leq 0$
 - (C) $f'(x) = 0$
 - (D) $f''(x) = 0$
2. A function f is decreasing on an interval if
 - (A) $f'(x) \leq 0$
 - (B) $f'(x) \geq 0$
 - (C) $f'(x) > 0$
 - (D) $f''(x) > 0$
3. The critical points are where
 - (A) $f'(x) = 0$ or f' is undefined
 - (B) $f(x) = 0$
 - (C) $f''(x) = 0$
 - (D) $x = 0$
4. For x^2 on $\mathbb{R}$, the function is
 - (A) decreasing on $(-\infty, 0)$ and increasing on $(0, \infty)$
 - (B) always increasing
 - (C) always decreasing
 - (D) constant

1 Mark Questions

1. State the condition for a function to be increasing.
2. State the condition for a function to be decreasing.
3. What are critical points?

2 Mark Questions

1. Find the interval in which $f(x) = x^2 - 4x + 3$ is increasing.
2. Show that $f(x) = x^3$ is increasing on $\mathbb{R}$.

3 Mark Questions

1. Find the intervals in which $f(x) = x^3 - 3x^2 - 9x + 5$ is increasing or decreasing.
2. Find the intervals in which $f(x) = 2x^3 - 15x^2 + 36x + 1$ is increasing or decreasing.

Maxima and Minima**MCQ Questions (choose the correct option)**

1. At a maximum point, $f'(x) = 0$ and $f''(x)$ is
 - (A) negative
 - (B) positive
 - (C) zero
 - (D) undefined
2. At a minimum point, $f'(x) = 0$ and $f''(x)$ is

- (A) positive
 - (B) negative
 - (C) zero
 - (D) undefined
3. The second-derivative test uses
- (A) $f''(x)$ at the critical point
 - (B) $f(x)$ only
 - (C) the y-intercept
 - (D) the domain
4. The local maximum of $f(x) = -x^2$ is at
- (A) $x = 0$
 - (B) $x = 1$
 - (C) $x = -1$
 - (D) $x = 2$

1 Mark Questions

1. State the condition for a local maximum.
2. State the condition for a local minimum.
3. Find the critical point of $f(x) = x^2 - 2x$.

2 Mark Questions

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

3 Mark Questions

1. Find the local maxima and minima of $f(x) = 2x^3 - 3x^2 - 12x + 5$.
2. Find the maximum and minimum values of $f(x) = x^3 - 6x^2 + 9x + 15$.

Optimisation and Approximations

MCQ Questions (choose the correct option)

1. 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) $f(x)/\Delta x$
2. 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
3. The absolute maximum of a continuous function on $[a, b]$ occurs at
 - (A) a critical point or an endpoint
 - (B) only a critical point
 - (C) only the midpoint

(D) always the endpoint

4. The approximate value of $(1.01)^3$ using linear approximation is

- (A) 1.03
- (B) 1.01
- (C) 1.3
- (D) 1.003

1 Mark Questions

1. Write the linear approximation formula.
2. For a fixed perimeter, when is the area of a rectangle maximum?
3. Where does the absolute maximum of f on $[a, b]$ occur?

2 Mark Questions

1. Use linear approximation to find $(1.01)^3$.
2. Find the maximum area of a rectangle with perimeter 20.

3 Mark Questions

1. Find two positive numbers whose sum is 15 and the sum of whose squares is minimum.
2. A wire of length 28 m is to be cut into two pieces to form a square and a circle. Find the lengths so that the total area enclosed is minimum.