

INTERNATIONAL INDIAN SCHOOL BURAIDAH

Worksheet for the Academic Year 2026-27

CLASS: 12

SUBJECT: MATHEMATICS

DATE: 30/05/2026

LESSON: APPLICATIONS OF DERIVATIVES

1. A function $f(x) = 10 - x - 2x^2$ is increasing on the interval

[a) $(-\infty, -\frac{1}{4}]$ b) $(-\infty, \frac{1}{4})$ c) $[-\frac{1}{4}, \infty)$ d) $[-\frac{1}{4}, \frac{1}{4}]$]

2. The radius of the balloon is increasing at the rate of 20m/s. At which rate is the surface area of the balloon increasing when the radius is 30m.

3. If the rate of change of volume of a sphere is equal to the rate of change of its radius, find the radius of the sphere.

4. The side of a square is increasing at the rate of 0.1cm/sec. Find the rate of increase of its perimeter.

5. The volume of a cube is increasing at a rate of $7\text{cm}^3/\text{s}$. How fast is the surface area increasing when

the length of the edge is 12cm? $[\frac{7}{3} \text{ cm}^2/\text{sec}]$

6. Show that the cone of greatest volume which can be inscribed in a given sphere has an altitude equal to $\frac{2}{3}$ of the diameter of the sphere.

7. The radius of a cylinder is increasing at the rate of 2m/s and its height is decreasing at the rate of 3 m/s. Find the rate of change of volume when the radius is 3m and height is 5m. $[33\pi \text{ cm}^3/\text{sec}]$

8. Separate $(0, \frac{\pi}{2})$ into subintervals in which $f(x) = \sin^4 x + \cos^4 x$ strictly increasing or strictly decreasing.

$[(\frac{\pi}{4}, \frac{\pi}{2}), (0, \frac{\pi}{4})]$

9. Find the points of local maxima or local minima, if any, for $f(x) = \sin x - \cos x$; $0 < x < 2\pi$.

10. Show that $f(x) = 5^x$ is increasing for all x .

11. Find the intervals on which $\tan^{-1} x - x$ is increasing or decreasing. $[\text{decreasing on } (-\infty, \infty)]$

12. Find the absolute maximum and absolute minimum values of

a) $f(x) = x^{50} - x^{20}$ $[0, 1]$ $[0, -3/5]$

b) $f(x) = \cos^2 x + \sin x$ $[0, \pi]$ $[\frac{5}{4}, 1]$

c) $f(x) = 2 \cos 2x - \cos 4x$ $[0, \pi]$ $[\frac{3}{2}, -3]$

13. Write the value of a for which $f(x) = \cos x + ax^2 + b$ is strictly increasing on $\mathbb{R}$

14. Find the intervals in which the following functions (i) strictly increasing (ii) strictly decreasing

a) $f(x) = 3x^4 - 4x^3 - 12x^2 = 5$ b) $f(x) = \frac{3}{10}x^4 - \frac{4}{5}x^3 - 3x^2 + \frac{36}{5}x + 11$ c) $f(x) = \frac{3}{2}x^4 - 4x^3 - 45x^2 + 51$

15. Find the coordinates of a point of the parabola $y = x^2 + 7x + 2$ which is closest to the straight line $y = 3x - 3$

16. Of all closed circular cylindrical cans of volume $128\pi \text{ cm}^3$, find the dimensions of the can which has maximum surface area.

17. Find the least value of the function $f(x) = 2x + \frac{3}{x}$, $x > 0$.

18. An insect moves along the ellipse $\frac{x^2}{16} + \frac{y^2}{4} = 1$. When the rate of change of abscissa is 4 times that of ordinate, find the quadrant in which the insect lies.

19. Find the value of a , for which the function $f(x) = \sqrt{3}\sin x - \cos x - 2ax + 6$ is decreasing in R .