

**BCM SCHOOL BASANT AVENUE DUGRI LUDHIANA**  
**ASSIGNMENT APPLICATION OF DERIVATIVE**

	<p style="text-align: center;"><b>BCM SCHOOL BASANT AVENUE DUGRI LUDHIANA</b>  <b>ASSIGNMENT APPLICATION OF DERIVATIVE</b></p>
1	<p>The maximum profit that a company can make, if the profit function is given by <math>P(x) = 41 + 24x - 18x^2</math>.  (a) 25                      (b) 43                      (c) 62                      (d) 49</p>
2	<p>The sides of an equilateral triangle are increasing at the rate of 2 cm/s. The rate at which the area increases, when the side is 10 cm, is  (a) <math>\sqrt{3}</math> cm<sup>2</sup>/s   (b) 10 cm<sup>2</sup>/s   (c) <math>10\sqrt{3}</math> cm<sup>2</sup>/s   (d) <math>\frac{10}{\sqrt{3}}</math> cm<sup>2</sup>/s</p>
3	<p>The radius of a cylinder is increasing at the rate of 3 m/s and its height is decreasing at the rate of 4 m/s. The rate of change of volume when the radius is 4 m and height is 6 m, is  (a) <math>80\pi</math> cm<sup>3</sup>/s   (b) <math>144\pi</math> cm<sup>3</sup>/s   (c) <math>80</math> cm<sup>3</sup>/s   (d) <math>64</math> cm<sup>3</sup>/s</p>
4	<p>the total revenue received from the sale of x units of a product is given by <math>R(x) = 3x^2 + 36x + 5</math> in rupees. Find the marginal revenue when <math>x = 5</math>, where by marginal revenue we mean the rate of change of total revenue with respect to the number of items sold at an instant.</p>
5	<p>Find the intervals in which the function given by;  <math>f(x) = \frac{3}{10}x^4 - \frac{4}{5}x^3 - 3x^2 + \frac{36}{5}x + 11</math> is  (i) strictly increasing.   (ii) strictly decreasing.</p>
6	<p>An Apache helicopter of enemy is flying along the curve given by <math>y = x^2 + 7</math>. A soldier, placed at (3, 7), wants to shoot down the helicopter when it is nearest to him. Find the nearest distance.</p>
7	<p>A water tank has the shape of an inverted right circular cone with its axis vertical and vertex lowermost. Its semi-vertical angle is <math>\tan^{-1}(0.5)</math>. Water is poured into it at a constant rate of 5 cubic metre per hour. Find the rate at which the level of the water is rising at the instant when the depth of water in the tank is 4 m.</p>
8	<p>A telephone company in a town has 500 subscribers on its list and collects fixed charges of ₹ 300/- per subscriber per year. The company proposes to increase the annual subscription and it is believed that for every increase of ₹ 1/- one subscriber will discontinue the service. Find what increase will bring maximum profit?</p>

**Case-Study :** Read the following passage and answer the questions given below.

In an elliptical sport field the authority wants to design a rectangular soccer field with the maximum possible area. The sport field is given by the graph of

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$

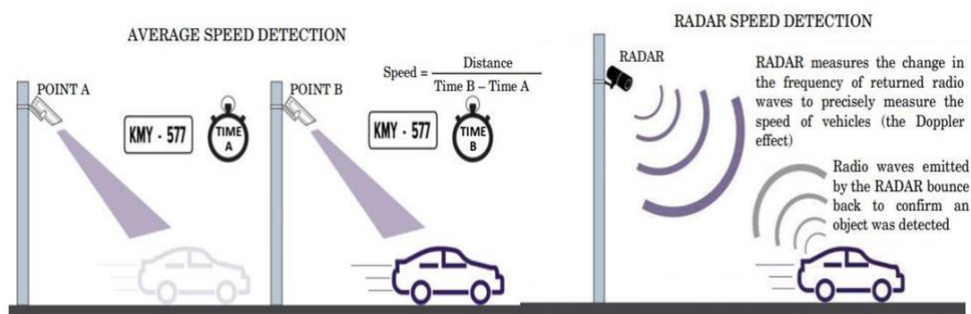


- (i) If the length and the breadth of the rectangular field be  $2x$  and  $2y$  respectively, then find the area function in terms of  $x$ .
- (ii) Find the critical point of the function.
- (iii) Use First Derivative Test to find the length  $2x$  and width  $2y$  of the soccer field (in terms of  $a$  and  $b$ ) that maximize its area.

**OR**

Use Second Derivative Test to find the length  $2x$  and width  $2y$  of the soccer field (in terms of  $a$  and  $b$ ) that maximize its area. (2022-23)

- 10 The traffic police have installed Over Speed Violation Detection (OSVD) system at various locations in a city. These cameras can capture a speeding vehicle from a distance of 300 m and even function in the dark.



A camera is installed on a pole at the height of 5 m. It detects a car travelling away from the pole at the speed of 20 m/s. At any point,  $x$  m away from the base of the pole, the angle of elevation of the speed camera from the car C is  $\theta$ .

On the basis of the above information, answer the following questions:

- (i) Express  $\theta$  in terms of height of the camera installed on the pole and  $x$ .
- (ii) Find  $\frac{d\theta}{dx}$
- (iii) (a) Find the rate of change of angle of elevation with respect to time at an instant when the car is 50 m away from the pole.

(iii)(b) If the rate of change of angle of elevation with respect to time of another car at a distance of 50 m from the base of the pole is $\frac{3}{101}$ rad/s, then find the speed of the car.
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