CLASS XII

APPLICATION OF DERIVATIVES

1. Sand is pouring from a pipe at the rate of $12cm^3$/sec. The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast is the height of the sand-cone increasing when the height is 4cm?

2. Water is dripping out from a conical funnel at a uniform rate of $4cm^3$/sec through a tiny hole at the vertex in the bottom. When the slant height of the water is 3cm, find the rate of decrease of the slant height of the water cone .Given that the vertical angle of the funnel is 120^0.

3. Find the points on the curve $y = x^3 - 11x + 5$at which the tangent has the equation $y = x - 1$

4. Find the equations of the tangent and normal to the curve $y = \frac{x-7}{(x-2)(x-3)}$at the point, where it cuts x-axis.

5. Find the points on the curve $9y^2 = x^3$ where the normal to curve makes equal intercepts with the axes.

6. Using differentials, find the approximate value of the following up to 3 places of decimals.

a) $3.968^{3/2}$ b) $\frac{1}{\sqrt{25.1}}$

7. Find the approximate value of f(5.001) ,where $f(x)=x^3-7x^2+15$.

8. If the radius of a sphere is measured as 9 m with an error of 0.03 m, then find the approximate error in calculating its surface area.

9. Find the intervals in which the functions given below are strictly decreasing or strictly increasing:-

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

b) $f(x) = x^4 - \frac{x^3}{3}$

10. *Find the Intervals*in which the function f given by

$f(x)=\sin x + \cos x\ , 0 \le x \le 2\pi, is$ increasing or decreasing.

11. An open box with a square base is to be made out of a given quantity of metal sheet of area c . Show that the maximum volume of the box is $\frac{C^3}{6\sqrt{3}}$.

12. Manufacturer can sell x items at a price of rupees $(5 - \frac{x}{100})$ each. The cost price of x items is Rs $(\frac{x}{5} + 500)$. Find the number of items he should sell to earn maximum profit.

13. A point on the hypotenuse of a right angled triangle is at distance a and b from the sides .Show that the length of the hypotenuse is at least $(a^{\frac{2}{3}}+b^{\frac{2}{3}})^{3/2}$.

14. The length of the sides of an isosceles triangle are $9+x^2$,$9+x^2$ and $18-2x^2$ units. Calculate the value of x which makes the area maximum. Also find the maximum area of the triangle.

15.A window has the shape of a rectangle surmounted by an equilateral triangle . If the perimeter of the window is 12m, find the dimensions of the rectangle $that$ will produce the largest area of the window.

16. An Apache helicopter of enemy is flying along the curve given by $y = x^2 + 7$.A soldier placed at (3 , 7) wants to shoot down the helicopter when it is nearest to him.