Assignment : 01
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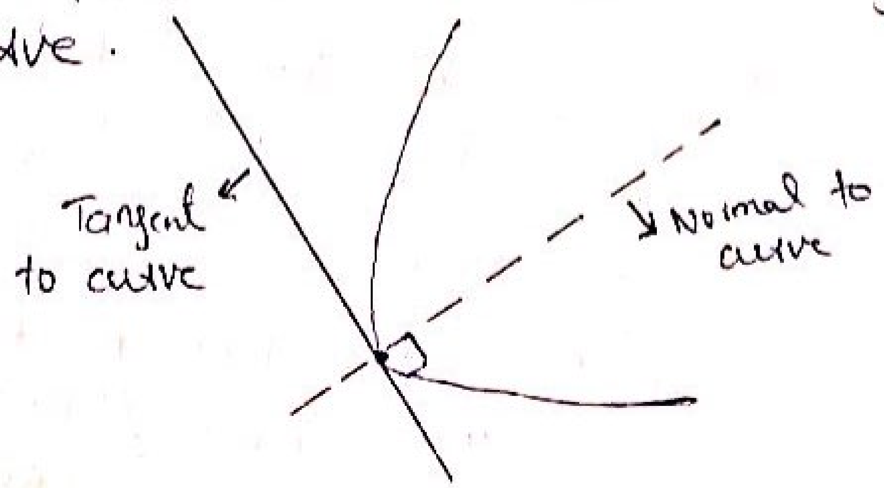
①

⇒ We use the derivatives to determine the maximum and minimum values of Particular Functions (e.g., cost, strength, amount of material used in building, Profit, loss etc.

⇒ Derivatives are met in many engineering and science problems, especially when modeling the behavior of moving objects. Our discussions begins with some general applications which we can then apply to specific problems.

Application of Derivatives.

① Tangents And Normal:- A tangent to a curve is a line that touches the curve at one point and has the same slope as the curve at that point. A normal to a curve is a line perpendicular to a tangent of the curve.



(2)

Note:- we can find the slope of a tangent at any point (x,y) using $\frac{dy}{dx}$.

Tangent:- If we are travelling in a car around a corner and we drive over something slipery on the road like oil, water and our car starts to skid, it will continue in a direction tangent to the curve.

Normal:- The spokes of a wheel are placed normal to the circular shape of the wheel at each point where the spoke connects with the center.

(2) Newton's Method:-

The process involves making a guess at the true solution and then applying a formula to get a better guess and so on until we arrive at an acceptable approximation for the solution.

If we wish to find x so that $f(x)=0$ then we guess some initial value x_0 which is close to desired solution and then we get a better approximation using Newton Method.

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)}.$$

(3) Related Rates:- If two variables both vary with respect to time and have a relation between them, we can express the rate of change of one in terms of one another.

That is we'll be finding $\frac{df}{dt}$ for some function $f(t)$.

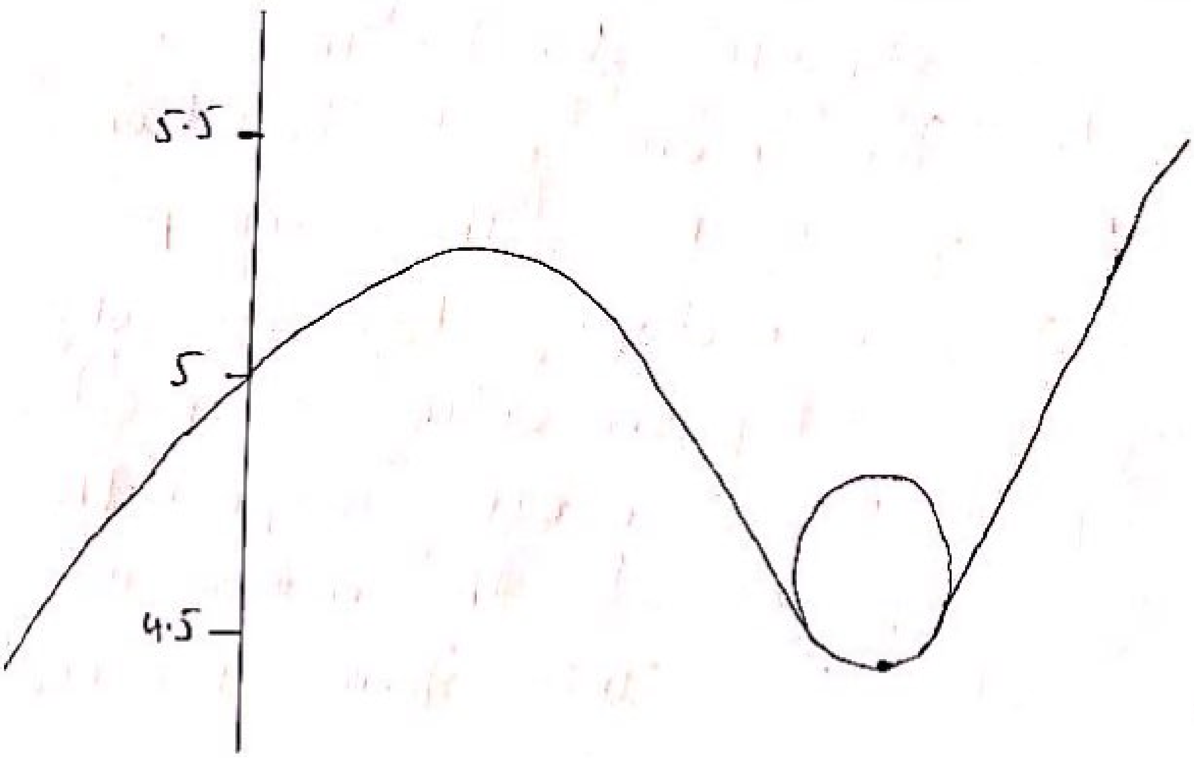
(4) Curvilinear Motion:- $v = \frac{ds}{dt}$, $a = \frac{dv}{dt} = \frac{d^2s}{dt^2}$

These formulae are only appropriate for rectilinear motion (velocity and acceleration in a straight line). This is inadequate for most real situations, so we introduce here the concept of curvilinear motion, where an object is moving in a plane along a specified curved path. we generally express the x and y components of the motion as functions of time. This form is called parametric form.

(5) Radius of curvature:-

$$\text{Radius of curvature} = \frac{\left[1+\left(\frac{dy}{dx}\right)^2\right]^{3/2}}{\left[\frac{d^2y}{dx^2}\right]}$$

The radius of curvature of the curve at a particular point is defined as the radius of the approximating circle. This radius changes as we move along the curve. The formula for the radius of curvature at any point x for the curve $y = f(x)$.



⇒ Applications of Integration:-

Integration:- The process of finding a function, given its derivatives, is called integration or anti-differentiation.

⇒ If $F'(x) = f(x)$ we say $F(x)$ is an anti-derivative of $f(x)$.

⇒ It is usually used to find the area.

(1) Shear Force And Bending Moment:

⇒ Shear force and bending moment are one of the important parameter for structural design these parameters, affect a structure a lot.

⇒ Take example of a rod suspended between two horizontal supports and some load is applied at the centre with application of load the beam will bend.

⇒ Some force will develop inside the rod which will try to break the rod in direction of force that force is called shear force and product of that force ~~is~~ with distance from either end is bending moment.

(2). Length of curve:- Corrugated Iron sheeting:

=> Corrugated iron is used extensively throughout the world as a versatile building material. Bending the material into a regular sine wave pattern gives it greater strength than if a flat sheed is used.

= So integration is used ~~to~~ to find out how wide should the flat sheet be to give us a corrugated sheet of required width.

(3) Area Under a Curve by Integration:

In civil engineering when we are dealing with curve or structure having curves then may need to find the area under the curve which is to be constructed so we use integration for this purpose.

$$\boxed{\text{Area} = \int_a^b f(x)\,dx.}$$

(4) Moment of Inertia by Integration:

Moment of Inertia is a geometrical Property of a section of a structural member. which is required to measure its resistance to bending and buckling.

⇒ 2 moment of inertia about x-axis.

$$I_x = \int_A y^2 dA.$$

where y is the y cordinate of the differential element of Area dA.

⇒ 2 moment of Inertia about y-axis.

$$I_y = \int_A x^2 dA.$$

where x is the x-cordinate of element dA.