Subject: Applied Calculus

Assignment No.: 01

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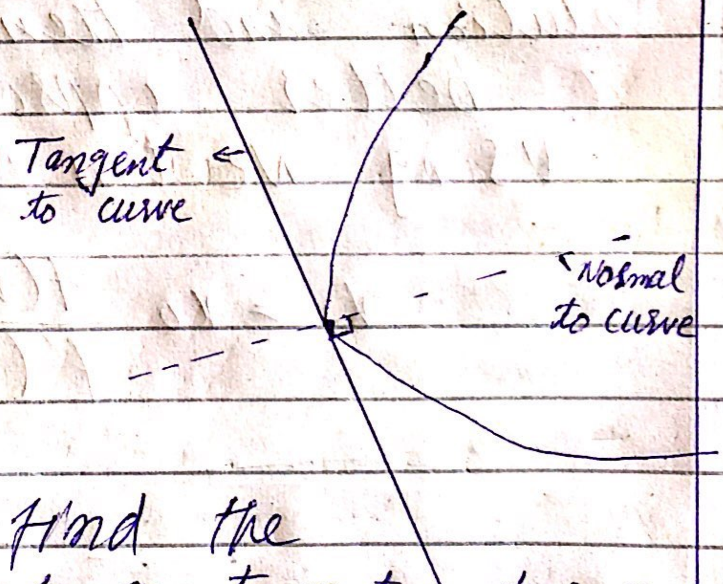
Application of Derivatives and Integration in Engineering.

We use the derivatives to determine the maximum and minimum values of particular function e.g cost, strength, amount of material used in Building, profit loss etc.

Derivatives are met in many Engineering and Science problems, especially when the modeling the behavior of moving objects. our discussion begin with some general applications which we can apply specific problems.

Tangents And Normal:

A tangent to a that touches the 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.



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

Newton's Method:

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

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

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

Related Rates:

If two variables both vary with respect to time and have relation between them, we can express the rate of change of one in terms of one another.

That is we will be finding $\frac{df}{dt}$ for some function $f(t)$.

Curvilinear Motion:

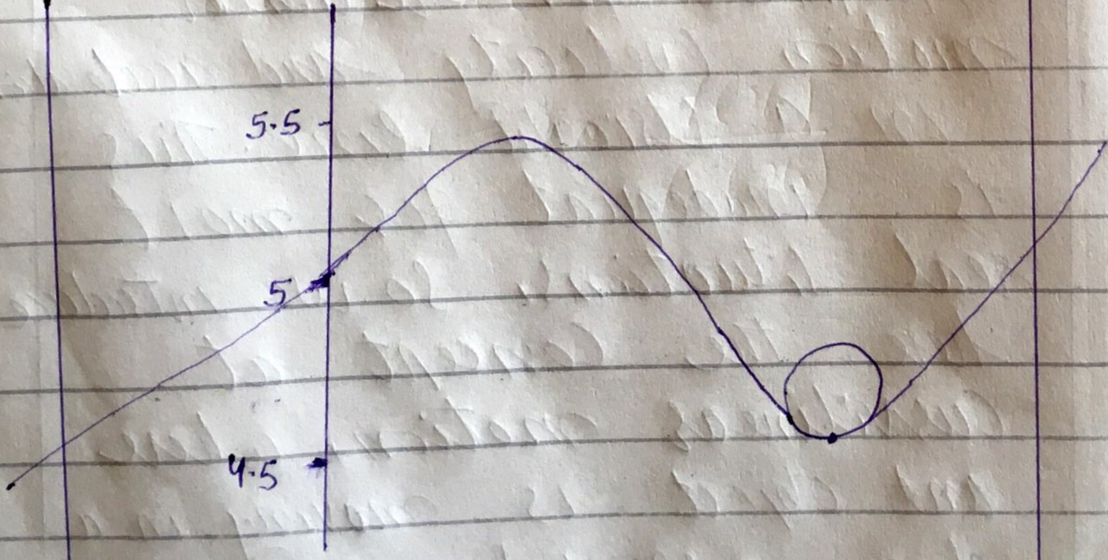
$$v = \frac{ds}{dt}, \quad a = \frac{dv}{dt} = \frac{d^2s}{dt^2}$$

These formula are only appropriate for rectilinear motion (velocity and acceleration in a straight line). This is inadequat for most real situations, so we introduce here the concept at curvilinear motion, where and object is moving in a along a specified curved path.

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).



Application of Integration

Integration:

The process of finding a function, given its derivatives is called integration or anti derivation.

It is usually used to find Area.

Shear Force and Bending Moment:

Shear force and Bending moment are one the most important parameter for the structural design. These parameter effect a structure.

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

That force is called called shear force and product of that force with distance from either end is bending moment.

Length of curve:

Corrugated iron sheeting: corrugated iron is used extensively through out the world as versatile building material into a regular sine wave pattern gives it greater strength than if a flat sheed is used.

Area Under a Curve by Integration:

In civil Engineering when we are dealing with curve or structure having curve then many need to Find the Area Under Curve which is to be constructed so we use integration for this purpose.

$$Area = \int_a^b f(x)\,dx$$

Centroid of an Area By Integration:

In tilt - slab constuction we have a concrete wall with doors and windows cut out) which we need to raise into posistion. we don't wont the wall to crack as we raise it, so we need to know the centre of mass of the wall. we can find the centroid at an area with straight sides, then we will extend the concept to area, with curved sides where we will use Integration.

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