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Assignment : 01

Q1: Application of Derivates & Integration in Engineering?

Ans: Application of Integration:

Following are the applications of Integration -

1) "Shear force and bending moment":

Shear force and bending moment are one of the important parameter for structural design, these parameter affects a structure alot.

Shearing force is defined as the force transverse to the beam at a given section tending to cause it to shear at that section. And bending moment is the reaction induced in a structural element when an external force or moment is applied to the element causing the element to bend.

2) Length of Curve

Corrugated iron is used extensively through out the world as a versatile though material - bending the material into a regular since wave pattern gives it greater strength than if a flat sheet is used.

→ So integration is used 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

As a civil engineer, when we are dealing with curve or structure having curve then we may need to find the area under the curve which is to be constructed so we can do integration for this purpose.

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

(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 ~~by~~ to bending & buckling.

⇒ Moment of inertia on X-axis

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

⇒ Moment of inertia on Y-axis.

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

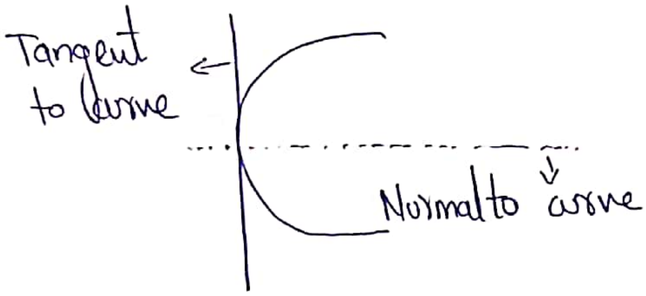
(5) "centroid of an area by integration":

In tilt and lab construction we have a concrete wall which we need to raise into position. we don't want the wall to crack as we raise it so we need to know the center of mass of the wall so we can find the centroid of an area with straight side then we will extend the concept of the area with curved side where will will use integration.

## Application of Derivatives:-

### 1) Tangent 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 a curve.




### 2) Newton method:

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

If we 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 an-other.

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

## 4 Curvilinear Motion:

These formula are only appropriate for rectilinear motion. This is inadequate for most real situation 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 $x$ & $y$ component of the motion as function of time. This form is called parametric form.

## 5 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 ~~$y =$~~ $y = f(x)$.