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Subject = Calculus.

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Q 1):- Application of derivates and integration in engineering.

Answer:-

"Application of Integration":-

Following are the application as given below:-

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.

→ Some forces 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 with distance from either end is bending moment.

2) "Length of Curve":-

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

→ So integration is used to find out how wide should the flat

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2) "Integrating Rational Function":-

$$\rightarrow \frac{3x+2}{2x^2+x-3} = \frac{3x+2}{(2x+3)(x-1)}$$

To integrate such a function we use the method of partial fraction to split the fraction into easily integrable pieces.

$$\frac{3x+2}{(2x+3)(x-3)} = \frac{1}{2x+3} + \frac{1}{x-1}$$

Now

$$\int \frac{3x+2}{2x^2+x-3}\,dx = \frac{1}{2}\log(2x+3) + \log(x-1) + c \ldots.$$

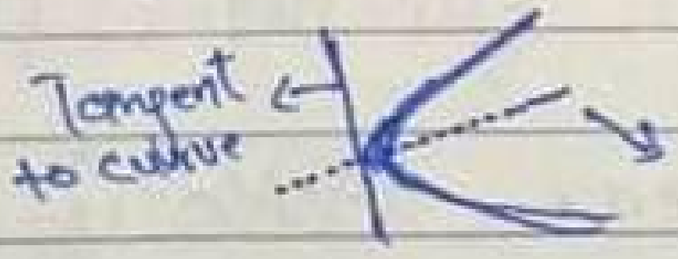
x ——— x ——— x

Crack as we raise it So we need to know the center of mass of the wall we can find the centriod of an area with straight side then we will extend the concept of area with curved side where we 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 the curve.



2) "Newton Method":-

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

Q 2:-

"Application of Trapezoidal Rule and Simpson's Rule in Engineering".

Answer:- "Application of Trapezoial Rule".

1) The trapezoidal rule is one of the family member of numerical integration formula.

a) The trapezoidal rule has faster convergence.

3) Moreover, the trapezoidal rule tends to become extremely accurate for periodic functions.

"Application of Simpson's Rule":-

- Simpson's Rule is a numerical method for approximating the integral of a function between two limits a and b. It's based on knowing the area under a parabola, or a plane curve.
- It include the calculation of a vessel's displacement, total wetted surface area, and the calculation of the longitudinal center of buoyancy of the hull.
- It is a weightend average that results in an

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 variable both vary with respect to time and have a relation between them, we can express the rate of change of one in term of the another.
That is well be finding finding $\frac{df}{dt}$ for some function $f(t)$.

4) "Curvilinear Motion":-

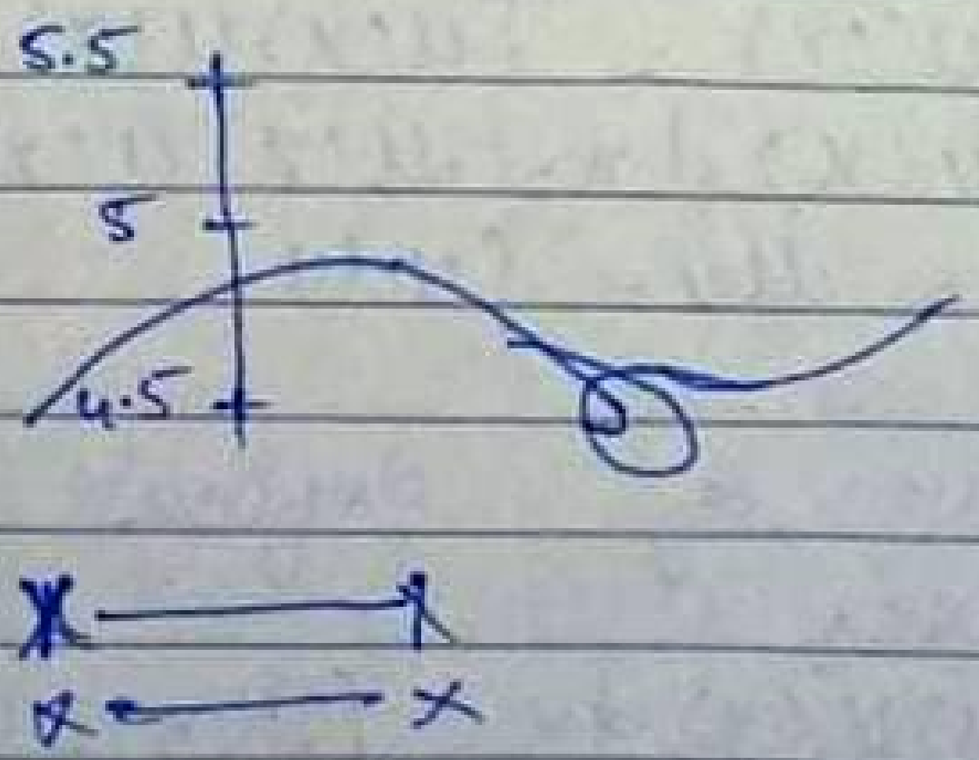
These formula are only appropriate for rectilinear motion. This is inadequate for most real situation so we introduce here the concept of curvilinear motion, where an object is moving in a plane along a specified curved path. we generally

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



Q1:-

"Review of Integration Concept":-

Answer:-

It Contain Some major Concept of integration, including

1) Substitution method.
2) Integration by parts.
3) Integration Rational function.

1) "Substitution method":-

$\rightarrow \int f(g(x))\,g'(x)\,dx = \int f(u)\,du$

If the function $f(u)$ has an easily identification anti derivatives then all is well. If do not another substitution method may be needed.

2) "Integration by Parts":-

$\rightarrow [u(x)v(x)]' = u'(x)v(x) + u(x)v'(x)$

$= u(x)v'(x) = [u(x)v(x)]' - u'(x)v(x)$

$= \int u(x)v'(x)\,dx = u(x)v(x) - \int u'(x)v(x)\,dx$

$= \int u\,dv = uv - \int v\,du$

In Case of definate integral we have;

$\int_a^b u(x)v'(x)\,dx = [u(x)v(x)]_{x=a}^{x=b} - \int_a^b v(x)\,dx.$

2) "Int

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3) "Area under a Curve by integration":-
In civil engineering when we are dealing with Curve or Structure having Curve then may need to find the area under the curve which is to be constructed. So we use integration for this purpose.

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

4) "Moment of intertia by integration"-
Moment of intertia 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

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

2 moment of inertia about Y-axis

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

5) "Centroid of an area by integration":-
In flat slab construction we have a concrete wall which we need to raise into position. we don't want the wall to