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Application of derivatives in Engineering

important application in mathematics

- Rate of change of Quantity.
- Increasing and decreasing functions.
- Tangent and normal to a Curve
- Minimum and maximum values.
- Newton Methods
- Linear Approximations.

* Rate of change of a Quality

General and most important application of Dirivatives. For Example

Check the rate of change of the volume with respect to its decreasing sides.

form of derivatives used.

dy/dx.

Dy represents rate of change of volume of Cube.

Dx represents change of sides of Cube.

* Increasing and Decreasing Function.

To find that given function is increasing or decreasing or constant, say in graph, we use derivatives. If it is a function which is continues in [P, q] and differentiable in the open interval than [P, q] then.

Maxima and Minima.

To calculate the highest and lowest point of the curve in a graph or to know its function is used.

- $x = a$, if $F(x) \leq f(a)$ for every x in the domain, than $F(x)$ has an absolute. Point a in is the point of the maximum value of f.
- when $x = a$, if $f(x) \leq f(a)$ for every x in some open interval (P, q) than $f(x)$ has a relative a Relative maximum value

- when $x = a$; if $f(x) \geq f(a)$ for every x in domain.
  absolute minimum value
- when $x = a$, if $f(x) \geq f(a)$ for every x in open interval.
  $f(x)$ has a relative minimum value.

Approximation or Finding Approximate value.

To a ~~final~~ find a very small change or variation of Quality, we can use derivatives to give the approximate value is represented by delta Δ.

Suppose change in the values of x, $dx = x$
then $dy/dx = \Delta x = x$.
Since the change in x, $dx \approx x$ therefore $dy \approx y$.

Point of inflection

For continues function $f(x)$, if $f'(x_0) = 0$ or $f''(x_0)$ does not exist at point where $f'(x_0)$ exists and if $f''(x)$ changes sign when passing through $x = x_0$ then x_0 is called the point of inflection.

• Application of Integration

- Area b/w Curves
- Volume
- work
- Kinetic energy: improper integral
- Arc length
- Distance, velocity, acceleration
- Average value of function
- Centre of mass
- probability
- Surface area.

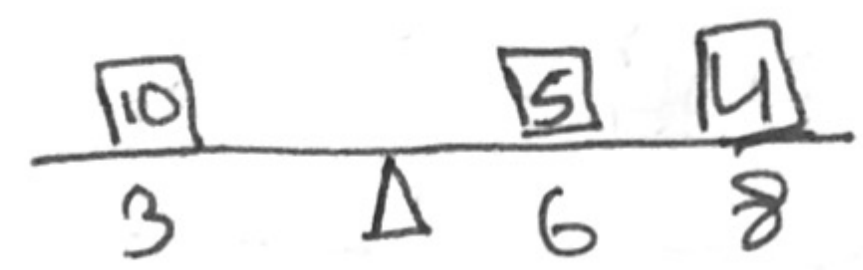
☆ Area between Curves

we have seen how integration can be used to find area between a curve x-axis with very little change we can find some areas b/w curves indeed the area b/w curve and the x-axis maybe interpreted as the area b/w the curve and a second "curve" with equation y=0 in the simplest of cases, the idea is quite easy to understand.

☆ Centre of Mass

Suppose a beam is 10 meters long and that there are three weights on the beam: a 10 kilogram weight 3meters from the left end, a 5 kilogram weight 6meters from the left end and a 5 kilogram weight 6 meters.

From the left end and a 4 kilograms weight 8 meters from the left end where should a fulcrum be placed so that the beam balances? Let's assign scale to the beam from 0 at the left end to 10 at the right, so that we can denote locations on the beam simply as cordinates the weight are at $x = 3$, $x = 6$ and $x = 8$, as



Suppose to begin with with that fulcrum is applaced at.

* Arc Length

Here is another geomatric application of the integral. find a length of a portion of a curve. As usual we need to think about how we might approximate the length and turn the Approximation into integral we already know how to compute one simple arc length, that of a line segment, if the end points are $P_0(x_0, y_0)$ and $P_1(x_1, y_1)$ then the length of the segment is the distance b/w the Points $\sqrt{(x_1 - x_0)^2 + (y_1 - y^0)^2}$ From the Pythagorean theoram as illustreted.