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ENGINEERING MATHEMATICS

Assignment One (1)

1 $$\lim_{x \to \frac{\pi}{2}} \left[\frac{(x^2 - \pi/4)[\sin(\cos x)]}{x - \pi/2} \right]$$

Solution

Using L'hopital Rule

Numerator = $(x^2 - \pi/4)[\sin(\cos x)]$

let $u = x^2 - \pi/4$ and $v = \sin(\cos x)$

$$\frac{du}{dx} = 2x$$

$$\frac{dv}{dx} =$$

let $w = \cos x$ $\therefore$ $dw/dx = \sin x$

$v = \sin w$ $dv/dw = \cos w$

$$\therefore \frac{dv}{dx} = \frac{dv}{dw} \times \frac{dw}{dx}$$

$= \cos w \times -\sin x$

$= \cos(\cos x) \times -\sin x$

$= -\sin x \cos(\cos x)$

Using Products rule

i.e

$$\frac{dy}{dx} = u\frac{dv}{dx} + v\frac{du}{dx}$$

$$\frac{dy}{dx} = (x^2 - \pi/4) - \sin x \cos(\cos x) + \sin(\cos x) 2x$$

$dy/dx = 2x \sin(\cos x) - \sin x \cos(\cos x)(x^2 - \pi/4)$

Also !

denominator $= x - \pi/2$ $\therefore$ $dy/dx = 1$

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Assignment Three (3)

1 $P = \frac{E^2}{R}$

If $E = 20$ volts and $R = 8$ ohm, find the change in P resulting from a drop of 5 volts in E and an increase of 0.2ohm in R

Solution

Recall

$$\partial P = \frac{\partial P}{\partial R}\partial R + \frac{\partial P}{\partial E}\partial E$$

$$\frac{\partial P}{\partial R} = -\frac{E^2}{R^2} = -\frac{20^2}{8^2}$$

$$\frac{\partial P}{\partial R} = ~~-5000~~ \; -625$$

Also

$$\frac{\partial P}{\partial E} = \frac{2E}{R} = \frac{2(20)}{8}$$

$$\frac{\partial P}{\partial E} = \frac{400}{8} = 50$$

but

$\partial E = -5V$ and $\partial R = 0.2\Omega$

$\therefore \partial p =$ ~~$(-50 \times 0.2) + (-5 \times 5)$~~ ~~$(-5000 \times 0.2) + (-5 \times 50)$~~

$$\partial p = (-625 \times 0.2) + (50 \times -5)$$

$$\partial p = -125 - 250$$

$\partial p = -375$ watts.

There is a decrease of 375 watts in P

2 The deflection y at the centre of a circular plate suspended at the edge and uniformly in equ 2

$$y = \frac{Kwd^4}{t^3}$$

Where w = total load , d = diameter of plate, t = thickness and K is a constant. Calculate the appropriate change in y if w is increased by 3 percent d is increased by 2½ percent and t is increased by 4 percent

Solution

$$y = \frac{Kwd^4}{t^3}$$

$$\therefore \partial y = \frac{\partial y}{\partial w}\partial w + \frac{\partial y}{\partial d}\partial d + \frac{\partial y}{\partial t}\partial t$$

$$\frac{\partial y}{\partial w} = \frac{Kd^4}{t^3}$$

$$\frac{\partial y}{\partial d} = \frac{4Kwd^3}{t^3}$$

$$\frac{\partial y}{\partial t} = -\frac{3Kwd^4}{t^4}$$

Also

$\partial w = 0.03w$, $\partial d = 0.025d$ and $\partial t = 0.04t$

$$\therefore \partial y = \frac{Kd^4}{t^3}(0.03w) + \frac{4Kwd^3}{t^3}(0.025d) + \left[-\frac{3Kwd^4}{t^4} \times 0.04t\right]$$

$$\partial y = \frac{Kwd^4}{t^3}(0.03) + \frac{Kwd^4}{t^3}(0.1) - \frac{Kwd^4}{t^3}(0.12)$$

factorizing out $\frac{Kwd^4}{t^3}$

$$\partial y = \frac{Kwd^4}{t^3}\left[0.03 + 0.1 - 0.12\right]$$

$$\partial y = \frac{Kwd^4}{t^3}(0.01)$$

Recall

$$\frac{Kwd^4}{t^3} = y$$

$$\partial y = 0.01y$$

This shows that there is a change (increase) of 1% in y