Iqra National University

Department of electrical Engineering

Assignment

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Course Details

Coerse Title: Calculas..... Module 03

Instructor: Himayatullah Total Marks 30

Student Details

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Q1: part (A): $\lim_{h \to 0} 2+h-2h$

$$\lim_{h \to 0} \frac{\sqrt{2+h} - \sqrt{2}}{h}$$

Sol:

$$\lim_{h \to 0} \frac{\sqrt{2+h} - \sqrt{2}}{h}$$

$$= \frac{\sqrt{2+0} - \sqrt{2}}{0} = \frac{\sqrt{2} - \sqrt{2}}{0} = 0/0$$

So

$$\lim_{h \to 0} \frac{\sqrt{2+h} - \sqrt{2}}{h}$$

Multiply and dividing $\sqrt{2+h} + \sqrt{2}$

$$= \lim_{h \to 0} \frac{\sqrt{2+h} - \sqrt{2}}{h} \times \frac{\sqrt{2+h} + \sqrt{2}}{\sqrt{2+h} + \sqrt{2}}$$

$$= \lim_{h \to 0} \frac{(\sqrt{2+h} - \sqrt{2})(\sqrt{2+h} + \sqrt{2})}{(h)(\sqrt{2+h} + \sqrt{2})}$$

$$= \lim_{h \to 0} \frac{(\sqrt{2+h})^2 - (\sqrt{2})^2}{h(\sqrt{2+h} + \sqrt{2})}$$

$$= \lim_{h \to 0} \frac{2+h-2}{h(\sqrt{2+h} + \sqrt{2})}$$

P.T.O

$$= \lim_{h \to 0} \frac{h}{h(\sqrt{2+h} + \sqrt{2})}$$

$$= \lim_{h \to} \frac{1}{\sqrt{2+h} + \sqrt{2}}$$

putting limit

$$= \frac{1}{\sqrt{2+0} + \sqrt{2}}$$

$$= \frac{1}{2\sqrt{2}}$$

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part B:

$$y = \left(x + \frac{1}{x}\right)\left(x - \frac{1}{x} + 1\right)$$

Sol: $y = \left(x + \frac{1}{x}\right)\left(x - \frac{1}{x} + 1\right)$

$$= \frac{dy}{dx} = \frac{d}{dx}\left(x + \frac{1}{x}\right)\left(x - \frac{1}{x} + 1\right)$$

$$= \left(x + x^{-1}\right)\frac{d}{dx}\left(x - x^{-1} + 1\right) + \left(x - x^{-1} + 1\right)\frac{d}{dx}\left(x + x^{-1}\right)$$

$$= \left(x + x^{-1}\right)\left(1 + x^{-2}\right) + \left(x - x^{-1} + 1\right)\left(1 - x^{-2}\right)$$

$$= \left(x + \frac{1}{x}\right)\left(1 + \frac{1}{x^2}\right) + \left(x - \frac{1}{x}\right)\left(1 - \frac{1}{x^2}\right)$$

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

$$= 2x + 1 - \frac{1}{x^2} + \frac{1}{x^3}$$ Ans

Q2 (a) $S = 160t - 16t^2$ ft

So Given $S = 160t - 16t^2$ ft

a) **velocity** $v = \frac{ds}{dt} = \frac{d}{dt}(160t - 16t^2)$

$$= \frac{d}{dt}160t - \frac{d}{dt}16t^2$$

$$v = 160 - 32t$$

Maximum Height $v = 0$

So $160 - 32t = 0$

$$\frac{160}{32} = \frac{32t}{32}$$

$t = 5$ second.

P.T.O.

$S_{max} = S(5) = 160(5) - 16(5)^2$

$S_{max} = 400ft$

b) **Given That $S = 256$ ft**

Then $S = 256ft$

$160t - 16t^2 = 256$

$16t^2 - 160t + 256 = 0$

$\frac{16}{16}(t^2 - 10t + 16) = \frac{0}{16}$

$t^2 - 10t + 16 = 0$

$t^2 - 8t - 2t + 16 = 0$

$t(t-8) - 2(t-8) = 0$

$(t-8)(t-2) = 0$

$t - 8 = 0 \quad t - 2 = 0$

$t = 8sec \quad t = 2sec$

Since $v = 160 - 32t$

$t = 2s$

$v(2) = 160 - 32(2)$

$= 160 - 64$

$v(2) = 96 m/s \Rightarrow$ velocity upward

$t = 8s$

P.T.O

$v(t) = 160 - 32(8)$

$= 160 - 256$

$= -96 \text{ m/s}$ => velocity d.

c

Since $V = 160 - 32t$

Time (t) given = 5 sec

So $V = 160 - 32(5)$

$V = 160 - 160$

$V = 0$

So to find acceleration

$$a = \frac{dv}{dt} = \frac{d}{dt} 0$$

$a = 0$

$a = 0 \text{ m/s}^2$ Ans

Q3 (a) Does the curve $y = x^4 - 2x^2 + 2$ have any horizontal tangent if so where

Sol

$$y = x^4 - 2x^2 + 2$$

$$\frac{dy}{dx} = \frac{d}{dx}(x^4 - 2x^2 + 2)$$

$$= \frac{d}{dx}x^4 - \frac{d}{dx}2x^2 + \frac{d}{dx}2$$

$$= 4x^3 \frac{dx}{dx} - 2 \times 2x \frac{dx}{dx} + 0$$

$$= 4x^3 - 4x + 0$$

$$\frac{dy}{dx} = 4x^3 - 4x$$

If the tangent is horizontal

then $\frac{dy}{dx} = 0$

$4x^3 - 4x = 0$

$4x(x^2 - 1) = 0$

$4x = 0 \qquad x^2 - 4 = 0$

$\frac{4x}{4} = \frac{0}{4} \qquad x^2 - 1 = 0$

$x = 0 \qquad \frac{x^2}{\sqrt{x^2}} = \frac{1}{\sqrt{1}}$

$x = 0 \qquad x = \pm 1$

So $x = 0, 1, -1$

Their corresponding point in $y = x^4 - 2x^2 + 2$

For

$y = x^4 - 2x^2 + 2$

$= (0)^4 - 2(0)^2 + 2$

$= 0 - 0 + 2$

$y = 2$

$x = 1$

$y = x^4 - 2x^2 + 2$

$= (1)^4 - 2(1)^2 + 2$

$= 1 - 2 + 2$

$y = 1$

$x = -1$

$$y = x^4 - 2x^2 + 2$$

$$= (-1)^4 - 2(-1)^2 + 2$$

$$= 1 - 2 + 2$$

$$= 1$$

Hence $(0, 2)$, $(1, 1)$, $(-1, 1)$