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Course: MAT 104

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Assignment

$$i) y = \frac{t^3 - t^2}{2} - 2t + 4$$

$$ii) \frac{dy}{dt} = 3t^2 - 2t - 2$$

At stationary point,  $\frac{dy}{dt} = 0$

$$0 = 3t^2 - 2t - 2$$

$$3t^2 - 2t - 2 = 0$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t = \frac{2 \pm \sqrt{4 + 24}}{6}$$

$$t = \frac{2 \pm \sqrt{28}}{6}$$

$$t = \frac{2 \pm 5.29}{6}$$

$$t = \frac{2 + 5.29}{6} \quad \text{or} \quad t = \frac{2 - 5.29}{6}$$

$$t = \frac{7.29}{6} \quad \text{or} \quad t = \frac{-3.29}{6}$$

$$t = 1.22 \quad \text{or} \quad t = -0.55$$

ii) when  $t = 1.22$

$$y = \frac{(1.22)^3 - (1.22)^2}{2} - 2(1.22) + 4$$

$$y = 1.82 - 0.74 - 2.44 + 4$$

$$y = 2.64$$

When  $t = -0.55$ 

$$y = \frac{(-0.55)^3 - (-0.55)^2 - 2(-0.55) + 4}{2}$$

$$y = \frac{-0.17 - 0.31 + 1.1 + 4}{2}$$

$$y = 4.78$$

The co-ordinates are  $(1.22, 2.64)$  or  $(-0.55, 4.78)$ 

$$\text{iii) } \frac{d^2y}{dt^2} = 6t - 2$$

When  $t = 1.22$ 

$$\frac{d^2y}{dt^2} = 6(1.22) - 2$$

$$= 7.32 - 2$$

$$= 5.32$$

 $\therefore$  At  $(1.22, 2.64)$  we have minimum pointWhen  $t = -0.55$ 

$$\frac{d^2y}{dt^2} = 6(-0.55) - 2$$

$$= -3.3 - 2$$

$$= -5.3$$

 $\therefore$  At  $(-0.55, 4.78)$  we have a maximum point

$$2) 2y^2 - 5x^4 - 2 - 7y^2 = 0$$

$$4y \frac{dy}{dx} - 20x^3 - 21y^2 \frac{dy}{dx} = 0$$

$$\frac{dy}{dx} (4y - 21y^2) = 20x^3$$

$$\frac{dy}{dx} = \frac{20x^3}{4y - 21y^2}$$

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3)  $4x^2 + 2xy^2 - 5y^3 = 0$

$$8x + 2y^3 + 3y^2 \left(\frac{dy}{dx}\right) 2x - 10y \left(\frac{dy}{dx}\right) = 0$$

$$8x + 2y^3 + 6xy^2 \left(\frac{dy}{dx}\right) - 10y \left(\frac{dy}{dx}\right) = 0$$

$$\frac{dy}{dx} (6xy^2 - 10y) = -8x - 2y^3$$

$$\frac{dy}{dx} = \frac{-8x - 2y^3}{6xy^2 - 10y}$$

$$\frac{dy}{dx} = \frac{2(-4x - y^3)}{2(3xy^2 - 5y)}$$

$$i) \frac{dy}{dx} = \frac{-4x - y^3}{3xy^2 - 5y}$$

ii) when  $x = 1$

$$\begin{aligned} \frac{dy}{dx} &= \frac{-4(1) - y^3}{3(1)y^2 - 5y} \\ &= \frac{-4 - y^3}{3y^2 - 5y} \end{aligned}$$

iii) when  $y = 2$

$$\begin{aligned} \frac{dy}{dx} &= \frac{-4x - (2)^3}{3x(2)^2 - 5(2)} \\ &= \frac{-4x - 8}{12x - 10} \\ &= \frac{2(-2x - 4)}{2(6x - 5)} \\ &= \frac{-2x - 4}{6x - 5} \end{aligned}$$