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DEPT: COMPUTER ENGINEERING

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COURSE: MAT 104

$$11) \quad y = \frac{t^3 - t^2}{2 - 2t + 4}$$

$$\text{Let } u = t^3 - t^2 \quad v = 2 - 2t + 4$$

Using the quotient rule

$$\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

$$\frac{du}{dt} = 3t^2 - 2t \quad \frac{dv}{dt} = -2$$

$$\frac{dy}{dx} = \frac{v \frac{du}{dt} - u \frac{dv}{dt}}{v^2}$$

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

$$= \frac{6t^2 - 4t - 6t^3 + 4t^2 + 12t^3 - 8t + 2t^3 - 2t^2}{(2 - 2t + 4)^2}$$

$$= \frac{-4t^3 + 20t^2 - 12t}{(2 - 2t + 4)^2}$$

$$= \frac{t(-t^2 + 5t - 3)}{(3 - t)^2}$$

$$\therefore \frac{dy}{dx} = \frac{t(-t^2 + 5t - 3)}{(3 - t)^2}$$

For a stationary point

$$\frac{dy}{dt} = 0$$

$$\frac{(t^3 + 5t - 3)}{(3-t)^2} = 0$$

$$\therefore t = \frac{5 - \sqrt{13}}{2} \approx 0.697$$

$$t = 0$$

$$t = \frac{\sqrt{13} + 5}{2} \approx 4.303$$

When $t = 0.697$

$$y = \frac{(0.697)^3 - (0.697)^2}{2 - 2(0.697) + 4}$$

$$y = -0.03$$

$$(t = 0.697, y = -0.03)$$

When $t = 0$

$$y = \frac{(0)^3 - (0)^2}{2 - 2(0.697) + 4}$$

$$y = 0$$

$$(t = 0, y = 0)$$

When $t = 4.303$

$$y = \frac{(4.303)^3 - (4.303)^2}{2 - 2(4.303) + 4}$$

$$y = -23.47$$

$$(t = 4.303, y = -23.47)$$

(2) $2y^2 - 5x^4 - 2 - 7y^3 = 0$ find $\frac{dy}{dx}$

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

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

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

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

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

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

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

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

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

(4) $\frac{dy}{dx}$ (at $x=1, y=2$)

$$\frac{dy}{dx} = \frac{-8(1) - 2(2)^3}{6(1)(2)^2 - 10(2)}$$

$$= -6$$

$\therefore \frac{dy}{dx}$ at $x=1, y=2$ is -6