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MAT 104 Assignment

Answers

1.) $y = t^3 - \frac{t^2}{2} - 2t - 4$

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

At stationary point, $dy/dx = 0$

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

Using factorization method

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

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

$3t(t-1) + 2(t-1) = 0$

$(3t-2)(t-1) = 0$

$\therefore t = 2/3$ and $t = 1$

The stationary points are $2/3$ and 1

At $t = 2/3$

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

$\therefore y = -5.26$

At $t = 1$

$y = (1)^3 - \frac{(1)^2}{2} - 2(1) - 4$

$\therefore y = -5.5$

$\therefore$ The coordinates are $(2/3, -5.26)$ and $(1, -5.5)$

Nature of stationary point

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

$\frac{d^2y}{dt^2} = 6t - 1$ ∴

At $t = 2/3$

$\frac{d^2y}{dt^2} = 4 - 1 \Rightarrow 3$.

At $t = 1$

$\frac{d^2y}{dt^2} = 6 - 1 \Rightarrow 5$

∴ At $(2/3, -5.26)$, there is a minimum point and at $(1, -5.5)$, there is also a minimum point.

2.) $2y^2 - 5x^4 - 2 - 7y^3 = 0$

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

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

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

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

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

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

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

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

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

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

When $x = 1$ and $y = 2$

$$\frac{dy}{dx} = \frac{-8 - 2y}{6(1)(2^2) - 10(2)} = -\frac{24}{4}$$

$$\therefore \frac{dy}{dx} = -6$$