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Course ⟹ Math 104
Mat. No ⟹ 19/Eng02/061
Date ⟹ 16/Oct/2020

(1) Determine the stationary point, Coordinate of the stationary point and nature of the stationary point of the curve. $y = t^3 - t^2 - 2t + 4$

Solution

$y = t^3 - t^2 - 2t + 4$

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

$= 3t^2 - t - 2$

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

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

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

$3t + 2 = 0$ or $t - 1 = 0$

$3t = -2$ or $t = 1$

$t = \frac{-2}{3}$ or $t = 1$

For Coordinate of the Stationary point

At $t = \frac{-2}{3} = -0.67$

$y = (-0.67)^3 - \frac{(-0.67)^2}{2} - 2(-0.67) + 4$

$y = 4.81$

At $t = 1$

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

$y = 2.5$

Coordinate of the Stationary point

$= (-0.67, 4.81)$ & $(1, 2.5)$

Nature of the Stationary point

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

$= 6t - 1$

at $t = -0.67$

$= 6(-0.67) - 1$

$= -4.02 - 1$

$= -5.02$ (at $t = -0.67$ we have maximum point)

at $t = 1$

$= 6(1) - 1$

$= 6 - 1$

$= 5$ (at $t = 1$, we have minimum point)

(2) If $2y^2 - 5x^4 - 2 - 7y^3 = 0$ find dy/dx

Solution

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

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

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

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

(3) Find dy/dx if $4x^2 + 2xy^3 - 5y^2 = 0$ and evaluate dy/dx when $x = 1$ & $y = 2$

Solution

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

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

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

at $x = 1$ & $y = 2$

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

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

$$= \frac{-8 - 16}{24 - 20}$$

$$= \frac{-24}{4}$$

$$= \frac{-6}{1}$$

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