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MAT 104 Assignment Serial No: 152

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

At stationary point $dy/dt = 0$

$\frac{dy}{dt} = 3t^2 - \frac{2t}{2} - 4$

$\therefore dy/dt = 3t^2 - t - 2$

$\therefore$ using quadratic formular.

$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ $a = 3$ $b = -1$ $c = -2$

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

$= \frac{-(-1) - \sqrt{(-1)^2 - 4(3)(-2)}}{2(3)} = -0.60$

$\therefore t = 1$ or $t = -0.66$

when $t = 1$

$\left[t^3 - \frac{t^2}{2} - 2t + 4\right] = (1)^3 - \frac{(1)^2}{2} - 2(1) + 4$
$= 2.5$

when $t = -0.66$ $(-0.66)^3 - \frac{(-0.66)^2}{2} - 2(-0.66) + 4 =$
$= 4.81$

$\therefore$ Coordinates are $(1, 2.5)$ & $(-0.66, 4.81)$

$dy/dt = 3t^2 - \frac{2t}{2} - \cancel{4}$
$= 3t^2 - t - 2$

$\therefore d^2y/dt = 6t - 1$

At $t = 1$ $(6(1) - 1) = 5$

At $t = -0.66$ $6(-0.66) - 1 = -4.96$
$= -5$

$\therefore$ The stationary point at $t = 1$ is a minimum point and the stationary point at $t = -0.66$ is a max point.

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

$\therefore$ find dy/dx

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

$\therefore 4y\,dy/dx - 20x^3 - 0 - 21y^2\,dy/dx = 0$

$4y\,dy/dx - 21y^2\,dy/dx = 20x^3$

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

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

(3)

$4x^2 + 2xy^3 - 5y^2 = 0$ find dy/dx

Soln

$d/dx(4x^2) + \frac{d}{dx}(2xy^3) - \frac{d}{dx}(5y^2) = 0$

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

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

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

$\therefore \frac{dy}{dx}\left[6y^2 - 10y\right] = -8x - 2y^3$

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

$\therefore$ when $x = 1$ & $y = 2$

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