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Math 104

1.) $y = t^3 - t^2/2 - 2t + 4$

(i) Stationary point

$y = t^3 - t^2/2 - 2t + 4$; at stationary point, $dy/dx = 0$

$dy/dx = 3t^2 - t - 2 = 0$

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

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

$t = 1$ and $t = -2/3$

the Stationary point is at $t = 1$ or $t = -2/3$

(ii.) The coordinates of the stationary point

at $t = 1$

$y = (1)^3 - (1)^2/2 - 2(1) + 4 = 1 - 1/2 - 2 + 4 = 5/2$ or 2.5

$(1, 2.5)$

at $t = -2/3$

$y = (-2/3)^3 - (-2/3)^2/2 - 2(-2/3) + 4 = -8/27 - 2/9 + 4/3 + 4 = 130/27$ OR 4.81

$(-0.67, 4.81)$

∴ coordinates of the stationary points are $(1, 2.5)$ and $(-0.67, 4.81)$

(iii.) Nature of stationary points of the curve

$dy/dx = 3t^2 - t - 2 = 0$; $d^2y/dx^2 = 6t - 1 = 0$

at $t = 1$, $d^2y/dx^2 = 6(1) - 1 = 6 - 1 = 5$

∴ the stationary point at $t = 1$ is a

at $t = -2/3$, $d^2y/dx^2 = 6(-2/3) - 1 = -5$

∴ the stationary point at $t = -2/3$ is a

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

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

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

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

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

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

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

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

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

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

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

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

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

when $x = 1$ and $y = 2$; $\frac{dy}{dx} = \frac{-8(1) - 2(2)^3}{6(2)^2(1) - 10(2)} = \frac{-8 - 16}{24 - 20} = \frac{-24}{4} = -6$