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Mechanical Engineering

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

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

At stationary point, $dy/dt = 0$

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

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

$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$t = \frac{2 \pm \sqrt{4 + 24}}{6}$

$t = \frac{2 \pm \sqrt{28}}{6}$

$t = \frac{2 \pm 5.29}{6}$

$t = \frac{2 + 5.29}{6}$ or $t = \frac{2 - 5.29}{6}$

$t = \frac{7.29}{6}$ or $t = \frac{-3.29}{6}$

$t = 1.22$ $t = -0.55$

ii) when $t = 1.22$

$y = (1.22)^3 - \frac{(1.22)^2}{2} - 2(1.22) + 4$

$y = 1.82 - 0.74 - 2.44 + 4$

$y = 2.64$

when $t = -0.55$

$y = (-0.55)^3 - \frac{(-0.55)^2}{2} - 2(-0.55) + 4$

$= -3.3 - 2$

$= -5.3$

$\therefore$ At ~~(-0.55)~~ $(-0.55, 4.78)$ we have a maximum point.

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

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

$3y^2 = 5y$

iii) when $y = 2$

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

$$= \frac{-4x - 8}{12x - 10}$$

$$= \frac{2(-2x - 4)}{2(6x - 5)}$$

$$= \frac{-2x - 4}{6x - 5}$$