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19/ENGG06/033

MAT 104

Mechanical engineering

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

At stationary point, $\frac{dy}{dx} = 0$

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

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

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

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

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

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

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

$$\Rightarrow 1.23 \quad \text{or} \quad -0.55$$

when $t = 1.23$

$$y = (1.23)^3 - \frac{(1.23)^2}{2} - 2(1.23) + 4$$

$$y = 1.82 - 0.74 = 4.4 + 4$$

$$y = 2.64$$

when $t = -0.55$

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

$$y = -0.17 - 0.15 + 1.1 + 4$$

$$y = 4.21$$

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

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

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

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

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

$$4x + 2y^3 + 5y^2 \left(\frac{dy}{dx}\right) 2x - 10y \left(\frac{dy}{dx}\right) = 0$$

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

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

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

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