MECHANICAL CODE

16/4/2020

MAT 109

① $y = t^3 - \frac{t^2}{2} - 2t + 4$

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

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

$t = 1.22$ or $t = -0.55$

② 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 $t = -0.55$

$$y = (-0.55)^3 - \frac{(-0.55)^2}{2} - 2(-0.55) + 7$$

$$y = -0.17 - 0.15 + 1.1 + 7$$

$$y = 4.78$$

The co-ordinates are $(1.22, 2.64)$ or $(-0.55, 4.78)$

(iii) $\frac{d^2y}{dt^2} = 6t - 2$

when $t = 1.22$

$$\frac{d^2y}{dt^2} = 6(1.22) - 2$$

$$= 7.32 - 2$$

$$= 5.32$$

$\therefore$ At $(1.22, 2.64)$ we have a minimum point

when $t = -0.55$

$$\frac{d^2y}{dt^2} = 6(-0.55) - 2$$

$$= -3.3 - 2$$

$$= -5.3$$

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

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

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

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

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

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

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

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

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

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

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

(4) $\frac{dy}{dx} = \frac{8x - y^2}{3xy^2 - 5y}$

(b) when $x = 1$

$\frac{dy}{dx} = \frac{-4(1) - y^3}{3(1)y^2 - 5y}$

$$= \frac{-4-y^3}{3y^2-5y}$$

ii) when $y=2$

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

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

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

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