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

when $x = 1$

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

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

ii) When $y = 2$

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

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

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

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

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1. ~~Ite~~ $y = t^3 - t^2 - 2t + 4$

Solution

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

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

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

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

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

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

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

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

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

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

$$t = 1.22 \qquad t = -0.55$$

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

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

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

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

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

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

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

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

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

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

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

ii) when $t = 1.22$

$$y = (1.22)^3 - \frac{(1-2)^2}{2} - 2(1.22) + 4$$

$y = 1.82 - 0.74 - 2.44 + 4$

$y = 2.64$

when $t = -0.55$

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

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

$y = 4.78$

The cordinates are $(1.22, 2.64)$ ~~and~~

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

when $t = 1.22$

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

$= 7.32 - 2$

$= 5.32$

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

when $t = -0.55$

$\frac{d^2y}{dt^2} = 6(0.55) - 2 = -5.3$