Chukwuemerie Excellence
Chemical Engineering
19/ENG01/005

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

$y = u/v$

$dy/dt = \frac{du/dt \cdot v - dv/dt \cdot u}{v^2}$

$dy/dt = \frac{(3t^2 - 2t)(2-2t-4) - (t^3 - t^2)(-2)}{(2-2t-4)^2}$

$dy/dt = \frac{6t^2 - 6t^3 - 12t^2 - 4t + 4t^2 + 8t + 2t^3 - 2t^2}{4 - 4t - 8 + 4t + 4t^2 + 8t - 8 + 8t + 16}$

$dy/dt = \frac{-4t^3 - 4t^2 + 4t}{4t^2 + 8t - 4}$

but at stationary point, $d^2y/dx^2 = 0$

$0 = -4t^3 - 12t^2 - 12t$

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

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

$d^2y/dx^2 = -12t^2 - 24t - 12$

$0 = -12t^2 - 24t - 12$

$0 = t^2 + 2t + 1$

at stationary point $dy/dx = 0$

$0 = 4t - 4t^3 - t^2$

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

$0 = 1 - t^2 - t$

$t = 0.618$ or -1.618

at $t = 0.618$

the turning point is $\frac{(0.618)^3 - (0.618)^2}{2 - 2(0.618) - 4}$

stationary $(0.618, 0.19)$

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

$4y\,dy/dx - 20x^3 - 21y^2\,dy/dx$

$-20x^3 = +21y^2\,dy/dx - 4y\,dy/dx$

$-20x^3 = (21y^2 - 4y)\,dy/dx$

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

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

$8x + 2x + 3y^2\,dy/dx - 10y\,dy/dx = 0$

$3y^2\,dy/dx - 10y\,dy/dx = -8x^2 - 2x$

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

When $x = 1, y = 1$

$dy/dx = \frac{-8(1)^2 - 2(1)}{3(1)^2 - 10(1)}$

$dy/dx = \frac{-10}{-8}$

$dy/dx = 5/4$