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19/ENG02/006
Maths 104 assignment.

1) Determine the stationary point, coordinate of the stationary point and nature of the stationary point of the curve.

$$y = t^3 - t^2/2 - 2t + 4$$

solution:

$y = t^3 - t^2/2 - 2t + 4$

at stationary point $dy/dt = 0$

$dy/dt = 3t^2 - t - 2$

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

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

$3t(t-1) + 2(t-1) = 0$

$(3t+2)(t-1) = 0$

$t = -2/3$ or $t = 1$

For coordinate of the stationary point

at $t = -2/3 = -0.67$

$y = (-0.67)^3 - \frac{(-0.67)^2}{2} - 2(-0.67) + 4$

$y = -0.301 - 0.224 + 1.34 + 4$

$y = 5.34 - 0.525$

$y = 4.815$

at $t=1$

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

$$y = 1 - \tfrac{1}{2} - 2 + 4$$

$$y = 5 - 2.5$$

$$y = 2.5$$

Coordinates $(-0.67, 4.815)$

$(1, 2.5)$

For the nature of the stationary point

$$d^2y/dx^2 = 6t - 1$$

at $t = -0.67$ and 1

at $t = -0.67$

$$d^2y/dx^2 = 6(-0.67) - 1$$

$$d^2y/dx^2 = -4.02 - 1 = -5.02$$

at $t = 1$

$$d^2y/dx^2 = 6(1) - 1 = 5$$

at $x = -0.67$, we have a maximum point

at $x = 1$, we have a minimum point.

2) If $2y^2 - 5x^4 - 2 - 7y^3 = 0$, find dy/dx

Solution

$$d/dx(2y^2) - d/dx(5x^4) - d/dx(2) - d/dx(7y^3) = 0$$

$$4y\, dy/dx - 20x^3 - 21y^2\, dy/dx = 0$$

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

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

2) Find dy/dx if $4x^2 + 2xy^3 - 5y^2 = 0$ and evaluate dy/dx when $x = 1$ and $y = 2$

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

$$8x + (6xy^2\, dy/dx + 2y^3) - 10y\, dy/dx = 0$$

$$8x + 6xy^2\, dy/dx + 2y^3 - 10y\, dy/dx = 0$$

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

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

when $x = 1$ and $y = 2$

$$\frac{dy}{dx} = \frac{-8(1) - 2(2)^3}{6(1)(2)^2 - 10(2)} = \frac{-8(2(8)) - 8 - 2(8)}{6(4) - 10(2)}$$

$$\frac{dy}{dx} = \frac{-8 - 16}{24 - 20} = \frac{-24}{4}$$

$$\therefore \frac{dy}{dx} = -6$$