MAT 104 Assignment

Name: Ogbeide Eseohe Hope

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Department: MBBS

Find (a) the equation of the tangent and (b) the equation of the normal for

1. $y = 2x^2$ at the point (1, 2)

Solution

$y = 2x^2$

$\frac{dy}{dx} = 4x$

$\left.\frac{dy}{dx}\right|_{x=1} = 4(1) = 4$

$m = 4$

equ of tangent: $y - y_1 = m(x - x_1)$

$y - 2 = 4(x - 1)$

$y - 2 = 4x - 4$

$y - 4x + 4 - 2 = 0$

$y - 4x + 2 = 0$ (equ of tangent)

equ of normal: $y - y_1 = \frac{-1}{m}(x - x_1)$

$y - 2 = \frac{-1}{4}(x - 1)$

$$y-2 = \frac{-x+1}{4}$$

$$4y-8 = -x+1$$

$$4y+x-8-1=0$$

$$4y+x-9=0$$ (equ of normal)

2.) $y = 3x^2 - 2x$ at point $(2,8)$

Solution

$$y = 3x^2 - 2x$$

$$\frac{dy}{dx} = 6x - 2$$

$$\frac{dy}{dx}\Big|_{x=2} \quad 6(2) - 2 = 12 - 2 = 10$$

$$m = 10$$

Equ of tangent: $y - y_1 = m(x - x_1)$

$$y - 8 = 10(x-2)$$

$$y - 8 = 10x - 20$$

$$y - 10x + 20 - 8 = 0$$

$$y - 10x + 12 = 0$$ (equ of tangent)

Equ of normal: $y - y_1 = \frac{-1}{m}(x - x_1)$

$$y - 8 = \frac{-1}{10}(x-2)$$

$y - 8 = \frac{-x+2}{10}$

$10y - 80 = -x + 2$

$10y + x - 80 - 2 = 0$

$10y + x - 82 = 0$ (equ of normal)

3) $y = \frac{x^3}{2}$ at point $(-1, -\frac{1}{2})$

Solution

$y = \frac{x^3}{2}$

$\frac{dy}{dx} = \frac{3x^2}{2}$

$\left.\frac{dy}{dx}\right|_{x=-1} \quad \frac{3(-1)^2}{2} = \frac{3}{2}$

$m = 3/2$

Equ of tangent: $y - y_1 = m(x - x_1)$

$y - (-1/2) = 3/2\,(x - (-1))$

$y + 1/2 = 3/2\,(x+1)$

$2y + 1 = 3x + 3$

$2y - 3x + 1 - 3 = 0$

$2y - 3x - 2 = 0$ (equ of tangent

Equation of normal : $y - y_1 = \frac{-1}{m}(x - x_1)$

$y - \left(\frac{-1}{2}\right) = \frac{-1}{3/2}(x - (-1))$

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

$y + \frac{1}{2} = -\frac{2}{3}x - \frac{2}{3}$

$6y + 3 = -4x - 4$

$6y + 4x + 4 + 3 = 0$

$6y + 4x + 7 = 0$ Equ of Normal

4. $y = 1 + x - x^2$ at point $(-2, -5)$

Solution

$y = 1 + x - x^2$

$\frac{dy}{dx} = 1 - 2x$

$\left.\frac{dy}{dx}\right|_{x=-2}$ $1 - 2(-2) = 1 + 4 = 5$

$m = 5$

Equation of tangent : $y - y_1 = m(x - x_1)$

$y - (-5) = 5(x - (-2))$

$y + 5 = 5(x + 2)$

$y+5 = 5x+10$

$y-5x+5-10=0$

$y-5x-5=0$ (equ of tangent)

Equation of normal: $y-y_1 = \frac{-1}{m}(x-x_1)$

$y-(-5) = \frac{-1}{5}(x-(-2))$

$y+5 = \frac{-1}{5}(x+2)$

$5y+25 = -x-2$

$5y+x+25+2=0$

$5y+x+27=0$

5) $y = 1/x$ at Point $(3, 1/3)$

$\frac{dy}{dx} = -\frac{1}{x^2}$

$\left.\frac{dy}{dx}\right|_{x=3} \quad \frac{-1}{3^2} = \frac{-1}{9}$

Equation for tangent: $y-y_1 = m(x-x_1)$

$y-\frac{1}{3} = \frac{-1}{9}(x-3)$

$9y-3 = -x+3$

$9y+x-3-3=0$

$9y+x-6=0$ (equ for tangent)

Equation of Normal: $y - y_1 = \frac{-1}{m}(x - x_1)$

$y - \frac{1}{3} = \frac{-1}{-1/9}(x - 3)$

$y - \frac{1}{3} = 9x - 27$

Multiply through by LCM = 3

$3y - 1 = 27x - 81$

$3y - 27x + 81 - 1 = 0$

$3y - 27x + 80 = 0$ (equ of normal)