COURSE CODE: MAT 104

COURSE TITLE: General Mathematics III

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MATRIC NO: 17/MHS01/173 DEPARTMENT: PHYSIOLOGY

Solution

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

$m_1 = dy/dx = 4x$

From the gradient at $x=1$

$m_1 = 4(1) = 4$

$\therefore y - y_1 = m(x - x_1)$

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

$y - 2 = 4x - 4$

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

OR $y - 4x + 2 = 0$ (Equation of the tangent)

Equation of the normal

$m_1 m_2 = -1$

$(4) m_2 = -1$

$m_2 = -1/4$

$y - y_1 = m(x - x_1)$

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

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

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

$4y - 8 = -x + 1$

$\cancel{4y - 8}$ $4y = -x + 1 + 8 = -x + 9$, $4y = -x + 9$

OR $4y + x - 9 = 0$

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

Solution

$m_1 = dy/dx = 6x - 2$

From the gradient at $x = 2$

$m_1 = 6(2) - 2 = 12 - 2$

$m_1 = 10$

$\therefore y - y_1 = m(x - x_1)$

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

$y - 8 = 10x - 20$

$y = 10x - 20 + 8$

$y = 10x - 12$

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

Equation of the normal

$m_1 m_2 = -1$

$(10)\, m_2 = -1$

$m_2 = -1/10$

$y - y_1 = m(x - x_1)$

$y - 8 = -1/10\,(x - 2)$

$10(y - 8) = -1(x - 2)$

$10y - 80 = -x + 2$

$10y = -x + 2 + 80$

$10y = -x + 82$

OR $10y + x - 82 = 0$

3. $y = x^3/2$ at the point $(-1, -1/2)$

Using quotient rule,

~~let $y = x^3$~~ Let $y = \dfrac{U(x)}{V(x)}$

$$\frac{dy}{dx} = \frac{V\,du/dx - U\,dv/dx}{V^2}$$

$y = \dfrac{x^3}{2}$ Let $u = x^3$, $du/dx = 3x^2$

Let $v = 2$, $dv/dx = 0$

$$\frac{dy}{dx} = \frac{2(3x^2) - x^3(0)}{2^2}$$

$$\frac{dy}{dx} = \frac{\overset{3}{\cancel{6}}x^2}{\underset{2}{\cancel{4}}} = \frac{3x^2}{2}$$

From the gradient at $x = -1$

$m_1 = dy/dx = 3x^2/2 = 3(-1)^2/2 = 3/2$

$\therefore y - y_1 = m(x - x_1)$

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

$y + 1/2 = \dfrac{3x + 1}{2}$

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

$2y + 1 = 3x + 1$

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

OR ~~$2y + 3$~~ $2y - 3x = 0$ (Equation of the tangent)

Equation of the normal

$m_1 m_2 = -1$

$\left(\frac{3}{2}\right) m_2 = -1$

$m_2 = {}^{-1}/({}^3/_2)$

$m_2 = -1 \times \frac{2}{3} = \frac{-2}{3}$

$y - y_1 = m(x - x_1)$

$y - (-{}^1/_2) = -{}^2/_3\, (x - (-1))$

$y + {}^1/_2 = \frac{-2(x+1)}{3}$, $y + {}^1/_2 = \frac{-2x-2}{3}$

$3(y + {}^1/_2) = -2x - 2$

$3y + {}^3/_2 = -2x - 2$

$3y = -2x - 2 - {}^3/_2$ OR $3y + 2x + 2 + {}^3/_2 = 0$

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

$m_1 = {}^{dy}/_{dx} = 1 - 2x$

From the gradient at $x = -2$

$m_1 = 1 - 2(-2)$

$m_1 = 1 - (-4) = 1 + 4 = 5$

$\therefore\ y - y_1 = m(x - x_1)$

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

$y + 5 = 5x + 10$

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

OR $y = -5x + 5 = 0$ (Equation of tangent)

Equation of the normal

$m_1 m_2 = -1$

$(5) m_2 = -1$

$m_2 = {}^{-1}/_5$

$y - y_1 = m(x - x_1)$

$\cancel{y - y_1 =}\ y - (-5) = -{}^1/_5\, (x - (-2))$

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

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

$5y + 25 = -x - 2$

$5y = -x - 2 - 25$

$5y = -x - 27$ or $5y + x + 27 = 0$

5. $y = 1/x$ at the point $(3, 1/3)$

$m_1 = \frac{dy}{dx} = -x^{-2}$

From the gradient at $x = 3$

$m_1 = -(3)^{-2}$

$m_1 = -3^{-2} = -1/3^2 = -1/9$

$\therefore y - y_1 = m(x - x_1)$

$y - 1/3 = -1/9(x-3)$

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

$9(y - 1/3) = -x + 3$

$9y - 3 = -x + 3$

$9y = -x + 3 + 3$

$9y = -x + 6$ OR $9y + x - 6 = 0$

Equation of the normal

$m_1 m_2 = -1$

$(-1/9)m^2 = -1$

$m^2 = -1/(-1/9) = \frac{-1 \times 9}{-1} = \frac{+9}{+1} = 9$

$y - y_1 = m(x - x_1)$

$y - 1/3 = 9(x - 3)$

$y - 1/3 = 9x - 27$

$y = 9x - 27 + 1/3$ OR $y - 9x + 27 - 1/3 = 0$