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19/MHS01/300
Medicine and Surgery
Maths 104

1) Find: (a) The equation of Tangent and (b) The equation of the normal for the follow Curves:

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

$y = 2x^2$

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

$\Rightarrow m = \frac{dy}{dx}\Big|_{x=1} \Rightarrow 4(1) = 4$

$\therefore \Rightarrow m = 4, \; x_1 = 1 \text{ and } y_1 = 2$

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

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

$\Rightarrow y - 2 = 4x - 4$

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

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

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

Equation for normal: $m_1 m_2 = -1$

$\Rightarrow m_2 = \frac{-1}{m_1} = \frac{-1}{4}$

$\Rightarrow y - y_1 = m_2(x - x_1)$

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

$\Rightarrow 4(y - 2) = -1(x - 1) \Rightarrow 4y - 8 = -x + 1$

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

$\Rightarrow 4y + x - 9 = 0$

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

$y = 3x^2 - 2x$

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

$\Rightarrow m = \left.\frac{dy}{dx}\right|_{x=2} \Rightarrow 6(2) - 2 = 12 - 2 = 10$

$\therefore m = 10,\ x_1 = 2$ and $y_1 = 8$

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

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

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

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

$\Rightarrow y - 10x + 12 = 0$

Equation for normal: $m_1 m_2 = -1$

$\Rightarrow m_2 = \frac{-1}{m_1} = -\frac{1}{10}$

$\Rightarrow y - y_1 = m_2(x - x_1)$

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

$\Rightarrow 10(y - 8) = -x + 2$

$\Rightarrow 10y - 80 = -x + 2$

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

$\Rightarrow 10y + x - 82 = 0$

Q) $y = \frac{x^3}{2}$ at the Point $(-1, -1/2)$

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

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

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

$\Rightarrow m = \frac{3}{2}$, $x_1 = -1$, and $y_1 = \frac{-1}{2}$

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

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

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

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

$\Rightarrow 2y + 1 = 3x + 3$

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

$\Rightarrow 2y - 3x - 2 = 0$

Equation for normal: $m_1 m_2 = -1$

$\Rightarrow m_2 = \frac{-1}{m_1} = \frac{-1}{3/2} = \frac{-2}{3}$

$\Rightarrow y - y_1 = m_2(x - x_1)$

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

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

$\Rightarrow 3y + 3/2 = -2x - 2 \Rightarrow 3y + 2x + 3/2 + 2 = 0$

$\Rightarrow 3y + 2x + \frac{7}{2} = 0$

$\Rightarrow 6y + 4x + 7 = 0$

d) $y = 1 + x - x^2$ at the Point $(-2, -5)$

$y = 1 + x - x^2$

$\Rightarrow \frac{dy}{dx} = 0 + 1 - 2x$

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

$\Rightarrow m = \frac{dy}{dx}\Big|_{x=-2} \Rightarrow 1 - 2(-2) = 1 + 4 = 5$

$\Rightarrow m = 5$, $x_1 = -2$ and $y_1 = -5$

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

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

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

$\Rightarrow y + 5 = 5x + 10$

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

$\Rightarrow y - 5x - 5 = 0$

Equation for normal: $m_1 m_2 = -1$

$\Rightarrow m_2 = -\frac{1}{m_1} = \frac{-1}{5}$

$\Rightarrow y - y_1 = m_2(x - x_1)$

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

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

$\Rightarrow 5y + 25 = -x - 2 \Rightarrow 5y + x + 25 + 2 = 0$

$\Rightarrow 5y + x + 27 = 0$

e) $y = \frac{1}{2}$ at the point $(3, 1/3)$

$y = \frac{1}{x} \Rightarrow y = x^{-1}$

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

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

$\therefore m = \frac{1}{9}$, $x_1 = 3$ and $y_1 = \frac{1}{3}$

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

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

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

$\Rightarrow 9y - 3 = x - 3$

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

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

$\Rightarrow 9y - x = 0$

$\Rightarrow 9y - x = 0$

Equation for normal: $m_1 m_2 = -1$

$\Rightarrow m_2 = \frac{-1}{m_1} = -\frac{1}{1/9} = -9$

$y - y_1 = m_2(x - x_1)$

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

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

$\Rightarrow y - \frac{1}{3} + 9x - 27 = 0 \Rightarrow y + 9x - \frac{82}{3} = 0$

$\Rightarrow 3y + 27x - 82 = 0$