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19/MHS01/001.
MBBS
MAT 104.

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

Soln.

$x_1 = 1 \quad y_1 = 2$

$Y = 2x^2$

$dy/dx = 4x$

$dy/dx\,|_{x=1} = 4(1)$

$M = 4$

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

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

$y - 2 = 4x - 4$

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

$y - 4x + 2 = 0$ ← Equation of tangent.

$M_1 M_2 = -1$

$M_2 = \frac{-1}{M_1} \qquad M_2 = \frac{-1}{4} \qquad M_2 = -1/4.$

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

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

$4y - 8 = -x + 1$

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

$4y + x - 9 = 0$ which gives the equation of the tangent

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

Soln.

$x_1 = 2, \quad y_1 = 8$

$Y = 3x^2 - 2x$

$dy/dx = 6x - 2$

$dy/dx\,|_{x=2} = 6(2) - 2$

$M = 10$

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

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

$y - 8 = 10x - 20$

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

$y - 10x + 12 = 0$

which gives the equation of the normal.

$M_2 = \frac{-1}{M_1}$ $\quad M_2 = \frac{-1}{10}$

$y - y_1 = M_2(x - x_1)$

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

$10y - 80 = -x + 2$

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

$10y + x - 82 = 0$ which gives the equation of the tangent

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

Soln.

$y = \frac{x^3}{2}$ $\quad x_1 = -1$ $\quad y_1 = -1/2$

$dy/dx = 3x^2$

$dy/dx\big|_{x=-1} = 3(-1)^2$

$M = 3$.

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

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

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

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

$y - 3x - 5/2 = 0$. which gives the equation of the normal

$M_2 = \frac{-1}{M_1}$ $\quad M_2 = -1/3$

$y - y_1 = M_2(x - x_1)$

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

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

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

$3y + x + \frac{3}{2} + 1 = 0$

$3y + x + \frac{5}{2} = 0$. which gives the equation of the tangent

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

Soln.

$Y = 1 + x - x^2$ $\qquad x_1 = -2, \quad y_1 = -5$

$dy/dx = 1 - 2x$

$dy/dx\,|_{x=-2} = 1 - 2(-2)$ $\qquad dy/dx = 1 + 4$

$= 5$

$M = 5$

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

~~$y - (-5) = M(x - (-2))$~~ $y - y$ $\qquad y - (-5) = 5(x - (-2))$

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

$y + 5 = 5x + 10$

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

$y - 5x - 5 = 0$ which gives the equation of the ~~tangent~~ normal.

$M_2 = \frac{-1}{M_1}$ $\qquad M_2 = -\frac{1}{5}$

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

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

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

$5y + 25 = -x - 2$

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

$5y + x + 27 = 0$ which gives the equation of the tangent

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

Soln.

$Y = 1/x$ $\qquad x_1 = 3, \quad y_1 = 1/3$

$Y = x^{-1}$

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

$$\frac{dy}{dx}\Big|_{x=3} = \frac{-1}{3^2}$$

$$M = -1/9$$

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

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

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

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

$$9y + x - 6 = 0.$$ which gives the equation of the normal.

$$M_2 = \frac{-1}{M_1} \qquad M_2 = \frac{-1}{-1/9} \qquad M_2 = 9.$$

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

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

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

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

$$y - 9x + 80/3 = 0$$ which gives the equation of the tangent.