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MATH104 ASSIGNMENT
MBBS 19/MHS01/192

Equation of the tangent and normal.

For the curves in problem 1 to 5, at the points given find

a) the equation of the tangent
b) the equation of the normal.

solution.

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

$x_1 = 1$, $y_1 = 2$

$y = 2x^2$

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

$= 4(1)$

$\frac{dy}{dx} = 4$ $\quad \frac{dy}{dx} = m_1$ $\therefore m_1 = 4$

a) $x_1 = 1$, $y_1 = 2$, $m_1 = 4$

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

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

$y - 2 = 4x - 4$

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

$y - 4x + 2 = 0$ → equation of the tangent.

b) $y - y_1 = m_2(x - x_1)$ $\quad m_2 = \frac{-1}{m_1}$

$y - y_1 = \frac{-1}{m_1}(x - x_1)$

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

$4y - 8 = -x + 1$

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

$4y + x - 9 = 0$ → equation of the normal

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

$x_1 = 2 \quad y_1 = 8$

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

$= 6(2) - 2$

$\frac{dy}{dx} = 12 - 2$

$\frac{dy}{dx} = 10$

$\frac{dy}{dx} = m_1$

$\therefore m_1 = 10$

a) $x_1 = 2,\ y_1 = 8,\ m_1 = 10$

$y - y_1 = m_1(x - x_1)$

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

$y - 8 = 10x - 20$

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

$y - 10x + 12 = 0$ -> equation of the tangent

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

b) $y - y_1 = \frac{-1}{m_1}(x - x_1)$

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

$10y - 80 = -x + 2$

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

$10y + x - 82 = 0$ -> equation of the normal.

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

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

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

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

$\frac{dy}{dx} = m_1 \quad \therefore m_1 = \frac{3}{2}$

$x_1 = -1, y_1 = -1/2, m_1 = \frac{3}{2}$

a $y - y_1 = m_1(x - x_1)$

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

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

$\frac{2y+1}{2} \times \frac{3x+3}{2}$

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

$4y + 2 = 6x + 6$

$4y - 6x + 2 - 6 = 0$

$\frac{4y}{2} - \frac{6x}{2} - \frac{4}{2} = \frac{0}{0}$

$2y - 3x - 2 = 0$ → equation of the tangent

$M_2 = \frac{-1}{m_1}$

b $y - y_1 = -\frac{1}{m_1}(x - x_1)$

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

$6 \times (y + 1/2) = -\frac{2}{3}(x+1) \times 6$

$6y + 3 = -4(x+1)$

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

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

$6y - 4x + 7 = 0$ → equation of the normal.

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

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

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

$\frac{dy}{dx} = 5$

$\frac{dy}{dx} = m_1 \therefore m_1 = 5$

$x_1 = -2,\ y_1 = -5,\ m_1 = 5$

$y - y_1 = m_1(x - x_1)$

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

$y + 5 = 5x + 10$

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

$y - 5x - 5 = 0$ -> equation of the tangent

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

$y - y_1 = \frac{-1}{m_1}(x - x_1)$

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

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

$5y + 25 = -x - 2$

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

$5y + x + 27 = 0$ -> equation of the normal

(5) $y = \frac{1}{x}$ at point $(3, \frac{1}{3})$

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

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

$\frac{dy}{dx} = \frac{1}{9}$ $\quad \frac{dy}{dx} = m_1 \quad m_1 = 1/9$

$x_1 = 3,\ y_1 = 1/3,\ m_1 = 1/9$

$y - y_1 = m_1(x - x_1)$

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

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

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$9y - 3 = x - 3$

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

$9y - x = 0 \rightarrow$ equation of the normal.