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MAT 104 Assignment: For the curves in problem 1 to 5, at the points given, find (a) the equation of the tangent, and (b) the equation of the normal.

1. $y = 2x^2$ at point (1, 2)
2. $y = 3x^2 - 2x$ at the point (2, 8)
3. $y = x^3/2$ at the point $(-1, -1/2)$
4. $y = 1 + x - x^2$ at the point $(-2, -5)$
5. $y = 1/x$ at the point $(3, 1/3)$.

Solution

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

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

$m = 4, \quad y_1 = 2, \quad x_1 = 1$

Equation of tangent

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

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

$y - 2 = 4x - 4$

$y - 4x + 2 = 0$.

Equation of the normal:

$y - y_1 = -1/m_1 (x - x_1)$

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

$4y - 8 = -x + 1$

$4y + x - 9 = 0$.

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

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

$m = 10, \quad x_1 = 2, \quad y_1 = 8$.

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

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

$y - 8 = 10x - 20$.

$y - 10x + 12 = 0$, Equation of tangent.

Equation of the normal.

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

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

$10y - 80 = -x + 2$

$10y + x - 82 = 0$

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

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

$m = 3/2$

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

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

$2y + 2 = 6x + 6$ } Divide through by 2

$y + 1 = 3x + 3$

$y - 3x - 2 = 0$. Equation of tangent.

Equation of normal

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

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

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

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

$3y + 4x + 7 = 0$.

4) $y = 1 + x - x^2 \quad (-2, -5)$

$dy/dx = 1 - 2x \qquad dy/dx_{x = -2} \qquad 1 - 2(-2)$

$m = 5$

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

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

$= y + 5 = 5x + 10.$

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

Equation of normal

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

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

$5y + 10 = -x - 2$

$5y + x + 12 = 0$

5) $y = \frac{1}{x} = x^{-1}$ $\quad dy/dx = -x^{-2}$.

$dy/dx|_{x=3} = -(3)^{-2} = -\frac{1}{9}$

$m = -\frac{1}{9}$, $y = \frac{1}{3}$ $\quad x = 3$

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

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

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

$9y + 3x - 18 = 0$ (Divide through by 3).

$3y + x - 6 = 0$. Equation of tangent

Equation of normal

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

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

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

Multiply through by 3

$3y - 1 = 27x - 81$

$3y - 27x + 80 = 0$.