Assignment 7

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For the curves in problem 1 to 5, at the points gi
Find (a) the equation of the tangent (b) the equation
of the normal.

① $y = 2x^2$ at the point $(x_1, y_1) = (1, 2)$

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

$$\left.\frac{dy}{dx}\right|_{x=1} = 4(1) = 4$$

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

(a) Equation of the tangent

$$y - y_1 = m(x - x_1)$$
$$y - 2 = 4(x - 1)$$
$$y - 2 = 4x - 4$$
$$y - 2 - 4x + 4 = 0$$
$$\therefore y - 4x + 2 = 0$$

(b) Equation of normal

$$m_1 m_2 = -1$$
$$4 \cdot m_2 = -1$$
$$\therefore m_2 = -\frac{1}{4}$$
$$y - y_1 = m(x - x_1)$$
$$y - 2 = -\frac{1}{4}(x - 1)$$
$$y - 2 = \frac{-x + 1}{4}$$
$$4(y - 2) = -x + 1$$
$$4y - 8 + x - 1 = 0$$
$$4y + x - 9 = 0$$

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

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

$$\left.\frac{dy}{dx}\right|_{x=2} \qquad 6(2) - 2$$

$$m = 12 - 2$$

$$\therefore m = 10 \quad , x_1 = 2, \; y_1 = 8$$

(a) Equation of tangent

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

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

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

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

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

(b) Equation of normal

$$m_1 \cdot m_2 = -1$$

$$10 \cdot m_2 = -1$$

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

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

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

$$y - 8 \times \frac{-x + 2}{10}$$

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

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

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

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

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

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

Find the gradient at $x = -1$

$2(-1)^2 = 2$

$\therefore m = 2, x_1 = -1, y_1 = -\frac{1}{2}$

(a) Equation of the tangent

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

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

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

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

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

$y - 2x - \frac{3}{2} = 0$

(b) Equation of normal

$m_1 \cdot m_2 = -1$

$2 \cdot m_2 = -1$

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

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

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

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

$y + \frac{1}{2} \not= \frac{-x - 1}{2}$

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

$2y + 1 = -x - 1$

$2y + 1 + x + 1 = 0$

$2y + x + 2 = 0$

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

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

$$\left.\frac{dy}{dx}\right|_{x=-2}$$

$$m = -2x + 1$$

$$m = -2(-2) + 1 = 5$$

a Equation of tangent

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

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

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

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

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

$$y - 5x - 5 = 0$$

b Equation of normal

$$m_1 m_2 = -1$$

$$5 \cdot m_2 = -1$$

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

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

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

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

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

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

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

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

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

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

$y = x^{-1}$

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

$\left.\frac{dy}{dx}\right|_{x=3} = -3^{-2}$

$m = \frac{-1}{9}$

a equation of tangent

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

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

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

$9y - 3 = -x + 3$

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

$9y + x - 6 = 0$

b equation of normal

$m_1 m_2 = -1$

$-\frac{1}{9} \cdot m_2 = -1$

$m_2 = -1 \div \frac{-1}{9}$

$m_2 = -1 \times \frac{9}{1}$

$\therefore m_2 = 9$

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

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

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

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

$y - 9x + \frac{80}{3} = 0$