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MATHS 104 ASSIGNMENT.

Question: For the curves in Problem 1 to 5, at the points given, find (a) the equation to the tangent and (b) the equation of the normal.

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

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

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

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

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

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

$y - 2 = 4x - 4$

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

$y - 4x + 2 = 0$ (Equation of the tangent).

b) Equation of the normal

$m_1 m_2 = -1$

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

$= -0.25.$

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

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

$4y - 8 = -x + 1$

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

~~$4y + x$~~ $4y + x - 9 = 0$

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

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

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

$= 12 - 2$

$= 10$

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

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

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

$y - 8 = 10x - 20$

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

$y - 10x + 12 = 0$ [Equation of the tangent].

b. $m_1 m_2 = -1$

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

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

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

$10y - 80 = -x + 2$

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

$10y + x - 82 = 0$ [Equation of the normal].

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

$m = \frac{dy}{dx} = 3 \cdot 1/2 = \frac{3}{2} x^2$.

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

$= \frac{3}{2}$

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

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

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

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

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

$2y - 3x - 2 = 0$

b. $m_1 m_2 = -1$

$m_2 = -1/m_1 = -1/3/2 = -2/3$.

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

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

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

$3y + 3/2 = -2x - 2$.

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

$3y + 2x + 7/2 = 0$

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

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

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

$m = 5, y_1 = -5, x_1 = -2.$

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

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

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

$y + 5 = 5x + 10$

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

$y - 5x - 5 = 0$

5. $m_1 m_2 = -1$

$m_2 = -1/m_1 = -1/5$

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

$y + 5 = -1/5(x + 2)$.

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

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

$5y + x + 27 = 0$

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

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

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

$$m = 1/9, x_1 = 3, y_1 = 1/3$$

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

$y - 1/3 = 1/9(x - 3)$.

$9y - 3 = x - 3$.

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

$9y - x = 0$.

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

$y - 1/3 = -9(x - 3)$.

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

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

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

$3y + 27x - 82 = 0$.