Equation of tangent

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MAT 104.

For the curves below, at the points given, find

a) the equation of the tangent

b) the equation of the normal.

(1) $y = 2x^2 \cdot (1, 2)$.

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

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

$m = 4$

$x = 1,\ y = 2,\ m = 4$

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

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

$y - 2 = 4x - 4$

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

$y - 4x - 2 = 0$: Equation of tangent

Equation of normal

$m_1 m_2 = -1$

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

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

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

$4y - 8 = -x + 1$

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

$4y + x - 9 = 0$: Equation of normal

$y = 3x^2 - 2x \quad (2, 8).$

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

$m = \frac{dy}{dx}\Big|_{x=2} = 6(2) - 2$

$m = 10$

$x = 2, y = 8, m = 10.$

Equation of tangent

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

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

$y - 8 = 10x - 20.$

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

$y - 10x + 12 = 0$

Equation of normal.

$m_1 m_2 = -1$

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

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

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

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

$10y - 80 = -x + 2$

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

$10y + x - 82 = 0.$

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

$\frac{dy}{dx}$ using quotient rule.

$\frac{dy}{dx} = \frac{2 \cdot 3x^2 - x^3 \cdot 0}{2^2}.$

$\frac{dy}{dx} = \frac{6x^2}{2^2}. = \frac{6x^2}{4}$

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

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

$m = \frac{3}{2}.$

Equation of tangent

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

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

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

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

$2y + 1 = 3x + 3$

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

$2y - 3x - 2 = 0.$

Equation of normal

$m_1 m_2 = -1$

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

$= \frac{-1}{3/2}$

$= -2/3.$

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

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

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

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

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

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

$6y + 4x + 7 = 0.$

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

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

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

$1 + 4$

$m = 5$

Equation of tangent

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

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

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

$y+5 = 5x+10$

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

$y-5x-5 = 0.$

Equation of normal

$m_1 m_2 = -1$

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

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

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

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

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

$5y+x+27 = 0.$

(5) $y = 1/x \quad (3, 1/3).$

$y = x^{-1}$

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

$m = \frac{dy}{dx}\Big|_{x=3} = -3^{-2} = \frac{-1}{9}.$

Equation of tangent

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

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

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

$9y-3 = -x+3$

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

$9y+x-6 = 0$

Equation of normal

$m_1 m_2 = -1$

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

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

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

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

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