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1 $y = 2x^2$ at the point $(1, 2)$ $\frac{dy}{dx} = 4x$

a. $m = 4$, Equation of the tangent

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

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

b. Equation of the normal

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

$\Rightarrow 4(y - 2) = -x + 1$

$4y - 8 = -x + 1 \Rightarrow 4y + x - 9 = 0$

2 $y = 3x^2 - 2x$ at the point $(2, 8)$ $\frac{dy}{dx} = 6x - 2$

a Equation of the tangent $m = 6x - 2 = 10$

$y - 8 = 10(x - 2)$, $y - 8 = 10x - 20$

$y - 8 - 10x + 20 = 0 \Rightarrow y - 10x + 12 = 0$

b Equation of the normal $m_1 m_2 = -1$

$10 m_2 = -1 \quad \therefore m_2 = -1/10$

$y - 8 = -1/10 (x - 2)$; $10(y - 8) = -1(x - 2)$

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

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

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

$\frac{dy}{dx} = 3/2 x^2$ from $1/2 x^3$

a Equation of the tangent

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

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

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

$\therefore 2y - 3x - 2 = 0$

b Equation of the normal; $m_1 m_2 = -1$

$3/2 m_2 = -1 \quad \therefore m_2 = -2/3$

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

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

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

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

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

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

a Equation of the tangent

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

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

$y + 5 = 5(x + 2)$; $y + 5 = 5x + 10$

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

b Equation of the normal:

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

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

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

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

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

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

a Equation of tangent:

$\frac{dy}{dx} = m = -1/9$

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

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

$9y + x - 3 - 3 = 0 \quad \therefore 9y + x - 6 = 0$

b Equation of the normal:

$m_1 m_2 = -1$, $-1/9 m_2 = -1$, $m_2 = 9$

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

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

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

$\therefore y - 9x + 80/3 = 0$