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1. $y = 2x^2$ at $(1,2)$ $\frac{dy}{dx} = 4x$ $\left.\frac{dy}{dx}\right|_{(x=1)} = 4$, $m = 4$ [gradient of the tangent]

Tangent passes through $(1,2)$, $x_1 = 1, y_1 = 2$

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

a) $y = 4x - 2$ //

Gradient of the normal = -1/gradient of the tangent $= -1/4$

b) $\therefore$ eqn of the normal $y - 2 = \frac{-x}{4} + \frac{1}{4}$, $4y - 8 = -x + 1$, $4y + x = 9$ //

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

for tangent, $\left.\frac{dy}{dx}\right|_{(x=2)} = m = 12 - 2 = 10$ //

where $(x_1, y_1) = (2,8)$, $(y - y_1) = m(x - x_1)$ $y - 8 = 10(x-2)$

a. $\therefore$ $y = 10x + 6$ //

$m_n = -1/m = -1/10$ For normal;

b. $10(y - 8) = -x + 2$; $10y + x = 82$ //

3. $y = \frac{x^3}{2}$ at $(-1, -0.5)$ $\frac{dy}{dx} = \frac{3x^2}{2}$ for tangent, $\left.\frac{dy}{dx}\right|_{(x=-1)} = m = 1.5(-1)^2 = 1.5$

$(x_1, y_1) = (-1, -0.5)$; $y - y_1 = m(x - x_1)$ $\therefore$ $y + 0.5 = 1.5(x+1)$

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

$m_n = -1/m = -1/1.5$ For normal;

$3(y + 0.5) = -2(x+1)$ $3y + 1.5 = -2x - 2$

b. $6y + 4x = -5$ //

4. $y = 1 + x - x^2$ at $(-2, -5)$ $\frac{dy}{dx} = -2x + 1$ for tanget, $\left.\frac{dy}{dx}\right|_{(x=-2)} = m = -2(-2) + 1 = 5$

$(x_1, y_1) = (-2, -5)$ $y - y_1 = m(x - x_1)$ $\therefore$ $y + 5 = 5(x+2)$

a. $y = 5x + 5$ //

Gradient of the normal = -1/Gradient of the tangent $= -1/5$

For normal;

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

b. $5y + x = -27$.

5. $y = x^{-1}$ at $(3, 1/3)$ $\frac{dy}{dx} = -1 \cdot x^{-2} = \frac{-1}{x^2}$

$\left.\frac{dy}{dx}\right|_{x=3} = m = \frac{-1}{9}$

$(x_1, y_1) = (3, 1/3)$; $y - y_1 = m(x - x_1)$

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

$9y - 3 = -x + 3$

a. $9y = 6 - x$

Gradient of the normal = -1/Gradient of the tangent = 9.

for normal;

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

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

b. $3y = 27x - 80$.