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

Soln

$y = \frac{x^3}{2}$

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

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

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

Eqn of tangent $y - y_1 = m(x - x_1)$

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

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

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

$2y + 1 = 3x + 3$

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

Eqn of normal $y - y_1 = -\frac{1}{m}(x - x_1)$

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

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

$6y + 4x + 3 + 4 = 0$ | $6y + 4x + 7 = 0$

4. $y = 1 + x - x^3$ at point $(-2, -5)$

Soln

$y = 1 + x - x^3$, $x = -2$, $y = -5$

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

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

Eqn of tangent $y - y_1 = m(x - x_1)$

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

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

$y - 5x - 5 = 0$

Eqn of normal $y - y_1 = -\frac{1}{m}(x - x_1)$

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

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

$5y + 25 = -x - 2$

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

$5y + x + 27 = 0$

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

Soln

$x_1 = 3, \; y_1 = \frac{1}{3}$, $y = \frac{1}{x}$

$\frac{dy}{dx} = -1(x)^{-1-1}$

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

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

Eqn of tangent $y - y_1 = m(x - x_1)$

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

$9y - 3 = -x + 3$

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

$9y + x - 6 = 0$

Eqn of normal: $y - y_1 = \frac{-1}{m}(x - x_1)$

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

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

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

$3y - 27x - 1 + 81 = 0$

$3y - 27x + 80 = 0$

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1) $y = 2x^2$ at Point $(1, 2)$

Soln

$x_1 = 1$, $y_1 = 2$, $y = 2x^2$, $\frac{dy}{dx} = 4x$

$\frac{dy}{dx}\Big|_{x=1}$ $4(1) = 4$

$m = 4$

Eqn of a tangent

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

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

$y - 2 = 4x - 4$

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

$y - 4x + 2 = 0$

Eqn of Normal: $y - y_1 = \frac{-1}{m}(x - x_1$

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

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

$4y - 8 = -x + 1$

$4y + x - 9 = 0$

2) $y = 5x^2 - 2x$ at Point $(2, 8)$

Soln

$x_1 = 2, \quad y_1 = 8, \quad y = 3x^2 - 2x$

$dy/dx = 6x - 2$

$\left.\frac{dy}{dx}\right|_{x=2} \quad 6(2) - 2 = 10$

$m = 10$

Eqn of a tangent

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

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

$y - 8 = 10x - 20$

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

$y - 10x + 12 = 0$

Eqn of normal $y - y_1 = \frac{-1}{m}(x - x_1)$

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

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

$10y - 80 = -x + 2$

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

$10y - x - 82 = 0$