Solutions

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

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

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

$m = 4$

$x_1 = 1, \; y_1 = 2$

Equ. of tangent

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

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

$y - 2 = 4x - 4$

$y - 4x + 2 = 0$

Equ. of normal

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

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

$4y - 8 = -x + 1$

$4y + x - 9 = 0$

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

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

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

$m = 10$

$x_1 = 2, \; y_1 = 8$

Equ. of tangent

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

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

Equ. of normal

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

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

$y - 8 = 10x + 20$

$y - 10x + 12 = 0$

$10y - 80 = -x + 2$

$10y - x - 82 = 0$

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

$$\frac{dy}{dx} = \frac{V\,du/dx - u\,dv/dx}{V^2}$$

$u = x^3 \; ; \; du/dx = 3x^2$

$V = 2 \; ; \; dv/dx = 0$

$$\therefore \frac{2 \cdot 3x^2 - x^3 \cdot 0}{2^2} \Rightarrow \frac{6x^2}{4}$$

$$\left.\frac{dy}{dx}\right|_{x=-1} = \frac{6(-1)^2}{4} \Rightarrow 6/4$$

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

$x_1 = -1, \; y_1 = -1/2$

Eqn. of tangent

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

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

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

$2y + 1 = 3x + 3$

$2y - 3x - 2 = 0$

Eqn. of normal

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

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

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

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

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

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

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

$m = 5$

$x_1 = -2, \quad y_1 = -5$

persamaan garis singgung	persamaan garis normal
$y - y_1 = m(x - x_1)$	$y - y_1 = \frac{-1}{m}(x - x_1)$
$y + 5 = 5(x + 2)$	$y + 5 = \frac{-1}{5}(x + 2)$
$y + 5 = 5x + 10$	$5y + 25 = -x - 2$
$y - 5x - 5 = 0$	$5y + x + 27 = 0$

5. $y = \frac{1}{x}$ $(3, 1/3)$

$\frac{dy}{dx} = \frac{V\,dU/dx - U\,dV/dx}{V^2}$

$U = 1 \; ; \; dU/dx = 0$

$V = x \; ; \; dV/dx = 1$

$\Rightarrow \frac{x \cdot 0 - 1 \cdot 1}{x^2} \Rightarrow \frac{-1}{x^2}$

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

$m = -1/9$

$x_1 = 3$; $y_1 = 1/3$

Eqn. of tangent	Eqn. of Normal
$y - y_1 = m(x - x_1)$	$y - y_1 = -\frac{1}{m}(x - x_1)$
$y - 1/3 = -\frac{1}{9}(x - 3)$	$y - 1/3 = 9(x - 3)$
$9y - 3 = -x + 3$	$y - 1/3 = 9x - 27$
$9y + x - 6 = 0$	$y - 9x + 80/3 = 0$