

① Equation of normal

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

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

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

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

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

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

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

Equation of normal,

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① $y = 2x^2$ (1, 2)

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

$$m = 4$$

$$x = 1 \quad y = 2$$

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

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

$$y - 2 = 4x - 4$$

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

$$y - 4x = -2$$

$$y - 4x + 2 = 0 \quad \text{(That gives equation of the tangent)}$$

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

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

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

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

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

$$4y + x = 9$$

$$4y + x - 9 = 0$$

$$\text{(which gives the equation of the normal)}$$

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

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

$$x = 2 \quad y = 8$$

$$6(2) - 2$$

$$12 - 2$$

$$m = 10$$

Equation of tangent

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

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

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

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

$$y - 10x = -12$$

$$y - 10x + 12 = 0 \quad \text{(which gives the equation of tangent)}$$

Equation of normal

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

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

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

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

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

$$10y + x = 82$$

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

The equation of the normal is $10y + x - 82 = 0$

③ $y = \frac{x^3}{2}$ (-1, -1/2)

$$\frac{dy}{dx} = \frac{3x^2}{2} \quad x = -1 \quad y = -\frac{1}{2}$$

$$m = \frac{3(-1)^2}{2}$$

$$m = \frac{3(1)}{2} = \frac{3}{2}$$

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

$$(y - y_1)$$

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

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

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

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

$$2y + 1 = 3n + 3$$

$$2y - 3n = 3 - 1$$

$$2y - 3n = 2$$

$$2y - 3n - 2 = 0 \text{ [which gives the equation of the tangent]}$$

Equation of the normal

$$(y - y_1) = \frac{-1}{m}(n - n_1)$$

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

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

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

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

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

$$3y + 2n = -\frac{7}{2}$$

$$3y + 2n + \frac{7}{2} = 0 \text{ [which gives the equation of the normal]}$$

$$1) y = 1 + n - n^2 \text{ } [-2, -5)$$

$$\frac{dy}{dn} = 1 - 2n$$

$$m = 1 - 2(-2)$$

$$1 - (-4)$$

$$m = 5$$

$$9 \times \frac{1}{3}$$

Equation of tangent

$$y - y_1 = m(n - n_1)$$

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

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

$$y + 5 = 5n + 10$$

$$y - 5n = 10 - 5$$

$$y - 5n = 5$$

$$y - 5n - 5 = 0 \text{ [which gives the equation of tangent]}$$

Equation of normal

$$(y - y_1) = \frac{-1}{m}(n - n_1)$$

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

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

$$5(y + 5) = -1(n + 2)$$

$$5y + 25 = -n - 2$$

$$5y + n = -2 - 25$$

$$5y + n = -27$$

$$5y + n + 27 = 0 \text{ [which gives the equation of the normal]}$$

$$5) y = \frac{1}{n} \text{ } (3, \frac{1}{3})$$

$$\frac{dy}{dn} = -1 = n^{-2} \text{ } y_1 = \frac{1}{3}$$

$$m = \frac{-1}{(3)^2} = \frac{-1}{9}$$

$$y - y_1 = m(n - n_1)$$

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

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

$$9y - 3 = -n + 3$$

$$9y + n = 3 + 3$$

$$9y + n = 6$$

$$9y + n - 6 = 0 \text{ [Equation of tangent]}$$