

① $y = 2x^2$ at the point (1,2)

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

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

$$m = 4 \quad y = 2, x = 1$$

Equation of tangent

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

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

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

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

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

Equation of the normal

$$y - y_1 = -\frac{1}{m_1}(x - x_1)$$

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

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

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

② $y = 3x^2 - 2x$ at the point (2,8)

$$\frac{dy}{dx} = 6x - 2 \quad \frac{dy}{dx} \Big|_{x=2} = 6(2) - 2$$

$$\therefore m = 10 \quad ; \quad x_1 = 2 \quad y_1 = 8$$

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

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

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

$$y - 10x + 12 = 0 \text{ Equation of tangent}$$

Equation of the normal

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

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

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

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

③ $y = \frac{x^3}{2}$ (-1, -1/2)

$$\frac{dy}{dx} = \frac{x^3}{2} = \frac{3x^2}{2} = \frac{3(-1)^2}{2}$$

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

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

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

$$2y + 1 = 3x + 3$$

$$2y - 3x - 2 = 0 \text{ Equation of tangent}$$

Equation of normal

$$y - y_1 = -\frac{1}{m_1}(x - x_1)$$

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

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

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

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

$$3y + 2x + \frac{3}{2} + 2 = 0$$

$$3y + 2x + \frac{7}{2} = 0 \quad \times 2$$

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

④ $y = 1 + x - x^2$ (-2, -5)

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

$$m = -5$$

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

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

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

$$y+5x+15=0 \text{ Equation of tangent}$$

Equation of normal

$$y-y_1 = \frac{1}{m_1}(x-x_1)$$

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

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

$$5y-x+22=0$$

Equation of normal
 $y-y_1 = \frac{1}{m_1}(x-x_1)$

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

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

$$3y-1 = -27(x-3)$$

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

$$3y+27x-82=0$$

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

$$y = \frac{1}{x} = x^{-1}$$

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

$$m = \frac{1}{9} \quad y = \frac{1}{3} \quad x = 3$$

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

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

$$9y-3 = x-3$$

$$9y-x+0=0 \text{ Equation of tangent}$$