

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

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

Question 1

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

$$\frac{dy}{dx} = 4x^2 = m$$

$$= 4(1)^2 = \underline{4}$$

Therefore

(a) Equation of tangent \Rightarrow

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

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

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

$$y = \underline{4x - 2}$$

(b) Equation of the normal

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

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

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

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

$$4y = -x + 9$$

$$\underline{4y + x = 9}$$

Question 2

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

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

$$\frac{dy}{dx} = m = 6(2) - 2$$

$$m = 12 - 2 = \underline{10}$$

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

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

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

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

$$\underline{y = 10x - 12}$$

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

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

$10y - 80 = -x + 2$

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

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

$$\underline{10y + x - 82}$$

Question 3

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

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

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

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

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

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

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

$$2y - 3x = 3 - 1$$

$$\underline{2y - 3x = 2}$$

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

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

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

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

$$6y + 3 = -4x - 4$$

$$6y + 4x = -4 - 3$$

$$\underline{6y + 4x = -7}$$

Question 4

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

(a) ~~$y - y_1 = m(x - x_1)$ Eq of tangent~~

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

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

a) Eq. of tangent

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

$$y - (-5) = 5[x - (-2)]$$

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

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

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

$$\underline{\underline{y - 5x = 5}}$$

b) Eq. of normal

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

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

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

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

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

$$\underline{\underline{5y + x = -27}}$$

Question 5

$$y = \frac{1}{x} \quad \text{at } (3, \frac{1}{3})$$

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

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

(a) Equation of normal