

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

Soln

$$y = 2x^2$$

$$y = 4x$$

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

dx

$$m = \frac{dy}{dx} \bigg|_{x=x_1}$$

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

$$m = 4$$

a) Equation of the tangent

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

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

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

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

$$y + 2 - 4x = 0 \quad \text{or} \quad y = 4x - 2$$

$$y - 4x + 2 = 0 \quad \text{or} \quad y = 4x - 2$$

b) Equation of the normal

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

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

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

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

$$4y - 8 - 1 + x = 0$$

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

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

$$y = 3x^2 - 2x$$

$$y = 6x - 2$$

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

$$m = \frac{dy}{dx} \Big|_{x=2}$$

$$m = \frac{dy}{dx} \Big|_{x=2} = 3(2)^2 - 2 = 10$$

$$m = 10$$

a) Equation of the tangent

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

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

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

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

$$y - 10x + 12 = 0$$

b) Equation of the normal

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

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

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

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

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

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

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

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

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

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

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

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

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

0) Equation of the tangent

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

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

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

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

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

$$1 + \frac{0}{2} \quad -1 + \frac{2}{-3}$$

$$y - 1 = 2x$$

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

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

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

b) Equation of the normal

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

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

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

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

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

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

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

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

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

$$y = 1 + 2x - x^2$$

$$y = 1 - 2x$$

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

$$m = \frac{dy}{dx} \bigg|_{x=x_1}$$

$$m = \frac{dy}{dx} \bigg|_{x=-2} = 1 - 2(-2) = 5$$

$$m = 5$$

a) Equation of the tangent

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

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

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

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

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

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

b) Equation of the normal

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

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

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

$$5y + 10 = -x - 2$$

$$5y - x + 10 + 2 = 0$$

$$5y - x + 12 = 0$$

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

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

$$y = 1$$

$$m = 1$$

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

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

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

$$y - \frac{1}{3} - x + 3 = 0$$

$$y - x + \frac{8}{3} = 0$$

b) equation of the normal

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

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

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

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

$$y - \frac{1}{3} + x - 3 = 0$$

$$y + x - \frac{10}{3} = 0$$

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19/MHTS01/336

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