

For the curves in problem 1-5 at the points given, find (a) the equation of the tangent and (b) the equation of the normal.

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

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

$$m = \frac{dy}{dx} \quad | \quad x=1$$

$$m = 4x, m = 4(1) \quad m = 4$$

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

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

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

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

$$y - 4x = -2$$

For normal  $y + 2$  equation:

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

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

Cross multiply

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

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

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

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

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

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

$$m = 6x - 2, \quad m = 6(2) - 2, \quad m = 10$$

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

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

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

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

$$y - 10x = -12$$

For a normal equation:

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

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

Cross multiply

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

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

$$10y + x = 82$$

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

$$\frac{dy}{dx} = \frac{3x^2}{0} = \text{Indefinite}$$



4.  $y = 1 + x - x^2$  at point  $(-2, -5)$   
 $\frac{dy}{dx} = 1 - 2x$

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

$$m = 1 + 4 \quad m = 5$$

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

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

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

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

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

$$y - 5x = 5$$

For normal equation

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

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

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

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

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

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

$$m = -\frac{1}{9}$$

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

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

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

$$27y - 9 = -3x + 9$$

$$27y + 3x = 18$$

For the normal equation.

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

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

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

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

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

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

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

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

$$3y - 27x = \underline{\underline{-80}}$$