

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

$$3y + 1.5 = -x - 1$$

$$3y + x + 1.5 + 1 = 0$$

$$3y + x + 2.5 = 0$$

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

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

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

$$\frac{dy}{dx} \text{ at } x = -2 \quad (1 - 2(-2))$$

$$m = \frac{dy}{dx} = 1 + 4$$

$$m = 5$$

Equation of tangent

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

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

$$(y + 5) = 5x + 10$$

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

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

Equation of the normal

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

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

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

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

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

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

$$5y + x + 25 + 2 = 0$$

$$5y + x + 27 = 0$$

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\* For the curves in problem 1 to 5, at the points given find

(a) The equation of the tangent

(b) The equation of the normal

Solution

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

For the normal

$$y = 2x^2$$

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

$$m = \frac{dy}{dx}(x=1)$$

$$m = 4(1)$$

$$m = 4$$

Equation of the Tangent

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

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

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

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

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

Equation of the normal

$$m_1 m_2 = -1$$

$$m_2 = \frac{-1}{m_1}$$

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

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

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

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

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

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

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

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

$$\frac{dy}{dx} \text{ at } x(2) = 6(2) - 2$$

$$\frac{dy}{dx} = m$$

3) For equation of normal  $y = x^{3/2}$  at the point  $(-1, -\frac{1}{2})$

For normal

$$y = x^{3/2}$$

$$\frac{dy}{dx} \text{ of } \frac{1}{2}x^3$$

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

$$m = \frac{dy}{dx} \Big|_{x=1} = \frac{3}{2}(1)^2 \therefore m = \frac{3}{2}$$

The equation of tangent

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

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

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

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

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

clt

$$2y - 3x + 1 - 3 = 0$$

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

The equation of normal

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

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

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

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

both sides multiply by 6

$$6(y + \frac{1}{2}) = -4(x + 1)$$

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

clt

$$6y + 4x + 3 + 4 = 0$$

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

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

For normal

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

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

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

$$= -(3)^{-2}$$

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

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

The equation of the tangent

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

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

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

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

$$9y - x = 3 + 3 = 6$$

$$9y - x - 6 = 0$$

The equation of the normal

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

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

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

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

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

multiply both sides by 3

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

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

$$3y - 27x - 1 + 81 = 0$$

Collect like terms

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

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

2.  $8x^2 - 2x$  at the point  $(2, 8)$

For normal

$$y = 8x^2 - 2x$$

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

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

$$6(2) - 2$$

$$m = 12 - 2$$

$$\therefore m = 10$$

Equation of tangent

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

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

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

CLT

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

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

Equation of the normal

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

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

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

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

CLT

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

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