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

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

At the point $(3, \frac{1}{3})$: $y - \frac{1}{3} = -1(x - 3)$

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

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

$$3y - 1 + 3x - 9 = 0$$

$3y + 3x - 10 = 0$ gives the equation of tangent

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

At the point $(3, \frac{1}{3})$: $y - \frac{1}{3} = \frac{1}{-1}(x - 3)$

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

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

$$3y - 1 + 3x - 9 = 0$$

$3y + 3x - 10 = 0$ gives the equation of normal

At point $(1,2)$: $y - 2 = \frac{1}{4}(x-1)$

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

$y - 2 - \frac{1}{4}x + \frac{1}{4} = 0$

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

$4y - x - 7 = 0$ gives equation of normal

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

Solution

$y = 3x^2 - 2x$

$dy/dx = 6x - 2$

$dy/dx|_{x=1} = 6(1) - 2 = 4$; $\therefore m = 4$

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

At point $(2,8)$: $y - 8 = 4(x-2)$

$y - 8 = 4x - 8$

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

$y - 4x = 0$ gives the equation of tangent.

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

At point $(2,8)$: $y - 8 = \frac{1}{4}(x-2)$

$y - 8 = \frac{1}{4}x - \frac{1}{2}$

$y - 8 - \frac{1}{4}x + \frac{1}{2} = 0$

$4y - 32 - x + 2 = 0$

$4y - x - 30 = 0$ gives the equation of normal

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

Solution

$y = x^3/2$

$dy/dx = 3x^2$

$dy/dx|_{x=1} = 3(1)^2 = 3$; $m = 3$

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

At the point $(-1, -\frac{1}{2})$: $y - (-\frac{1}{2}) = 3(x - (-1))$

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

Assignment

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

(1) $y = 2x^2$ at the point $(1, 2)$ (2) $y = 3x^2 - 2x$ at the point $(2, 8)$

(3) $y = x^3/2$ at the point $(-1, -\frac{1}{2})$ (4) $y = 1 + x - x^2$ at the point $(-2, $

(5) $y = 1/x$ at the point $(3, 1/3)$

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MEDICINE AND SURGERY

MAT 104 ASSIGNMENT

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

Solution

$y = 2x^2$

$dy/dx = 4x$

$dy/dx|_{x=1} = 4(1) = 4; \therefore m = 4$

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

At point $(1, 2)$: $y - 2 = 4(x - 1)$

$y - 2 = 4x - 4$

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

$y - 4x + 2 = 0$ gives the equation of tangent

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

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

$2y + 1 - 6x - 6 = 0$

$2y - 6x - 5 = 0$ gives the equation of the tangent

Equation of normal: $y - y_1 = 1/m(x - x_1)$

At the point $(-1, -1/2)$: $y - (-1/2) = 1/3(x - (-1))$

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

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

$6y + 3 - 2x - 2 = 0$

$6y - 2x + 1 = 0$ gives the equation of the normal

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

Solution

$y = 1 - x + x^2$

$dy/dx = -1 + 2x \Rightarrow 2x - 1$

$dy/dx|_{x=1} = 2(1) - 1 = 1$; $m = 1$

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

At the point $(-2, -5)$: $y - (-5) = 1(x - (-2))$

$y + 5 = x + 2$

$y + 5 - x - 2 = 0$

$y - x + 3 = 0$ gives the equation of the tangent

Equation of normal: $y - y_1 = 1/m(x - x_1)$

At the point $(-2, -5)$: $y - (-5) = 1/1(x - (-2))$

$y + 5 = x + 2$

$y + 5 - x - 2 = 0$

$y - x + 3 = 0$ gives the equation of the normal

5. $y = 1/x$ at the point $(3, 1/3)$

Solution

$y = 1/x$

$y = x^{-1}$

$dy/dx = -1x^{-2}$