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QUESTION

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

1. $y = 2x^2$ at the point $[1, 2]$

Solution

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

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

Equation of the tangent

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

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

$y - 2 = 4x - 4$

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

$y - 4x + 2 = 0$

$y = 4x - 2$

Normaly for the Equation

$m = -1/4 = -1/4$

$y - y_1 = 1/m\,(x - x_1)$

$y - 2 = 1/4\,(x - 1)$

$4y - 8 = -x + 1$

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

$4y + x - 9 = 0$

2. $y = 3x^2 - 2x$ at the point $\{3, 8\}$

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

$m = dy/dx \mid_{x=2} = 6(2) - 2 = 10$

Equation of the tangent

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

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

$y - 8 = 10x - 20$

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

$y = 10x - 12$

For Normal Equation

$m = -1/10 = -1/10$

$y - y_1 = 1/m (x - x_1)$

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

$10y - 80 = -x + 2$

$10y = -x + 2 + 80$

$10y + x - 82 = 0$

3 $y = x^{3/2}$ at the point $[-1, -1/2]$

Solution

$y = 1/2 x^3$

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

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

Equation of Tangent

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

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

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

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

$y - 3x - 5/2 = 0$

$y = 3x + 5/2$

For Normal Equation

$m = -1/3 \Rightarrow -1/3$

$y - y_1 = -1/m (x - x_1)$

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

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

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

$3y + x + 5/2 = 0$

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

Solution

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

$m = \frac{dy}{dx} = 1 - 2(-2), = 1 - 4 = -3$

Equation of Tangent

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

$y + 5 = -3(x + 2)$

$y + 5 = -3x - 6$

$y + 5 + 3x + 6 = 0$

$y + 3x + 11 = 0$

$y = -3x - 11$

For Normal Equation

$m = -1/4 = -1/4$

$y - y_1 = -1/m (x - x_1)$

$y + 5 = +1/3 (x + 2$

$3y + 15 = x + 2$

$3y + 15 - 2 - x = 0$

$3y + 13 - x = 0$

5. $y = 1/x$ at the point $\{3, 1/3\}$

Solution

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

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

$m = dy/dx = -1(3)^{-2} = -1/9$

Equation of the Tangent

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

$y - 1/3 = -1/9(x - 3)$

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

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

$y + 1/9x - 2/3 = 0$

$y = -1/9x + 2/3$

For Normal Equation

$m = -1/9 - 1/9 = 9/1$

$y - y_1 = 9/1(x - x_1)$

$y - 1/3 = 9/1(x - 3)$

$y - 1/3 = 9x - 27$

$y - 9x - 1/2 + 27 = 0$

$y - 9x - 53/2 = 0$