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

Solution

$y = 2x^2$

$\frac{dy}{dx} = 4x \, (1, 2)$

$m = \frac{dy}{dx}, \; x = 1$

$m = 4$

→ Equation of the tangent

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

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

$y - 2 = 4x - 4$

$y - 2 - (4x - 4) = 0$

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

$y - 4x + 2 = 0$

→ Equation of the normal

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

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

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

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

$4y - 8 = -x + 1$

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

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

$4y + x - 9 = 0$

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

$2y-3x-2=0$

ii **Equation of the normal;**

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

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

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

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

$y+\frac{1}{2} - (-\frac{2}{3}x - \frac{2}{3}) = 0$

$y+\frac{1}{2} - \frac{2}{3}x - \frac{2}{3} = 0$

$y + \frac{2}{3}x + \frac{7}{6} = 0$

$6y+4x+7=0$

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

Solution.

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

$m = 1-2x = 1-2(-2) = 1+4$

$= 5$

i **Equation of a tangent;**

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

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

$y+5 = 5x+10$

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

$y-5x-5 = 0$

ii **Equation of the normal;**

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

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

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

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

$5y+25 = -x-2$

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

$5y+x+27 = 0$

5 $y = 1/x \ (3, 1/3)$

Solution

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

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

$m = -1/x^2 = -1/3^2 = -1/9$

=> Equation of the tangent

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

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

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

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

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

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

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

=> Equation of the normal

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

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

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

$3y - 1 = 9x - 27$

$3y - 1 - 9x + 27 = 0$

$3y - 9x + 26 = 0$

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

Solution

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

$m = 6(2) - 2 = 8 - 2$

$= 6$

i **Equation of the tangent:**

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

$(y - 8) = 6(x - 2)$

$y - 8 = 6x - 12$

$y - 8 - (6x - 12) = 0$

$y - 8 - 6x - 12 = 0$

$y - 6x + 4 = 0$

ii **Equation of the normal:**

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

$(y - 8) = -\frac{1}{6}(x - 2)$

$(y - 8) = -x/6 + 2/6$

$6(y - 8) = -x + 2$

$6y - 48 = -x + 2$

$6y - 48 - (-x + 2) = 0$

$6y - 48 + x - 2 = 0$

$6y + x - 50 = 0$

3 $y = x^3/2 \quad (-1, -1/2)$

Solution

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

$m = 3/2 x^2 = \frac{3}{2}(-1)^2 = 3/2$

i **Equation of tangent:**

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

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

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

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

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