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① $y = 2x^2$ at the point $(1, 2)$

Solution

$y = 2x^2$

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

$m = 4$

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

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

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

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

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

$4y - 8 = -x + 1$

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

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

$4y + x - 9 = 0$.

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

Solution

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

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

i) Equation of the tangent

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

~~$(8 - y_1)$~~

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

$y - 8 = 6x - 12$

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

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

$y - 6x + 4 = 0$,,

ii) Equation of the normal

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

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

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

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

$6y - 48 = -x + 2$

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

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

$6y + x - 50 = 0$,,

3) $y = x^{3/2}$ $(-1, -1/2)$

Solution

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

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

i) Equation of the tan

$-1 \div 3/2$

$-1 \times 2/3 = -2/3$ $\quad \frac{1}{a} + \frac{2}{5}$ $\quad \frac{3+4}{6} = \frac{7}{6}$

i) Equation of the tangent

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

~~$(y = t$~~

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

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

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

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

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

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

ii) Equation of the normal

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

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

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

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

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

$y + 2/3x + 7/6 = 0$

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

4. $y = 1 + x - x^2 \quad (-2, -5)$

Solution

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

$m = 1 - 2x = 1 - 2(-2) = 1 + 4 = 5.$

i) Equation of the tangent

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

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

$y + 5 = 5x + 10$

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

$y - 5x - 5 = 0.$

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) $y = \frac{1}{x}$ $(3, 1/3)$

Solution

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

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

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

Equation of the tangent

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

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

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

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

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

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

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

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

Equation of the normal

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

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

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

$y - 1/3 - (9x - 27) = 0$

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

$3y - 1 = 9x - 27$

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

$3y - 9x + 26 = 0$