

Chain Rule Practice

Differentiate each function with respect to x .

1) $y = \sin 4x^4$

2) $y = \sin(\tan 5x^2)$

3) $y = (2x^3 + 3)^{-3}$

4) $y = (5x^5 + 1)^4(-5x^4 - 1)$

$$5) y = \left(\frac{2x + 1}{-4x^3 + 1} \right)^{-4}$$

$$6) y = ((x + 2)^4 + 3)^{-3}$$

For each problem, use implicit differentiation to find $\frac{dy}{dx}$ in terms of x and y .

$$7) 5x^3 + xy = 2y$$

$$8) x^2 = 2xy + 5x^2y^2$$

For each problem, use implicit differentiation to find $\frac{d^2y}{dx^2}$ in terms of x and y .

$$9) 2 = 2x + 5y^2$$

$$10) -4y^2 + 2 = 5x^2$$

Answers to Chain Rule Practice

$$1) \frac{dy}{dx} = 16x^3 \cos 4x^4 \quad 2) \frac{dy}{dx} = 10x \cos(\tan 5x^2) \cdot \sec^2 5x^2$$

$$3) \frac{dy}{dx} = -3(2x^3 + 3)^{-4} \cdot 6x^2 \\ = -\frac{18x^2}{(2x^3 + 3)^4}$$

$$4) \frac{dy}{dx} = (5x^5 + 1)^4 \cdot -20x^3 + (-5x^4 - 1) \cdot 4(5x^5 + 1)^3 \cdot 25x^4 \\ = -20x^3(5x^5 + 1)^3(30x^5 + 5x + 1)$$

$$5) \frac{dy}{dx} = -4 \cdot \left(\frac{2x+1}{-4x^3+1} \right)^{-5} \cdot \frac{(-4x^3+1) \cdot 2 - (2x+1) \cdot -12x^2}{(-4x^3+1)^2} \\ = -\frac{8(-4x^3+1)^3(8x^3+6x^2+1)}{(2x+1)^5}$$

$$6) \frac{dy}{dx} = -3((x+2)^4 + 3)^{-4} \cdot 4(x+2)^3 \\ = -\frac{12(x+2)^3}{((x+2)^4 + 3)^4}$$

$$7) \frac{dy}{dx} = \frac{15x^2 + y}{2 - x}$$

$$8) \frac{dy}{dx} = \frac{x - y - 5xy^2}{x + 5x^2y}$$

$$9) \frac{d^2y}{dx^2} = -\frac{1}{25y^3} \quad 10) \frac{d^2y}{dx^2} = \frac{-20y^2 - 25x^2}{16y^3}$$