

Station 2 - Chain Rule (Challenging)**Differentiate each function with respect to x .**

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

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

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

4) $y = (3x^3 + 5)^4(4x - 3)$

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

6) $y = \sqrt[5]{5x + 1}(-3x^3 + 4)$

7) $y = \frac{(5x^3 + 1)^{\frac{1}{3}}}{2x^2 + 1}$

8) $y = (4x^2 + 1)^{\frac{1}{5}}$

9) $y = ((3x^3 + 1)^2 + 3)^3$

10) $y = ((-4x^2 + 5)^2 - 1)^5$

Answers to Station 2 - Chain Rule (Challenging)

$$1) \frac{dy}{dx} = 2(x^2 + 5) \cdot 2x \\ = 4x(x^2 + 5)$$

$$2) \frac{dy}{dx} = \frac{(2x^4 + 1) \cdot 3(5x^2 + 1)^2 \cdot 10x - (5x^2 + 1)^3 \cdot 8x^3}{(2x^4 + 1)^2} \\ = \frac{2x(5x^2 + 1)^2(10x^4 + 15 - 4x^2)}{(2x^4 + 1)^2}$$

$$3) \frac{dy}{dx} = 5 \cdot \left(\frac{5x^2 + 2}{5x^5 + 3}\right)^4 \cdot \frac{(5x^5 + 3) \cdot 10x - (5x^2 + 2) \cdot 25x^4}{(5x^5 + 3)^2} \\ = \frac{25x(5x^2 + 2)^4(-15x^5 + 6 - 10x^3)}{(5x^5 + 3)^6}$$

$$4) \frac{dy}{dx} = (3x^3 + 5)^4 \cdot 4 + (4x - 3) \cdot 4(3x^3 + 5)^3 \cdot 9x^2 \\ = 4(3x^3 + 5)^3(39x^3 + 5 - 27x^2) \quad 5) \frac{dy}{dx} = \frac{3}{4}(-5x^4 + 1)^{-\frac{1}{4}} \cdot -20x^3 \\ = -\frac{15x^3}{(-5x^4 + 1)^{\frac{1}{4}}}$$

$$6) \frac{dy}{dx} = (5x + 1)^{\frac{1}{5}} \cdot -9x^2 + (-3x^3 + 4) \cdot \frac{1}{5}(5x + 1)^{-\frac{4}{5}} \cdot 5 \\ = \frac{-48x^3 - 9x^2 + 4}{(5x + 1)^{\frac{4}{5}}}$$

$$7) \frac{dy}{dx} = \frac{(2x^2 + 1) \cdot \frac{1}{3}(5x^3 + 1)^{-\frac{2}{3}} \cdot 15x^2 - (5x^3 + 1)^{\frac{1}{3}} \cdot 4x}{(2x^2 + 1)^2} \\ = \frac{x(-10x^3 - 4 + 5x)}{(2x^2 + 1)^2 \cdot (5x^3 + 1)^{\frac{2}{3}}}$$

$$8) \frac{dy}{dx} = \frac{1}{5}(4x^2 + 1)^{-\frac{4}{5}} \cdot 8x \\ = \frac{8x}{5(4x^2 + 1)^{\frac{4}{5}}} \quad 9) \frac{dy}{dx} = 3((3x^3 + 1)^2 + 3)^2 \cdot 2(3x^3 + 1) \cdot 9x^2 \\ = 54x^2((3x^3 + 1)^2 + 3)^2(3x^3 + 1)$$

$$10) \frac{dy}{dx} = 5((-4x^2 + 5)^2 - 1)^4 \cdot 2(-4x^2 + 5) \cdot -8x \\ = -80x((-4x^2 + 5)^2 - 1)^4(-4x^2 + 5)$$