

Product Rule ... Set 2

Product and Quotient Rules

Differentiate each function with respect to x .

1) $y = (2x^2 + 1) \cdot -4x^2$

2) $y = (-2x^2 + 3) \cdot 2x^4$

3) $y = 3x^3(4x^5 + 2)$

4) $y = 2x^3(5x^4 + 5)$

5) $y = (x^4 + 4)(x^5 + 2)$

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

7) $y = (4x^3 + 1)(-3x^3 + 3)$

8) $y = (5x^4 + 3)(5x^4 + 2)$

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

10) $y = (-4x^5 + 2x^3 + 1)(2x^4 + 5)$

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

12) $y = (-2x^5 - 4)(4x^4 + 3x^2 + 4)$

Product Rule ... Set 2

Answers

$$1) \frac{dy}{dx} = (2x^2 + 1) \cdot -8x - 4x^2 \cdot 4x \\ = -32x^3 - 8x$$

$$3) \frac{dy}{dx} = 3x^3 \cdot 20x^4 + (4x^5 + 2) \cdot 9x^2 \\ = 96x^7 + 18x^2$$

$$5) \frac{dy}{dx} = (x^4 + 4) \cdot 5x^4 + (x^5 + 2) \cdot 4x^3 \\ = 9x^8 + 20x^4 + 8x^3$$

$$7) \frac{dy}{dx} = (4x^3 + 1) \cdot -9x^2 + (-3x^3 + 3) \cdot 12x^2 \\ = -72x^5 + 27x^2$$

$$9) \frac{dy}{dx} = (x^5 + 3x^4 + 3) \cdot 3x^2 + (x^3 - 5)(5x^4 + 12x^3) \\ = 8x^7 + 21x^6 - 25x^4 - 60x^3 + 9x^2$$

$$10) \frac{dy}{dx} = (-4x^5 + 2x^3 + 1) \cdot 8x^3 + (2x^4 + 5)(-20x^4 + 6x^2) \\ = -72x^8 + 28x^6 - 100x^4 + 8x^3 + 30x^2$$

$$11) \frac{dy}{dx} = (2x^2 + 3)(-25x^4 + 3x^2) + (-5x^5 + x^3 - 5) \cdot 4x \\ = -70x^6 - 65x^4 + 9x^2 - 20x$$

$$12) \frac{dy}{dx} = (-2x^5 - 4)(16x^3 + 6x) + (4x^4 + 3x^2 + 4) \cdot -10x^4$$

$$2) \frac{dy}{dx} = (-2x^2 + 3) \cdot 8x^3 + 2x^4 \cdot -4x \\ = -24x^5 + 24x^3$$

$$4) \frac{dy}{dx} = 2x^3 \cdot 20x^3 + (5x^4 + 5) \cdot 6x^2 \\ = 70x^6 + 30x^2$$

$$6) \frac{dy}{dx} = (-x^3 - 4) \cdot 12x^2 + (4x^3 + 3) \cdot -3x^2 \\ = -24x^5 - 57x^2$$

$$8) \frac{dy}{dx} = (5x^4 + 3) \cdot 20x^3 + (5x^4 + 2) \cdot 20x^3 \\ = 200x^7 + 100x^3$$

Product Rule ... Set 2

Quotient Rule

Differentiate each function with respect to x .

$$13) y = \frac{5x^5}{3x^5 + 3}$$

$$14) y = \frac{5x^2}{2x^4 + 2}$$

$$15) y = \frac{2x^3}{4x^4 + 5}$$

$$16) y = \frac{4x^3}{x^5 + 3}$$

$$17) y = \frac{x^5 + 5}{x^3 + 5}$$

$$18) y = \frac{x^4 + 4x^2}{2x^4 + 2}$$

$$19) y = \frac{x^5 - 3}{3x^3 + 3}$$

$$20) y = \frac{2x^5 + 5x^3}{x^5 + 4}$$

Product Rule ... Set 2

Answers

$$13) \frac{dy}{dx} = \frac{-72x^8 - 42x^6 - 40x^4 - 64x^3 - 24x}{(3x^5 + 3)^2}$$

$$15) \frac{dy}{dx} = \frac{(4x^4 + 5) \cdot 6x^2 - 2x^3 \cdot 16x^3}{(4x^4 + 5)^2}$$

$$17) \frac{dy}{dx} = \frac{(x^3 + 5) \cdot 5x^4 - (x^5 + 5) \cdot 3x^2}{(x^3 + 5)^2}$$

$$19) \frac{dy}{dx} = \frac{(3x^3 + 3) \cdot 5x^4 - (x^5 - 3) \cdot 9x^2}{(3x^3 + 3)^2}$$

$$20) \frac{dy}{dx} = \frac{(x^5 + 4)(10x^4 + 15x^2) - (2x^5 + 5x^3) \cdot 5x^4}{(x^5 + 4)^2}$$

$$14) \frac{dy}{dx} = \frac{(2x^4 + 2) \cdot 10x - 5x^2 \cdot 8x^3}{(2x^4 + 2)^2}$$

$$16) \frac{dy}{dx} = \frac{(x^5 + 3) \cdot 12x^2 - 4x^3 \cdot 5x^4}{(x^5 + 3)^2}$$

$$18) \frac{dy}{dx} = \frac{(2x^4 + 2)(4x^3 + 8x) - (x^4 + 4x^2) \cdot 8x^3}{(2x^4 + 2)^2}$$

Product Rule ... Set 2

Quotient Rule

Differentiate each function with respect to x .

$$21) y = \frac{5x^4 + 2x^3 + x^2}{2x^5 + 2}$$

$$22) y = \frac{2x^4 + 4x^3 + 5x^2}{5x^3 + 5}$$

$$23) y = \frac{x^3 + 4x^2 + 4}{4x^3 + 3}$$

$$24) y = \frac{x^5 + 5x^3 + 5x^2}{3x^2 + 3}$$

Product Rule ... Set 2

Answers

$$\begin{aligned} 21) \frac{dy}{dx} &= \frac{(2x^5 + 2)(20x^3 + 6x^2 + 2x) - (5x^4 + 2x^3 + x^2) \cdot 10x^4}{(2x^5 + 2)^2} \\ &= \frac{-5x^8 - 4x^7 - 3x^6 + 20x^3 + 6x^2 + 2x}{2x^{10} + 4x^5 + 2} \end{aligned}$$

$$\begin{aligned} 22) \frac{dy}{dx} &= \frac{(5x^3 + 5)(8x^3 + 12x^2 + 10x) - (2x^4 + 4x^3 + 5x^2) \cdot 15x^2}{(5x^3 + 5)^2} \\ &= \frac{2x^6 - 5x^4 + 8x^3 + 12x^2 + 10x}{5x^6 + 10x^3 + 5} \end{aligned}$$

$$\begin{aligned} 23) \frac{dy}{dx} &= \frac{(4x^3 + 3)(3x^2 + 8x) - (x^3 + 4x^2 + 4) \cdot 12x^2}{(4x^3 + 3)^2} \\ &= \frac{-16x^4 - 39x^2 + 24x}{16x^6 + 24x^3 + 9} \end{aligned}$$

$$\begin{aligned} 24) \frac{dy}{dx} &= \frac{(3x^2 + 3)(5x^4 + 15x^2 + 10x) - (x^5 + 5x^3 + 5x^2) \cdot 6x}{(3x^2 + 3)^2} \\ &= \frac{3x^6 + 10x^4 + 15x^2 + 10x}{3x^4 + 6x^2 + 3} \end{aligned}$$