

Calculus Practice: Differentiating Products and Quotients of Functions 1a

Differentiate each function with respect to x .

1) $f(x) = (x^4 + 3)(5x^4 + 3)$

A) $f'(x) = x^4 + 3 + 4x^3$
 $= x^4 + 4x^3 + 3$

C) $f'(x) = (x^4 + 3) \cdot 4x^3 + (5x^4 + 3) \cdot 20x^3$
 $= 104x^7 + 72x^3$

B) $f'(x) = (x^4 + 3)(5x^4 + 3) + 4x^3 \cdot 20x^3$
 $= 5x^8 + 80x^6 + 18x^4 + 9$

D) $f'(x) = (x^4 + 3) \cdot 20x^3 + (5x^4 + 3) \cdot 4x^3$
 $= 40x^7 + 72x^3$

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

A) $f'(x) = (5x^2 + 5)(3x^4 - 2x^3 + 1) + 10x(12x^3 - 6x^2)$
 $= 15x^6 - 10x^5 + 135x^4 - 70x^3 + 5x^2 + 5$

B) $f'(x) = (5x^2 + 5)(12x^3 - 6x^2) + (3x^4 - 2x^3 + 1) \cdot 10x$
 $= 90x^5 - 50x^4 + 60x^3 - 30x^2 + 10x$

C) $f'(x) = 3x^4 - 2x^3 + 1 + 12x^3 - 6x^2$
 $= 3x^4 + 10x^3 - 6x^2 + 1$

D) $f'(x) = (3x^4 - 2x^3 + 1) \cdot 10x$
 $= 30x^5 - 20x^4 + 10x$

3) $f(x) = (x^3 - 2)(3x^2 - 4)$

A) $f'(x) = (3x^2 - 4) \cdot 3x^2$
 $= 9x^4 - 12x^2$

C) $f'(x) = (x^3 - 2) \cdot 6x + (3x^2 - 4) \cdot 3x^2$
 $= 15x^4 - 12x^2 - 12x$

B) $f'(x) = x^3 - 2 + 3x^2$
 $= x^3 + 3x^2 - 2$

D) $f'(x) = (x^3 - 2)(3x^2 - 4) + 3x^2 \cdot 6x$
 $= 3x^5 + 14x^3 - 6x^2 + 8$

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

A) $f'(x) = (4x^2 + 1) \cdot 2x^2 + 8x \cdot 4x$
 $= 8x^4 + 34x^2$

C) $f'(x) = (4x^2 + 1) \cdot 4x + 2x^2 \cdot 8x$
 $= 32x^3 + 4x$

B) $f'(x) = 4x^2 + 1 + 8x$
 $= 4x^2 + 8x + 1$

D) $f'(x) = 2x^2 + 4x$

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

A) $f'(x) = (x^2 + 2)(10x^4 + 12x^2) + (2x^5 + 4x^3 - 2) \cdot 2x$
 $= 14x^6 + 40x^4 + 24x^2 - 4x$

B) $f'(x) = (2x^5 + 4x^3 - 2) \cdot 2x$
 $= 4x^6 + 8x^4 - 4x$

C) $f'(x) = 2x^5 + 4x^3 - 2 + 10x^4 + 12x^2$
 $= 2x^5 + 10x^4 + 4x^3 + 12x^2 - 2$

D) $f'(x) = (x^2 + 2)(2x^5 + 4x^3 - 2) + 2x(10x^4 + 12x^2)$
 $= 2x^7 + 28x^5 + 32x^3 - 2x^2 - 4$

$$6) f(x) = (-2x^2 - 4)(4x^4 + 4x^3 - 1)$$

$$A) f'(x) = (-2x^2 - 4)(16x^3 + 12x^2) \\ = -32x^5 - 24x^4 - 64x^3 - 48x^2$$

$$B) f'(x) = (-2x^2 - 4) \cdot -4x + (4x^4 + 4x^3 - 1)(16x^3 + 12x^2) \\ = 64x^7 + 112x^6 + 48x^5 - 8x^3 - 12x^2 + 16x$$

$$C) f'(x) = (-2x^2 - 4)(4x^4 + 4x^3 - 1) - 4x(16x^3 + 12x^2) \\ = -8x^6 - 8x^5 - 80x^4 - 64x^3 + 2x^2 + 4$$

$$D) f'(x) = (-2x^2 - 4)(16x^3 + 12x^2) + (4x^4 + 4x^3 - 1) \cdot -4x \\ = -48x^5 - 40x^4 - 64x^3 - 48x^2 + 4x$$

$$7) y = (x^2 + 3)(-2x^5 - 2)$$

$$A) \frac{dy}{dx} = (x^2 + 3)(-2x^5 - 2) + 2x \cdot -10x^4 \\ = -2x^7 - 26x^5 - 2x^2 - 6$$

$$B) \frac{dy}{dx} = x^2 + 3 + 2x \\ = x^2 + 2x + 3$$

$$C) \frac{dy}{dx} = (x^2 + 3) \cdot -10x^4 + (-2x^5 - 2) \cdot 2x \\ = -14x^6 - 30x^4 - 4x$$

$$D) \frac{dy}{dx} = (x^2 + 3) \cdot 2x + (-2x^5 - 2) \cdot -10x^4 \\ = 20x^9 + 20x^4 + 2x^3 + 6x$$

$$8) y = 3x^4(3x^4 + 1)$$

$$A) \frac{dy}{dx} = 3x^4 \cdot 12x^3 + (3x^4 + 1) \cdot 12x^3 \\ = 72x^7 + 12x^3$$

$$B) \frac{dy}{dx} = 3x^4 + 12x^3$$

$$C) \frac{dy}{dx} = (3x^4 + 1) \cdot 12x^3 \\ = 36x^7 + 12x^3$$

$$D) \frac{dy}{dx} = 3x^4(3x^4 + 1) + 12x^3 \cdot 12x^3 \\ = 9x^8 + 144x^6 + 3x^4$$

$$9) y = (x^4 - 2)x^3$$

$$A) \frac{dy}{dx} = x^3 + 3x^2$$

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

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

$$D) \frac{dy}{dx} = (x^4 - 2) \cdot 3x^2 + x^3 \cdot 4x^3 \\ = 7x^6 - 6x^2$$

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

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

$$B) \frac{dy}{dx} = 4x^4 \cdot 3x^2 + (x^3 + 1) \cdot 16x^3 \\ = 28x^6 + 16x^3$$

$$C) \frac{dy}{dx} = (x^3 + 1) \cdot 16x^3 \\ = 16x^6 + 16x^3$$

$$D) \frac{dy}{dx} = 4x^4(x^3 + 1) + 16x^3 \cdot 3x^2 \\ = 4x^7 + 48x^5 + 4x^4$$

Calculus Practice: Differentiating Products and Quotients of Functions 1a

Differentiate each function with respect to x .

1) $f(x) = (x^4 + 3)(5x^4 + 3)$

A) $f'(x) = x^4 + 3 + 4x^3$
 $= x^4 + 4x^3 + 3$

C) $f'(x) = (x^4 + 3) \cdot 4x^3 + (5x^4 + 3) \cdot 20x^3$
 $= 104x^7 + 72x^3$

B) $f'(x) = (x^4 + 3)(5x^4 + 3) + 4x^3 \cdot 20x^3$
 $= 5x^8 + 80x^6 + 18x^4 + 9$

*D) $f'(x) = (x^4 + 3) \cdot 20x^3 + (5x^4 + 3) \cdot 4x^3$
 $= 40x^7 + 72x^3$

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

A) $f'(x) = (5x^2 + 5)(3x^4 - 2x^3 + 1) + 10x(12x^3 - 6x^2)$
 $= 15x^6 - 10x^5 + 135x^4 - 70x^3 + 5x^2 + 5$

*B) $f'(x) = (5x^2 + 5)(12x^3 - 6x^2) + (3x^4 - 2x^3 + 1) \cdot 10x$
 $= 90x^5 - 50x^4 + 60x^3 - 30x^2 + 10x$

C) $f'(x) = 3x^4 - 2x^3 + 1 + 12x^3 - 6x^2$
 $= 3x^4 + 10x^3 - 6x^2 + 1$

D) $f'(x) = (3x^4 - 2x^3 + 1) \cdot 10x$
 $= 30x^5 - 20x^4 + 10x$

3) $f(x) = (x^3 - 2)(3x^2 - 4)$

A) $f'(x) = (3x^2 - 4) \cdot 3x^2$
 $= 9x^4 - 12x^2$

*C) $f'(x) = (x^3 - 2) \cdot 6x + (3x^2 - 4) \cdot 3x^2$
 $= 15x^4 - 12x^2 - 12x$

B) $f'(x) = x^3 - 2 + 3x^2$
 $= x^3 + 3x^2 - 2$

D) $f'(x) = (x^3 - 2)(3x^2 - 4) + 3x^2 \cdot 6x$
 $= 3x^5 + 14x^3 - 6x^2 + 8$

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

A) $f'(x) = (4x^2 + 1) \cdot 2x^2 + 8x \cdot 4x$
 $= 8x^4 + 34x^2$

*C) $f'(x) = (4x^2 + 1) \cdot 4x + 2x^2 \cdot 8x$
 $= 32x^3 + 4x$

B) $f'(x) = 4x^2 + 1 + 8x$
 $= 4x^2 + 8x + 1$

D) $f'(x) = 2x^2 + 4x$

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

*A) $f'(x) = (x^2 + 2)(10x^4 + 12x^2) + (2x^5 + 4x^3 - 2) \cdot 2x$
 $= 14x^6 + 40x^4 + 24x^2 - 4x$

B) $f'(x) = (2x^5 + 4x^3 - 2) \cdot 2x$
 $= 4x^6 + 8x^4 - 4x$

C) $f'(x) = 2x^5 + 4x^3 - 2 + 10x^4 + 12x^2$
 $= 2x^5 + 10x^4 + 4x^3 + 12x^2 - 2$

D) $f'(x) = (x^2 + 2)(2x^5 + 4x^3 - 2) + 2x(10x^4 + 12x^2)$
 $= 2x^7 + 28x^5 + 32x^3 - 2x^2 - 4$

$$6) f(x) = (-2x^2 - 4)(4x^4 + 4x^3 - 1)$$

$$A) f'(x) = (-2x^2 - 4)(16x^3 + 12x^2) \\ = -32x^5 - 24x^4 - 64x^3 - 48x^2$$

$$B) f'(x) = (-2x^2 - 4) \cdot -4x + (4x^4 + 4x^3 - 1)(16x^3 + 12x^2) \\ = 64x^7 + 112x^6 + 48x^5 - 8x^3 - 12x^2 + 16x$$

$$C) f'(x) = (-2x^2 - 4)(4x^4 + 4x^3 - 1) - 4x(16x^3 + 12x^2) \\ = -8x^6 - 8x^5 - 80x^4 - 64x^3 + 2x^2 + 4$$

$$*D) f'(x) = (-2x^2 - 4)(16x^3 + 12x^2) + (4x^4 + 4x^3 - 1) \cdot -4x \\ = -48x^5 - 40x^4 - 64x^3 - 48x^2 + 4x$$

$$7) y = (x^2 + 3)(-2x^5 - 2)$$

$$A) \frac{dy}{dx} = (x^2 + 3)(-2x^5 - 2) + 2x \cdot -10x^4 \\ = -2x^7 - 26x^5 - 2x^2 - 6$$

$$B) \frac{dy}{dx} = x^2 + 3 + 2x \\ = x^2 + 2x + 3$$

$$*C) \frac{dy}{dx} = (x^2 + 3) \cdot -10x^4 + (-2x^5 - 2) \cdot 2x \\ = -14x^6 - 30x^4 - 4x$$

$$D) \frac{dy}{dx} = (x^2 + 3) \cdot 2x + (-2x^5 - 2) \cdot -10x^4 \\ = 20x^9 + 20x^4 + 2x^3 + 6x$$

$$8) y = 3x^4(3x^4 + 1)$$

$$*A) \frac{dy}{dx} = 3x^4 \cdot 12x^3 + (3x^4 + 1) \cdot 12x^3 \\ = 72x^7 + 12x^3$$

$$B) \frac{dy}{dx} = 3x^4 + 12x^3$$

$$C) \frac{dy}{dx} = (3x^4 + 1) \cdot 12x^3 \\ = 36x^7 + 12x^3$$

$$D) \frac{dy}{dx} = 3x^4(3x^4 + 1) + 12x^3 \cdot 12x^3 \\ = 9x^8 + 144x^6 + 3x^4$$

$$9) y = (x^4 - 2)x^3$$

$$A) \frac{dy}{dx} = x^3 + 3x^2$$

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

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

$$*D) \frac{dy}{dx} = (x^4 - 2) \cdot 3x^2 + x^3 \cdot 4x^3 \\ = 7x^6 - 6x^2$$

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

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

$$*B) \frac{dy}{dx} = 4x^4 \cdot 3x^2 + (x^3 + 1) \cdot 16x^3 \\ = 28x^6 + 16x^3$$

$$C) \frac{dy}{dx} = (x^3 + 1) \cdot 16x^3 \\ = 16x^6 + 16x^3$$

$$D) \frac{dy}{dx} = 4x^4(x^3 + 1) + 16x^3 \cdot 3x^2 \\ = 4x^7 + 48x^5 + 4x^4$$