

1. Use the Product Rule to differentiate. Simplify the answer.

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

2. Use the Product Rule to differentiate. Simplify the answer.

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

3. Use the Product Rule to differentiate. Simplify the answer.

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

4. Use the Product Rule to differentiate. Simplify the answer.

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

5. Use the Product Rule to differentiate. Simplify the answer.

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

6. Use the Product Rule to differentiate. Simplify the answer.

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

7. Use the Product Rule to differentiate. Simplify the answer.

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

8. Use the Product Rule to differentiate. Simplify the answer.

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

9. Use the Product Rule to differentiate. Simplify the answer.

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

10. Use the Product Rule to differentiate. Simplify the answer.

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

- Answers:
1.  $f'(x) = 18 + 6x - 90x^2 + 36x^3 + 90x^4 - 18x^5 - 42x^6$
  2.  $f'(x) = -8x - 6x^2 - 12x^3 - 25x^4 + 72x^5 + 63x^6$
  3.  $f'(x) = 3 + 10x - 3x^2 - 44x^3 + 5x^4 + 18x^5$
  4.  $f'(x) = 1 + 18x - 15x^2 + 36x^3 - 10x^4 + 36x^5$
  5.  $f'(x) = 6 - 14x + 36x^2 - 24x^3 + 45x^4$
  6.  $f'(x) = -2 + 14x - 18x^2 + 20x^3 + 30x^4$
  7.  $f'(x) = 1 - 8x + 21x^2 - 24x^3 - 36x^4 - 28x^6$
  8.  $f'(x) = -6 - 4x - 32x^3 - 20x^4$
  9.  $f'(x) = -9 - 4x + 15x^2 - 12x^3$
  10.  $f'(x) = -9 - 2x + 24x^2 - 15x^3 + 36x^4 - 42x^5$

Solutions:

$$1. f'(x) = \frac{d}{dx}(-3 + 3x + 3x^2 - 3x^3)(3 - 3x - x^2 + 3x^3 + 2x^4)$$

► Apply:  $\frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$

$$f'(x) = (-3 + 3x + 3x^2 - 3x^3)\frac{d}{dx}(3 - 3x - x^2 + 3x^3 + 2x^4) + (3 - 3x - x^2 + 3x^3 + 2x^4)\frac{d}{dx}(-3 + 3x + 3x^2 - 3x^3)$$

► Apply:  $\frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots$      $\frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x)$      $\frac{d}{dx}(x^n) = nx^{n-1}$

$$f'(x) = (-3 + 3x + 3x^2 - 3x^3)(-3 - 2x + 9x^2 + 8x^3) + (3 - 3x - x^2 + 3x^3 + 2x^4)(3 + 6x - 9x^2)$$

► Expand and simplify:

$$f'(x) = 18 + 6x - 90x^2 + 36x^3 + 90x^4 - 18x^5 - 42x^6$$

$$2. f'(x) = \frac{d}{dx}(2 - 2x + 2x^2 - 2x^3 - 3x^4)(1 + x - 2x^2 - 3x^3)$$

► Apply:  $\frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$

$$f'(x) = (2 - 2x + 2x^2 - 2x^3 - 3x^4)\frac{d}{dx}(1 + x - 2x^2 - 3x^3) + (1 + x - 2x^2 - 3x^3)\frac{d}{dx}(2 - 2x + 2x^2 - 2x^3 - 3x^4)$$

► Apply:  $\frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots$      $\frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x)$      $\frac{d}{dx}(x^n) = nx^{n-1}$

$$f'(x) = (2 - 2x + 2x^2 - 2x^3 - 3x^4)(1 - 4x - 9x^2) + (1 + x - 2x^2 - 3x^3)(-2 + 4x - 6x^2 - 12x^3)$$

► Expand and simplify:

$$f'(x) = -8x - 6x^2 - 12x^3 - 25x^4 + 72x^5 + 63x^6$$

$$3. f'(x) = \frac{d}{dx}(2 - 3x - x^2 + x^3)(-1 + 2x^2 + 3x^3)$$

► Apply:  $\frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$

$$f'(x) = (2 - 3x - x^2 + x^3)\frac{d}{dx}(-1 + 2x^2 + 3x^3) + (-1 + 2x^2 + 3x^3)\frac{d}{dx}(2 - 3x - x^2 + x^3)$$

► Apply:  $\frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots$      $\frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x)$      $\frac{d}{dx}(x^n) = nx^{n-1}$

$$f'(x) = (2 - 3x - x^2 + x^3)(4x + 9x^2) + (-1 + 2x^2 + 3x^3)(-3 - 2x + 3x^2)$$

► Expand and simplify:

$$f'(x) = 3 + 10x - 3x^2 - 44x^3 - 5x^4 + 18x^5$$

$$4. f'(x) = \frac{d}{dx}(2 + x + 2x^2 - 3x^3)(3 - x + 2x^2 + 2x^3)$$

► Apply:  $\frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$

$$f'(x) = (2 + x + 2x^2 - 3x^3)\frac{d}{dx}(3 - x + 2x^2 + 2x^3) + (3 - x + 2x^2 + 2x^3)\frac{d}{dx}(2 + x + 2x^2 - 3x^3)$$

► Apply:  $\frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots$      $\frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x)$      $\frac{d}{dx}(x^n) = nx^{n-1}$

$$f'(x) = (2 + x + 2x^2 - 3x^3)(-1 + 4x + 6x^2) + (3 - x + 2x^2 + 2x^3)(1 + 4x - 9x^2)$$

► Expand and simplify:

$$f'(x) = 1 + 18x - 15x^2 + 36x^3 - 10x^4 - 36x^5$$

$$5. f'(x) = \frac{d}{dx}(3x + x^2 + 3x^3)(2 - 3x + 3x^2)$$

$$\blacktriangleright \text{Apply: } \frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$$

$$f'(x) = (3x + x^2 + 3x^3)\frac{d}{dx}(2 - 3x + 3x^2) + (2 - 3x + 3x^2)\frac{d}{dx}(3x + x^2 + 3x^3)$$

$$\blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \quad \frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x) \quad \frac{d}{dx}(x^n) = nx^{n-1}$$

$$f'(x) = (3x + x^2 + 3x^3)(-3 + 6x) + (2 - 3x + 3x^2)(3 + 2x + 9x^2)$$

$\blacktriangleright$  Expand and simplify:

$$f'(x) = 6 - 14x + 36x^2 - 24x^3 + 45x^4$$

$$6. f'(x) = \frac{d}{dx}(-3 + 2x - 3x^2)(2 + 2x - 3x^2 - 2x^3)$$

$$\blacktriangleright \text{Apply: } \frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$$

$$f'(x) = (-3 + 2x - 3x^2)\frac{d}{dx}(2 + 2x - 3x^2 - 2x^3) + (2 + 2x - 3x^2 - 2x^3)\frac{d}{dx}(-3 + 2x - 3x^2)$$

$$\blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \quad \frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x) \quad \frac{d}{dx}(x^n) = nx^{n-1}$$

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

$\blacktriangleright$  Expand and simplify:

$$f'(x) = -2 + 14x - 18x^2 + 20x^3 + 30x^4$$

$$7. f'(x) = \frac{d}{dx}(-1 + 2x + 2x^3)(-x + 2x^2 - 3x^3 - 2x^4)$$

$$\blacktriangleright \text{Apply: } \frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$$

$$f'(x) = (-1 + 2x + 2x^3)\frac{d}{dx}(-x + 2x^2 - 3x^3 - 2x^4) + (-x + 2x^2 - 3x^3 - 2x^4)\frac{d}{dx}(-1 + 2x + 2x^3)$$

$$\blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \quad \frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x) \quad \frac{d}{dx}(x^n) = nx^{n-1}$$

$$f'(x) = (-1 + 2x + 2x^3)(-1 + 4x - 9x^2 - 8x^3) + (-x + 2x^2 - 3x^3 - 2x^4)(2 + 6x^2)$$

$\blacktriangleright$  Expand and simplify:

$$f'(x) = 1 - 8x + 21x^2 - 24x^3 - 36x^5 - 28x^6$$

$$8. f'(x) = \frac{d}{dx}(-2x - 2x^2)(3 - 2x + 2x^2 + 2x^3)$$

$$\blacktriangleright \text{Apply: } \frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$$

$$f'(x) = (-2x - 2x^2)\frac{d}{dx}(3 - 2x + 2x^2 + 2x^3) + (3 - 2x + 2x^2 + 2x^3)\frac{d}{dx}(-2x - 2x^2)$$

$$\blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \quad \frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x) \quad \frac{d}{dx}(x^n) = nx^{n-1}$$

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

► Expand and simplify:

$$f'(x) = -6 - 4x - 32x^3 - 20x^4$$

$$9. f'(x) = \frac{d}{dx}(-2 + 3x)(-3 + x^2 - x^3)$$

► Apply:  $\frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$

$$f'(x) = (-2 + 3x)\frac{d}{dx}(-3 + x^2 - x^3) + (-3 + x^2 - x^3)\frac{d}{dx}(-2 + 3x)$$

► Apply:  $\frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots$       $\frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x)$       $\frac{d}{dx}(x^n) = nx^{n-1}$

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

► Expand and simplify:

$$f'(x) = -9 - 4x + 15x^2 - 12x^3$$

$$10. f'(x) = \frac{d}{dx}(1 - x + 3x^2 - 2x^3 - 2x^4)(-3 + 3x + 3x^3)$$

► Apply:  $\frac{d}{dx}f(x)g(x) = f(x)\frac{d}{dx}g(x) + g(x)\frac{d}{dx}f(x)$

$$f'(x) = (1 - x + 3x^2 - 2x^3 - 2x^4)\frac{d}{dx}(-3 + 3x + 3x^3) + (-3 + 3x + 3x^3)\frac{d}{dx}(1 - x + 3x^2 - 2x^3 - 2x^4)$$

► Apply:  $\frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots$       $\frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x)$       $\frac{d}{dx}(x^n) = nx^{n-1}$

$$f'(x) = (1 - x + 3x^2 - 2x^3 - 2x^4)(3 + 9x^2) + (-3 + 3x + 3x^3)(-1 + 6x - 6x^2 - 8x^3)$$

► Expand and simplify:

$$f'(x) = 6 - 24x + 54x^2 - 12x^3 + 15x^4 - 36x^5 - 42x^6$$