

1. Differentiate: $f(x) = -4x + x^2 + 3x^3$
2. Differentiate: $f(x) = 2 - 5x + x^2 + 3x^3 - 3x^4$
3. Differentiate: $f(x) = 5 + 5x + 2x^2 + 2x^3$
4. Differentiate: $f(x) = x - 3x^2 + 3x^3 - 5x^4$
5. Differentiate: $f(x) = -1 + 4x - 2x^2 - 2x^3 - 5x^4 + 3x^5$
6. Differentiate: $f(x) = -5 - 2x + 5x^2 - 5x^3 - 5x^4 - 3x^5$
7. Differentiate: $f(x) = -4 - 4x + 5x^2$
8. Differentiate: $f(x) = -1 - x - 2x^2 - 2x^3$
9. Differentiate: $f(x) = -5 - 2x - 4x^2 - 3x^3$
10. Differentiate: $f(x) = -2 + 2x - 2x^2 - 5x^3$

Answers:

1. $f'(x) = -4 + 2x + 9x^2$
2. $f'(x) = -5 + 2x + 9x^2 - 12x^3$
3. $f'(x) = 5 + 4x + 6x^2$
4. $f'(x) = 1 - 6x + 9x^2 - 20x^3$
5. $f'(x) = 4 - 4x - 20x^2 + 15x^3 + 15x^4$
6. $f'(x) = -2 + 10x - 15x^2 - 20x^3 - 15x^4$
7. $f'(x) = -4 + 10x$
8. $f'(x) = -1 - 4x - 6x^2$
9. $f'(x) = -2 - 8x - 6x^2$
10. $f'(x) = 2 - 4x - 15x^2$

Solutions:

$$\begin{aligned}
1. f'(x) &= \frac{d}{dx}(-4x + x^2 + 3x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(-4x) + \frac{d}{dx}(x^2) + \frac{d}{dx}(3x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x) \\
&= (-4)\frac{d}{dx}x^1 + (1)\frac{d}{dx}x^2 + (3)\frac{d}{dx}x^3 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= (-4)(1)(x^0) + (1)(2)(x^1) + (3)(3)(x^2) \quad \blacktriangleright \text{Simplify:} \\
&= -4 + 2x + 9x^2
\end{aligned}$$

$$\begin{aligned}
2. f'(x) &= \frac{d}{dx}(2 - 5x + x^2 + 3x^3 - 3x^4) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(2) + \frac{d}{dx}(-5x) + \frac{d}{dx}(x^2) + \frac{d}{dx}(3x^3) + \frac{d}{dx}(-3x^4) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x) \\
&= \frac{d}{dx}(2) + (-5)\frac{d}{dx}x^1 + (1)\frac{d}{dx}x^2 + (3)\frac{d}{dx}x^3 + (-3)\frac{d}{dx}x^4 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= 0 + (-5)(1)(x^0) + (1)(2)(x^1) + (3)(3)(x^2) + (-3)(4)(x^3) \quad \blacktriangleright \text{Simplify:} \\
&= -5 + 2x + 9x^2 - 12x^3
\end{aligned}$$

$$\begin{aligned}
3. f'(x) &= \frac{d}{dx}(5 + 5x + 2x^2 + 2x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(5) + \frac{d}{dx}(5x) + \frac{d}{dx}(2x^2) + \frac{d}{dx}(2x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x) \\
&= \frac{d}{dx}(5) + (5)\frac{d}{dx}x^1 + (2)\frac{d}{dx}x^2 + (2)\frac{d}{dx}x^3 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= 0 + (5)(1)(x^0) + (2)(2)(x^1) + (2)(3)(x^2) \quad \blacktriangleright \text{Simplify:} \\
&= 5 + 4x + 6x^2
\end{aligned}$$

$$\begin{aligned}
4. f'(x) &= \frac{d}{dx}(x - 3x^2 + 3x^3 - 5x^4) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(x) + \frac{d}{dx}(-3x^2) + \frac{d}{dx}(3x^3) + \frac{d}{dx}(-5x^4) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x) \\
&= (1)\frac{d}{dx}x^1 + (-3)\frac{d}{dx}x^2 + (3)\frac{d}{dx}x^3 + (-5)\frac{d}{dx}x^4 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= (1)(1)(x^0) + (-3)(2)(x^1) + (3)(3)(x^2) + (-5)(4)(x^3) \quad \blacktriangleright \text{Simplify:} \\
&= 1 - 6x + 9x^2 - 20x^3
\end{aligned}$$

$$\begin{aligned}
5. f'(x) &= \frac{d}{dx}(-1 + 4x - 2x^2 - 2x^3 - 5x^4 + 3x^5) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(-1) + \frac{d}{dx}(4x) + \frac{d}{dx}(-2x^2) + \frac{d}{dx}(-2x^3) + \frac{d}{dx}(-5x^4) + \frac{d}{dx}(3x^5) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) = c\frac{d}{dx}f(x) \\
&= \frac{d}{dx}(-1) + (4)\frac{d}{dx}x^1 + (-2)\frac{d}{dx}x^2 + (-2)\frac{d}{dx}x^3 + (-5)\frac{d}{dx}x^4 + (3)\frac{d}{dx}x^5 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= 0 + (4)(1)(x^0) + (-2)(2)(x^1) + (-2)(3)(x^2) + (-5)(4)(x^3) + (3)(5)(x^4) \quad \blacktriangleright \text{Simplify:} \\
&= 4 - 4x - 6x^2 - 20x^3 + 15x^4
\end{aligned}$$

$$\begin{aligned}
6. f'(x) &= \frac{d}{dx}(-5 - 2x + 5x^2 - 5x^3 - 5x^4 - 3x^5) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(-5) + \frac{d}{dx}(-2x) + \frac{d}{dx}(5x^2) + \frac{d}{dx}(-5x^3) + \frac{d}{dx}(-5x^4) + \frac{d}{dx}(-3x^5) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) =
\end{aligned}$$

$$\begin{aligned}
& c \frac{d}{dx} f(x) \\
&= \frac{d}{dx}(-5) + (-2) \frac{d}{dx} x^1 + (5) \frac{d}{dx} x^2 + (-5) \frac{d}{dx} x^3 + (-5) \frac{d}{dx} x^4 + (-3) \frac{d}{dx} x^5 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= 0 + (-2)(1)(x^0) + (5)(2)(x^1) + (-5)(3)(x^2) + (-5)(4)(x^3) + (-3)(5)(x^4) \quad \blacktriangleright \text{Simplify:} \\
&= -2 + 10x - 15x^2 - 20x^3 - 15x^4
\end{aligned}$$

$$\begin{aligned}
7. f'(x) &= \frac{d}{dx}(-4 - 4x + 5x^2) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(-4) + \frac{d}{dx}(-4x) + \frac{d}{dx}(5x^2) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) = c \frac{d}{dx}f(x) \\
&= \frac{d}{dx}(-4) + (-4) \frac{d}{dx}x^1 + (5) \frac{d}{dx}x^2 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= 0 + (-4)(1)(x^0) + (5)(2)(x^1) \quad \blacktriangleright \text{Simplify:} \\
&= -4 + 10x
\end{aligned}$$

$$\begin{aligned}
8. f'(x) &= \frac{d}{dx}(-1 - x - 2x^2 - 2x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(-1) + \frac{d}{dx}(-x) + \frac{d}{dx}(-2x^2) + \frac{d}{dx}(-2x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) = c \frac{d}{dx}f(x) \\
&= \frac{d}{dx}(-1) + (-1) \frac{d}{dx}x^1 + (-2) \frac{d}{dx}x^2 + (-2) \frac{d}{dx}x^3 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= 0 + (-1)(1)(x^0) + (-2)(2)(x^1) + (-2)(3)(x^2) \quad \blacktriangleright \text{Simplify:} \\
&= -1 - 4x - 6x^2
\end{aligned}$$

$$\begin{aligned}
9. f'(x) &= \frac{d}{dx}(-5 - 2x - 4x^2 - 3x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(-5) + \frac{d}{dx}(-2x) + \frac{d}{dx}(-4x^2) + \frac{d}{dx}(-3x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) = c \frac{d}{dx}f(x) \\
&= \frac{d}{dx}(-5) + (-2) \frac{d}{dx}x^1 + (-4) \frac{d}{dx}x^2 + (-3) \frac{d}{dx}x^3 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= 0 + (-2)(1)(x^0) + (-4)(2)(x^1) + (-3)(3)(x^2) \quad \blacktriangleright \text{Simplify:} \\
&= -2 - 8x - 9x^2
\end{aligned}$$

$$\begin{aligned}
10. f'(x) &= \frac{d}{dx}(-2 + 2x - 2x^2 - 5x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(f(x) + g(x) + \dots) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x) + \dots \\
&= \frac{d}{dx}(-2) + \frac{d}{dx}(2x) + \frac{d}{dx}(-2x^2) + \frac{d}{dx}(-5x^3) \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(cf(x)) = c \frac{d}{dx}f(x) \\
&= \frac{d}{dx}(-2) + (2) \frac{d}{dx}x^1 + (-2) \frac{d}{dx}x^2 + (-5) \frac{d}{dx}x^3 \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1} \\
&= 0 + (2)(1)(x^0) + (-2)(2)(x^1) + (-5)(3)(x^2) \quad \blacktriangleright \text{Simplify:} \\
&= 2 - 4x - 15x^2
\end{aligned}$$