1. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(-3 + 2x - 3x^3)(-2x + 2x^2)}$

2. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(-3 + x - 2x^2)(-1 + 2x + 3x^2 + 2x^3)}$

3. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(3 + 3x - 2x^2)(2 - 2x - 3x^2 + x^3)}$

4. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(3 - 2x^2 - x^3)(-3 + 3x^2)}$

5. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(-2 - 3x^2)(-2x^2)}$

6. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(-3 + x - 3x^2)(-2 + x + 2x^2)}$

7. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(2 - x - 3x^2 + 3x^3)(-1 - 2x + x^3)}$

8. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(3 - 2x + x^2)(-1 + x + x^2)}$

9. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(-2 - 3x - 2x^2 + 2x^3)(-2 + 2x^2)}$

10. Use the Power and Chain Rules to differentiate. Simplify the answer.
$f(x) = \sqrt{(-3 + 2x + 3x^3)(3 - x - 2x^2 + x^3)}$

Answers:

1. $f'(x) = \dfrac{6 - 20x + 12x^2 + 24x^3 - 30x^4}{2\sqrt{(-3 + 2x - 3x^3)(-2x + 2x^2)}}$

2. $f'(x) = \dfrac{-7 - 10x - 21x^2 - 16x^3 - 20x^4}{2\sqrt{(-3 + x - 2x^2)(-1 + 2x + 3x^2 + 2x^3)}}$

3. $f'(x) = \dfrac{-38x - 6x^2 + 36x^3 - 10x^4}{2\sqrt{(3 + 3x - 2x^2)(2 - 2x - 3x^2 + x^3)}}$

4. $f'(x) = \dfrac{30x + 9x^2 - 24x^3 - 15x^4}{2\sqrt{(3 - 2x^2 - x^3)(-3 + 3x^2)}}$

5. $f'(x) = \dfrac{8x + 24x^3}{2\sqrt{(-2 - 3x^2)(-2x^2)}}$

6. $f'(x) = \dfrac{-5 + 2x - 3x^2 - 24x^3}{2\sqrt{(-3 + x - 3x^2)(-2 + x + 2x^2)}}$

7. $f'(x) = \dfrac{-3 + 10x + 15x^2 - 28x^3 - 15x^4 + 18x^5}{2\sqrt{(2 - x - 3x^2 + 3x^3)(-1 - 2x + x^3)}}$

8. $f'(x) = \dfrac{5 - 3x^2 + 4x^3}{2\sqrt{(3 - 2x + x^2)(-1 + x + x^2)}}$

9. $f'(x) = \dfrac{6 - 30x^2 - 16x^3 + 20x^4}{2\sqrt{(-2 - 3x - 2x^2 + 2x^3)(-2 + 2x^2)}}$

10. $f'(x) = \dfrac{9 + 8x + 6x^2 - 4x^3 - 30x^4 + 18x^5}{2\sqrt{(-3 + 2x + 3x^3)(3 - x - 2x^2 + x^3)}}$

Solutions:

1. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(-3+2x-3x^3)(-2x+2x^2)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(-3+2x-3x^3)(-2x+2x^2)]}{2\sqrt{(-3+2x-3x^3)(-2x+2x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(-3+2x-3x^3)\frac{\mathrm{d}}{\mathrm{d}x}(-2x+2x^2) + (-2x+2x^2)\frac{\mathrm{d}}{\mathrm{d}x}(-3+2x-3x^3)}{2\sqrt{(-3+2x-3x^3)(-2x+2x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(-3+2x-3x^3)(-2+4x) + (-2x+2x^2)(2-9x^2)}{2\sqrt{(-3+2x-3x^3)(-2x+2x^2)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{6-20x+12x^2+24x^3-30x^4}{\sqrt{(-3+2x-3x^3)(-2x+2x^2)}}$

2. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(-3+x-2x^2)(-1+2x+3x^2+2x^3)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(-3+x-2x^2)(-1+2x+3x^2+2x^3)]}{2\sqrt{(-3+x-2x^2)(-1+2x+3x^2+2x^3)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(-3+x-2x^2)\frac{\mathrm{d}}{\mathrm{d}x}(-1+2x+3x^2+2x^3) + (-1+2x+3x^2+2x^3)\frac{\mathrm{d}}{\mathrm{d}x}(-3+x-2x^2)}{2\sqrt{(-3+x-2x^2)(-1+2x+3x^2+2x^3)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(-3+x-2x^2)(2+6x+6x^2) + (-1+2x+3x^2+2x^3)(1-4x)}{2\sqrt{(-3+x-2x^2)(-1+2x+3x^2+2x^3)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{-7-10x-21x^2-16x^3-20x^4}{\sqrt{(-3+x-2x^2)(-1+2x+3x^2+2x^3)}}$

3. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(3+3x-2x^2)(2-2x-3x^2+x^3)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(3+3x-2x^2)(2-2x-3x^2+x^3)]}{2\sqrt{(3+3x-2x^2)(2-2x-3x^2+x^3)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(3+3x-2x^2)\frac{\mathrm{d}}{\mathrm{d}x}(2-2x-3x^2+x^3) + (2-2x-3x^2+x^3)\frac{\mathrm{d}}{\mathrm{d}x}(3+3x-2x^2)}{2\sqrt{(3+3x-2x^2)(2-2x-3x^2+x^3)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(3+3x-2x^2)(-2-6x+3x^2) + (2-2x-3x^2+x^3)(3-4x)}{2\sqrt{(3+3x-2x^2)(2-2x-3x^2+x^3)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{-38x-6x^2+36x^3-10x^4}{\sqrt{(3+3x-2x^2)(2-2x-3x^2+x^3)}}$

4. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(3-2x^2-x^3)(-3+3x^2)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(3-2x^2-x^3)(-3+3x^2)]}{2\sqrt{(3-2x^2-x^3)(-3+3x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(3-2x^2-x^3)\frac{\mathrm{d}}{\mathrm{d}x}(-3+3x^2) + (-3+3x^2)\frac{\mathrm{d}}{\mathrm{d}x}(3-2x^2-x^3)}{2\sqrt{(3-2x^2-x^3)(-3+3x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(3-2x^2-x^3)(6x)+(-3+3x^2)(-4x-3x^2)}{2\sqrt{(3-2x^2-x^3)(-3+3x^2)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{30x+9x^2-24x^3-15x^4}{\sqrt{(3-2x^2-x^3)(-3+3x^2)}}$

5. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(-2-3x^2)(-2x^2)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(-2-3x^2)(-2x^2)]}{2\sqrt{(-2-3x^2)(-2x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x)+g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(-2-3x^2)\frac{\mathrm{d}}{\mathrm{d}x}(-2x^2)+(-2x^2)\frac{\mathrm{d}}{\mathrm{d}x}(-2-3x^2)}{2\sqrt{(-2-3x^2)(-2x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(-2-3x^2)(-4x)+(-2x^2)(-6x)}{2\sqrt{(-2-3x^2)(-2x^2)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{8x+24x^3}{\sqrt{(-2-3x^2)(-2x^2)}}$

6. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(-3+x-3x^2)(-2+x+2x^2)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(-3+x-3x^2)(-2+x+2x^2)]}{2\sqrt{(-3+x-3x^2)(-2+x+2x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x)+g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(-3+x-3x^2)\frac{\mathrm{d}}{\mathrm{d}x}(-2+x+2x^2)+(-2+x+2x^2)\frac{\mathrm{d}}{\mathrm{d}x}(-3+x-3x^2)}{2\sqrt{(-3+x-3x^2)(-2+x+2x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(-3+x-3x^2)(1+4x)+(-2+x+2x^2)(1-6x)}{2\sqrt{(-3+x-3x^2)(-2+x+2x^2)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{-5+2x-3x^2-24x^3}{\sqrt{(-3+x-3x^2)(-2+x+2x^2)}}$

7. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(2-x-3x^2+3x^3)(-1-2x+x^3)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(2-x-3x^2+3x^3)(-1-2x+x^3)]}{2\sqrt{(2-x-3x^2+3x^3)(-1-2x+x^3)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x)+g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(2-x-3x^2+3x^3)\frac{\mathrm{d}}{\mathrm{d}x}(-1-2x+x^3)+(-1-2x+x^3)\frac{\mathrm{d}}{\mathrm{d}x}(2-x-3x^2+3x^3)}{2\sqrt{(2-x-3x^2+3x^3)(-1-2x+x^3)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(2-x-3x^2+3x^3)(-2+3x^2)+(-1-2x+x^3)(-1-6x+9x^2)}{2\sqrt{(2-x-3x^2+3x^3)(-1-2x+x^3)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{-3+10x+15x^2-28x^3-15x^4+18x^5}{\sqrt{(2-x-3x^2+3x^3)(-1-2x+x^3)}}$

8. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(3-2x+x^2)(-1+x+x^2)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(3-2x+x^2)(-1+x+x^2)]}{2\sqrt{(3-2x+x^2)(-1+x+x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x)+g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(3-2x+x^2)\frac{\mathrm{d}}{\mathrm{d}x}(-1+x+x^2)+(-1+x+x^2)\frac{\mathrm{d}}{\mathrm{d}x}(3-2x+x^2)}{2\sqrt{(3-2x+x^2)(-1+x+x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(3-2x+x^2)(1+2x)+(-1+x+x^2)(-2+2x)}{2\sqrt{(3-2x+x^2)(-1+x+x^2)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{5-3x^2+4x^3}{\sqrt{(3-2x+x^2)(-1+x+x^2)}}$

9. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(-2-3x-2x^2+2x^3)(-2+2x^2)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(-2-3x-2x^2+2x^3)(-2+2x^2)]}{2\sqrt{(-2-3x-2x^2+2x^3)(-2+2x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x)+g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(-2-3x-2x^2+2x^3)\frac{\mathrm{d}}{\mathrm{d}x}(-2+2x^2)+(-2+2x^2)\frac{\mathrm{d}}{\mathrm{d}x}(-2-3x-2x^2+2x^3)}{2\sqrt{(-2-3x-2x^2+2x^3)(-2+2x^2)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(-2-3x-2x^2+2x^3)(4x)+(-2+2x^2)(-3-4x+6x^2)}{2\sqrt{(-2-3x-2x^2+2x^3)(-2+2x^2)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{6-30x^2-16x^3+20x^4}{\sqrt{(-2-3x-2x^2+2x^3)(-2+2x^2)}}$

10. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{(-3+2x+3x^3)(3-x-2x^2+x^3)}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}\sqrt{f(x)} = \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}f(x)}{2\sqrt{f(x)}}$

$= \dfrac{\frac{\mathrm{d}}{\mathrm{d}x}[(-3+2x+3x^3)(3-x-2x^2+x^3)]}{2\sqrt{(-3+2x+3x^3)(3-x-2x^2+x^3)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}[f(x)g(x)] = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x)+g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = \dfrac{(-3+2x+3x^3)\frac{\mathrm{d}}{\mathrm{d}x}(3-x-2x^2+x^3)+(3-x-2x^2+x^3)\frac{\mathrm{d}}{\mathrm{d}x}(-3+2x+3x^3)}{2\sqrt{(-3+2x+3x^3)(3-x-2x^2+x^3)}}$ ▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}(x^n) = nx^{n-1}$

$f'(x) = \dfrac{(-3+2x+3x^3)(-1-4x+3x^2)+(3-x-2x^2+x^3)(2+9x^2)}{2\sqrt{(-3+2x+3x^3)(3-x-2x^2+x^3)}}$ ▶ Expand and simplify:

$f'(x) = \dfrac{9+8x+6x^2-4x^3-30x^4+18x^5}{\sqrt{(-3+2x+3x^3)(3-x-2x^2+x^3)}}$

