1. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (-2 - x - 3x^2)^5(-3 + x)$

2. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (2 + 2x - 2x^2)^3(1 + 2x)^3$

3. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (3 - 2x)^3(-3 + x - x^2)^4$

4. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (-1 + x - x^2)^5(2 - 2x - 3x^2)^3$

5. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (3 + x^2)^3(2 - 2x - 3x^2)^4$

6. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (-3 + x - 2x^2)^4(3 - x - x^2)$

7. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (2 + 3x + x^2)^4(1)^2$

8. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (3 + 3x + 3x^2)^5(3 - 2x - x^2)$

9. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (3)^2(-2x + x^2)^2$

10. Use the Chain Rule to differentiate. Simplify the answer.
$f(x) = (2 - x^2)^3(3 - 2x^2)^3$

Answers:
1. $f'(x) = (-2 - x - 3x^2)^4(13 + 84x - 33x^2)$
2. $f'(x) = (2 + 2x - 2x^2)^2(1 + 2x)^2(18 + 12x - 36x^2)$
3. $f'(x) = (3 - 2x)^2(-3 + x - x^2)^3(30 - 38x + 22x^2)$
4. $f'(x) = (-1 + x - x^2)^4(2 - 2x - 3x^2)^2(16 - 18x - 7x^2 + 48x^3)$
5. $f'(x) = (3 + x^2)^2(2 - 2x - 3x^2)^3(-24 - 60x - 20x^2 - 42x^3)$
6. $f'(x) = (-3 + x - 2x^2)^3(15 - 47x + 12x^2 + 20x^3)$
7. $f'(x) = (2 + 3x + x^2)^3(1)(12 + 8x)$
8. $f'(x) = (3 + 3x + 3x^2)^4(39 + 48x - 87x^2 - 36x^3)$
9. $f'(x) = (3)(-2x + x^2)(-12 + 12x)$
10. $f'(x) = (2 - x^2)^2(3 - 2x^2)^2(-42x + 24x^3)$

Solutions:

1. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}(-2-x-3x^2)^5(-3+x)$

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

$f'(x) = (-2-x-3x^2)^5(1)(1) + (-3+x)(5)(-2-x-3x^2)^4(-1-6x)$

▶ Factor:

$f'(x) = (-2-x-3x^2)^4[(-2-x-3x^2)(1)(1) + (-3+x)(5)(-1-6x)]$

▶ Expand and simplify:

$f'(x) = (-2-x-3x^2)^4(13+84x-33x^2)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

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

▶ Factor:

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

▶ Expand and simplify:

$f'(x) = (2+2x-2x^2)^2(1+2x)(18+12x-36x^2)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

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

▶ Factor:

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

▶ Expand and simplify:

$f'(x) = (3-2x)^2(-3+x-x^2)(30-38x+22x^2)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

$f'(x) = (-1+x-x^2)^5(3)(2-2x-3x^2)^2(-2-6x) + (2-2x-3x^2)^3(5)(-1+x-x^2)^4(1-2x)$

▶ Factor:

$f'(x) = (-1+x-x^2)^4(2-2x-3x^2)[(-1+x-x^2)(3)(-2-6x) + (2-2x-3x^2)(5)(1-2x)]$

▶ Expand and simplify:

$f'(x) = (-1+x-x^2)^4(2-2x-3x^2)(16-18x-7x^2+48x^3)$

5. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}(3+x^2)^3(2-2x-3x^2)^4$

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

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

▶ Factor:

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

▶ Expand and simplify:

$f'(x) = (3+x^2)^2(2-2x-3x^2)(-24-60x-20x^2-42x^3)$

6. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}(-3+x-2x^2)^4(3-x-x^2)$

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

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

▶ Factor:

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

▶ Expand and simplify:

$f'(x) = (-3+x-2x^2)^3(15-47x+12x^2+20x^3)$

7. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}(2+3x+x^2)^4(1)^2$

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = (2+3x+x^2)^4\dfrac{\mathrm{d}}{\mathrm{d}x}(1)^2 + (1)^2\dfrac{\mathrm{d}}{\mathrm{d}x}(2+3x+x^2)^4$

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

$f'(x) = (2+3x+x^2)^4(2)(1)\dfrac{\mathrm{d}}{\mathrm{d}x}(1) + (1)^2(4)(2+3x+x^2)^3\dfrac{\mathrm{d}}{\mathrm{d}x}(2+3x+x^2)$

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

$f'(x) = (2+3x+x^2)^4(2)(1)(0) + (1)^2(4)(2+3x+x^2)^3(3+2x)$

▶ Factor:

$f'(x) = (2+3x+x^2)^3(1)[(2+3x+x^2)(2)(0) + (1)(4)(3+2x)]$

▶ Expand and simplify:

$f'(x) = (2+3x+x^2)^3(1)(12+8x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

▶ Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

$f'(x) = (3+3x+3x^2)^5(1)(-2-2x) + (3-2x-x^2)(5)(3+3x+3x^2)^4(3+6x)$

► Factor:

$f'(x) = (3+3x+3x^2)^4[(3+3x+3x^2)(1)(-2-2x)+(3-2x-x^2)(5)(3+6x)]$

► Expand and simplify:

$f'(x) = (3+3x+3x^2)^4(39+48x-87x^2-36x^3)$

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

► Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

► Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

► Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

$f'(x) = (3)^2(2)(-2x+x^2)(-2+2x) + (-2x+x^2)^2(2)(3)(0)$

► Factor:

$f'(x) = (3)(-2x+x^2)[(3)(2)(-2+2x)+(-2x+x^2)(2)(0)]$

► Expand and simplify:

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

10. $f'(x) = \dfrac{\mathrm{d}}{\mathrm{d}x}(2-x^2)^3(3-2x^2)^3$

► Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)g(x) = f(x)\dfrac{\mathrm{d}}{\mathrm{d}x}g(x) + g(x)\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

► Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)^n = nf(x)^{n-1}\dfrac{\mathrm{d}}{\mathrm{d}x}f(x)$

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

► Apply: $\dfrac{\mathrm{d}}{\mathrm{d}x}x^n = nx^{n-1}$

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

► Factor:

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

► Expand and simplify:

$f'(x) = (2-x^2)^2(3-2x^2)(-42x+24x^3)$

