

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

$$f(x) = \sqrt{\frac{-1 + x - x^2}{2 - 2x - x^2}}$$

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

$$f(x) = \sqrt{\frac{x + 2x^2}{-3 - 2x + 3x^2}}$$

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

$$f(x) = \sqrt{\frac{-1 - x + x^2}{1 + x - 2x^2}}$$

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

$$f(x) = \sqrt{\frac{-2 + 2x - 3x^2}{3 - x - x^2}}$$

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

$$f(x) = \sqrt{\frac{x - x^2}{-2 - x + 2x^2}}$$

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

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

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

$$f(x) = \sqrt{\frac{2 + x + 2x^2}{2 + x + 2x^2}}$$

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

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

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

$$f(x) = \sqrt{\frac{-2 + 3x - x^2}{-2 - 2x - 2x^2}}$$

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

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

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

$$\frac{2(x^2 - x^2 - 2)}{2x^8 + x^4 - 10} \times \frac{x - x^3 + 2}{2x^2 - x^2 - 2} \sqrt{\frac{2}{1}} = (x) f' \quad 9.$$

$$\frac{2(x^3 + x^3 + 2)}{2x^6 - x^2 + 5} \times \frac{2x^2 - x + 1}{2x^3 + x^3 + 2} \sqrt{\frac{2}{1}} = (x) f' \quad 8.$$

$$\frac{2(x^2 + x + 2)}{0} \times \frac{2x^2 + x + 2}{2x^2 + x + 2} \sqrt{\frac{2}{1}} = (x) f' \quad 7.$$

$$\frac{2(x^3 + x^2 - 1)}{2x^4 + x^4} \times \frac{2x^2 - 2}{2x^3 + x^2 - 1} \sqrt{\frac{2}{1}} = (x) f' \quad 6.$$

$$\frac{2(x^2 + x - 2)}{2x^2 - x^4 + 2} \times \frac{x - x}{2x^2 + x - 2} \sqrt{\frac{2}{1}} = (x) f' \quad 5.$$

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

$$\frac{2(x^2 - x + 1)}{2x^2 - x^2} \times \frac{2x^2 - x - 1}{2x^2 - x + 1} \sqrt{\frac{2}{1}} = (x) f' \quad 3.$$

$$\frac{2(x^3 + x^2 - 3)}{2x^3 - x^2 - 1} \times \frac{x + 2x^2}{2x^3 + 3x^2} \sqrt{\frac{2}{1}} = (x) f' \quad 2.$$

Answers: 1.  $f'(x) = \frac{2(-1 + x - x^2)}{2 - 2x - x^2} \times \frac{2x^2 - 2x - x^2}{-6x^2 + 3x^2} \sqrt{\frac{2}{1}}$

Solutions:

$$1. f'(x) = \frac{d}{dx} \sqrt{\frac{-1+x-x^2}{2-2x-x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{-1+x-x^2}{2-2x-x^2}}} \times \frac{d}{dx} \frac{-1+x-x^2}{2-2x-x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x)\frac{d}{dx}f(x)-f(x)\frac{d}{dx}g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{2-2x-x^2}{-1+x-x^2}} \times \frac{(2-2x-x^2)\frac{d}{dx}(-1+x-x^2) - (-1+x-x^2)\frac{d}{dx}(2-2x-x^2)}{(2-2x-x^2)^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{2-2x-x^2}{-1+x-x^2}} \times \frac{(2-2x-x^2)(1-2x) - (-1+x-x^2)(-2-2x)}{(2-2x-x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{2-2x-x^2}{-1+x-x^2}} \times \frac{-6x+3x^2}{(2-2x-x^2)^2}$$

$$2. f'(x) = \frac{d}{dx} \sqrt{\frac{x+2x^2}{-3-2x+3x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{x+2x^2}{-3-2x+3x^2}}} \times \frac{d}{dx} \frac{x+2x^2}{-3-2x+3x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x)\frac{d}{dx}f(x)-f(x)\frac{d}{dx}g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{-3-2x+3x^2}{x+2x^2}} \times \frac{(-3-2x+3x^2)\frac{d}{dx}(x+2x^2) - (x+2x^2)\frac{d}{dx}(-3-2x+3x^2)}{(-3-2x+3x^2)^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{-3-2x+3x^2}{x+2x^2}} \times \frac{(-3-2x+3x^2)(1+4x) - (x+2x^2)(-2+6x)}{(-3-2x+3x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{-3-2x+3x^2}{x+2x^2}} \times \frac{-3-12x-7x^2}{(-3-2x+3x^2)^2}$$

$$3. f'(x) = \frac{d}{dx} \sqrt{\frac{-1-x+x^2}{1+x-2x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{-1-x+x^2}{1+x-2x^2}}} \times \frac{d}{dx} \frac{-1-x+x^2}{1+x-2x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x)\frac{d}{dx}f(x)-f(x)\frac{d}{dx}g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{1+x-2x^2}{-1-x+x^2}} \times \frac{(1+x-2x^2)\frac{d}{dx}(-1-x+x^2) - (-1-x+x^2)\frac{d}{dx}(1+x-2x^2)}{(1+x-2x^2)^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{1+x-2x^2}{-1-x+x^2}} \times \frac{(1+x-2x^2)(-1+2x) - (-1-x+x^2)(1-4x)}{(1+x-2x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{1+x-2x^2}{-1-x+x^2}} \times \frac{-2x-x^2}{(1+x-2x^2)^2}$$

$$4. f'(x) = \frac{d}{dx} \sqrt{\frac{-2+2x-3x^2}{3-x-x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{-2+2x-3x^2}{3-x-x^2}}} \times \frac{d}{dx} \frac{-2+2x-3x^2}{3-x-x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x)\frac{d}{dx}f(x)-f(x)\frac{d}{dx}g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{3-x-x^2}{-2+2x-3x^2}} \times \frac{(3-x-x^2) \frac{d}{dx}(-2+2x-3x^2) - (-2+2x-3x^2) \frac{d}{dx}(3-x-x^2)}{(3-x-x^2)^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{3-x-x^2}{-2+2x-3x^2}} \times \frac{(3-x-x^2)(2-6x) - (-2+2x-3x^2)(-1-2x)}{(3-x-x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{3-x-x^2}{-2+2x-3x^2}} \times \frac{4-22x+5x^2}{(3-x-x^2)^2}$$

$$5. f'(x) = \frac{d}{dx} \sqrt{\frac{x-x^2}{-2-x+2x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{x-x^2}{-2-x+2x^2}}} \times \frac{d}{dx} \frac{x-x^2}{-2-x+2x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x) \frac{d}{dx} f(x) - f(x) \frac{d}{dx} g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{-2-x+2x^2}{x-x^2}} \times \frac{(-2-x+2x^2) \frac{d}{dx}(x-x^2) - (x-x^2) \frac{d}{dx}(-2-x+2x^2)}{(-2-x+2x^2)^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{-2-x+2x^2}{x-x^2}} \times \frac{(-2-x+2x^2)(1-2x) - (x-x^2)(-1+4x)}{(-2-x+2x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{-2-x+2x^2}{x-x^2}} \times \frac{-2+4x-x^2}{(-2-x+2x^2)^2}$$

$$6. f'(x) = \frac{d}{dx} \sqrt{\frac{-2x^2}{-1-2x+3x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{-2x^2}{-1-2x+3x^2}}} \times \frac{d}{dx} \frac{-2x^2}{-1-2x+3x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x) \frac{d}{dx} f(x) - f(x) \frac{d}{dx} g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{-1-2x+3x^2}{-2x^2}} \times \frac{(-1-2x+3x^2) \frac{d}{dx}(-2x^2) - (-2x^2) \frac{d}{dx}(-1-2x+3x^2)}{(-1-2x+3x^2)^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{-1-2x+3x^2}{-2x^2}} \times \frac{(-1-2x+3x^2)(-4x) - (-2x^2)(-2+6x)}{(-1-2x+3x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{-1-2x+3x^2}{-2x^2}} \times \frac{4x+4x^2}{(-1-2x+3x^2)^2}$$

$$7. f'(x) = \frac{d}{dx} \sqrt{\frac{2+x+2x^2}{2+x+2x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{2+x+2x^2}{2+x+2x^2}}} \times \frac{d}{dx} \frac{2+x+2x^2}{2+x+2x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x) \frac{d}{dx} f(x) - f(x) \frac{d}{dx} g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{2+x+2x^2}{2+x+2x^2}} \times \frac{(2+x+2x^2) \frac{d}{dx}(2+x+2x^2) - (2+x+2x^2) \frac{d}{dx}(2+x+2x^2)}{(2+x+2x^2)^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{2+x+2x^2}{2+x+2x^2}} \times \frac{(2+x+2x^2)(1+4x) - (2+x+2x^2)(1+4x)}{(2+x+2x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{2+x+2x^2}{2+x+2x^2}} \times \frac{0}{(2+x+2x^2)^2}$$

$$8. f'(x) = \frac{d}{dx} \sqrt{\frac{1+x-2x^2}{-2+3x+3x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{1+x-2x^2}{-2+3x+3x^2}}} \times \frac{d}{dx} \frac{1+x-2x^2}{-2+3x+3x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x)\frac{d}{dx}f(x)-f(x)\frac{d}{dx}g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{-2+3x+3x^2}{1+x-2x^2}} \times \frac{(-2+3x+3x^2)\frac{d}{dx}(1+x-2x^2) - (1+x-2x^2)\frac{d}{dx}(-2+3x+3x^2)}{(-2+3x+3x^2)^2} \quad \blacktriangleright \text{Apply:}$$

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{-2+3x+3x^2}{1+x-2x^2}} \times \frac{(-2+3x+3x^2)(1-4x) - (1+x-2x^2)(3+6x)}{(-2+3x+3x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{-2+3x+3x^2}{1+x-2x^2}} \times \frac{-5+2x-9x^2}{(-2+3x+3x^2)^2}$$

$$9. f'(x) = \frac{d}{dx} \sqrt{\frac{-2+3x-x^2}{-2-2x-2x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{-2+3x-x^2}{-2-2x-2x^2}}} \times \frac{d}{dx} \frac{-2+3x-x^2}{-2-2x-2x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x)\frac{d}{dx}f(x)-f(x)\frac{d}{dx}g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{-2-2x-2x^2}{-2+3x-x^2}} \times \frac{(-2-2x-2x^2)\frac{d}{dx}(-2+3x-x^2) - (-2+3x-x^2)\frac{d}{dx}(-2-2x-2x^2)}{(-2-2x-2x^2)^2} \quad \blacktriangleright \text{Ap-}$$

$$\text{ply: } \frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{-2-2x-2x^2}{-2+3x-x^2}} \times \frac{(-2-2x-2x^2)(3-2x) - (-2+3x-x^2)(-2-4x)}{(-2-2x-2x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{-2-2x-2x^2}{-2+3x-x^2}} \times \frac{-10-4x+8x^2}{(-2-2x-2x^2)^2}$$

$$10. f'(x) = \frac{d}{dx} \sqrt{\frac{2+2x-3x^2}{-1-3x-x^2}} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \sqrt{f(x)} = \frac{1}{2\sqrt{f(x)}} \frac{d}{dx} f(x)$$

$$f'(x) = \frac{1}{2\sqrt{\frac{2+2x-3x^2}{-1-3x-x^2}}} \times \frac{d}{dx} \frac{2+2x-3x^2}{-1-3x-x^2} \quad \blacktriangleright \text{Apply: } \frac{d}{dx} \frac{f(x)}{g(x)} = \frac{g(x)\frac{d}{dx}f(x)-f(x)\frac{d}{dx}g(x)}{g^2(x)}$$

$$= \frac{1}{2} \sqrt{\frac{-1-3x-x^2}{2+2x-3x^2}} \times \frac{(-1-3x-x^2)\frac{d}{dx}(2+2x-3x^2) - (2+2x-3x^2)\frac{d}{dx}(-1-3x-x^2)}{(-1-3x-x^2)^2} \quad \blacktriangleright \text{Apply:}$$

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

$$= \frac{1}{2} \sqrt{\frac{-1-3x-x^2}{2+2x-3x^2}} \times \frac{(-1-3x-x^2)(2-6x) - (2+2x-3x^2)(-3-2x)}{(-1-3x-x^2)^2} \quad \blacktriangleright \text{Expand and simplify:}$$

$$= \frac{1}{2} \sqrt{\frac{-1-3x-x^2}{2+2x-3x^2}} \times \frac{4+10x+11x^2}{(-1-3x-x^2)^2}$$