The Product and Quotient Rules

Learning Objectives

- Use the product rule to find the derivative of a function in the form $f(x)g(x)$
- Use the quotient rule to find the derivative of a function in the form $f(x)/g(x)$
- Use the product rule to find the derivative of a function in the form $f(x)g(x)h(x)$
- Combine the product and quotient rules with polynomials

Use the product rule to find the derivative of a function in the form $f(x)g(x)$

1. Find the derivative of the function $F(x) = (x^2 + 11x + 1)(x^3 - 3x^2 - 7)$.

Use the quotient rule to find the derivative of a function in the form $f(x)/g(x)$

2. Use the quotient rule to find the derivative of $G(x) = \frac{2x-1}{x^2+3x}$.

Use the product rule to find the derivative of a function in the form $f(x)g(x)h(x)$

3. Find the derivative of $H(x) = e^x(x^2 + 1)(x^3 - 6x)$.

Combine the product and quotient rules with polynomials

4. Find the derivative of $K(x) = \frac{(2x+1)(3x-4)}{x^2+3}$.

- Check your work by distributing polynomials when you can.
- Try to simplify quotients when you can.
- Make a list of the separate components of your formula like $f(x), g(x), f'(x), g'(x)$ to help break down a complex problem.

ANSWER KEY

1. $F'(x) = (2x + 11)(x^3 - 3x^2 - 7) + (x^2 + 11x + 1)(3x^2 - 6x) = 5x^4 + 32x^3 - 96x^2 - 20x - 77$

2. $G'(x) = \frac{-2x^2 + 2x - 3}{(x^2 + 3x)^2}$

3. $H'(x) = e^x(x^2 + 1)(x^3 - 6x) + e^x(2x)(x^3 - 6x) + e^x(x^2 + 1)(3x^2 - 6) =$
$e^x(x^5 + 5x^4 - 5x^3 - 15x^2 - 6x - 6)$

4. $K'(x) = \frac{[2(3x-4) + 3(2x+1)](x^2+3) - 2x(2x+1)(3x-4)}{(x^2+3)^2} = \frac{-3x^2 + 44x - 15}{(x^2+3)^2}$