

Logarithmic Differentiation

Date:

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The derivatives of most functions involving exponential and logarithmic expressions can be determined by using the methods that we have developed. A function $y = x^x$ poses new problems, however. The power rule cannot be used because the exponent is not a constant. The method of determining the derivative of an exponential function also cannot be used because the base is not a constant. In such cases we are using the **logarithmic differentiation**.

Steps in Logarithmic Differentiation

- 1) Take logarithms of both sides of an equation $y = f(x)$.
- 2) Differentiate implicitly with respect to x .
- 3) Solve the resulting equation for y' .

Example 1: Determine the derivative of a function using logarithmic differentiation

Determine $\frac{dy}{dx}$ for the function $y = x^x, x > 0$.

Example 2: Determine the derivative of a function using logarithmic differentiation

For $y = (x^2 + 3)^x, \frac{dy}{dx}$.

Example 3: Determine the derivative of a function using logarithmic differentiation

Given $y = \frac{(x^4 + 1)\sqrt{x+2}}{(2x^2 + 2x + 1)}$, determine $\frac{dy}{dx}$ at $x = -1$.

Homework: P. 582
1-9, 12, 13