Using what the last sections have taught about functions and their inverses, this section will show how to find the derivative of logarithms and exponents, leading to yet another method of differentiation known as *logarithmic differentiation*.

# Derivative of a Logarithmic Function

The derivative of a logarithm is:

## Implications

If the logarithm’s base , then so .

# Logarithmic Differentiation

Logarithmic differentiation (method) – the method of differentiating an expression or equation involving products, quotients, and powers by taking the derivative of their logarithmic form.

## Motive

* Using the product rule and quotient rule (section 2.4) takes much time.
* Multiplication, division, and exponents can be converted into sums, differences, and products of logarithms and constants which take less time to differentiate (section 3.2).

## Process

The textbook recommends this procedure[[1]](#footnote-1) for performing logarithmic differentiation:

1. Convert both sides of the equation into logarithmic form, using natural logarithms and the laws of logarithms (section 3.2).
2. Perform implicit differentiation on both sides over (section 2.6).
3. Solve for .

# Derivative of an Exponential Function

The derivative of an exponential function is:

## Implications

If the power’s base , then so .

# What Did You Learn?

* What is the derivative of a logarithmic function? of an exponential function?
* How is logarithmic differentiation performed? Why does it save time?
* Why is used in logarithmic differentiation?

1. Stewart, J. (2013). Essential Calculus - Early Transcendentals. In J. Stewart, *Essential Calculus - Early Transcendentals* (p. 167). Belmont, CA: BROOKS/COLE CENGAGE Learning. [↑](#footnote-ref-1)