Derivatives of Logarithmic Functions

Summary

1.

For $y = \ln(x)$, $\quad \dfrac{dy}{dx} = \dfrac{1}{x}$

Example 1. Find the derivative of each.

(a) $f(x) = 2\ln(x)$

(b) $g(x) = \ln(x^3)$

(c) $h(x) = 7 - 4\ln(x)$

Example 2. The amount of fish products imported into the U.S. each year for human consumption can be modeled by

$$f(x) = 4.21 + 0.67\ln(x) \quad [1, 20]$$

where x represents the number of years since 2009 and $f(x)$ represents the annual impact of fish products in billions of pounds.

(a) Evaluate and interpret $f'(2)$.

(b) Evaluate and interpret $f'(19)$.

`Chain Rule for Natural Logarithms`
If g is differentiable, then the derivative of $h(x) = \ln(g(x))$ is

$$h'(x) = \frac{g'(x)}{g(x)}$$

Example 3. Find the derivative of each.

(a) $y = \ln(x^4 - 2x)$

(b) $h(x) = \ln\left(\sqrt{6x - 1}\right)$

(c) $f(x) = (\ln(x))^3$