

Notes: Derivatives of General Exponentials and Logarithmic Functions

Review from Algebra

Derivatives Day 8

Rules for Logs:

1. $\log(ab) =$ _____
2. $\log\left(\frac{a}{b}\right) =$ _____
3. $\log(a^b) =$ _____

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Change of Base

Formula:

$$\log_b x =$$

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Derivatives of Exponentials:

$$\frac{d}{dx} [b^x] =$$

$$\frac{d}{dx} [b^{f(x)}] =$$

$$\frac{d}{dx} [b^x] =$$

$$\frac{d}{dx} [b^{AT}] =$$

AT = Anything

Derivatives of Natural Logs:

$$\frac{d}{dx} [\ln(x)] =$$

$$\frac{d}{dx} [\ln(f(x))] =$$

$$\frac{d}{dx} [\ln x] =$$

$$\frac{d}{dx} [\ln(AT)] =$$

AT = Anything

Example One: Find the derivative of each:

A. $f(x) = 4^{3x}$

B. $f(x) = 5^{x^2}$

C. $f(x) = x3^x$

Example Two: Find $f'(x)$ of each:

A. $f(x) = x \ln x$

B. $f(x) = (\ln x)^2$

C. $f(x) = \ln(x^2)$

Example Three: Find $\frac{dy}{dx}$ of each:

A. $y = \ln(x^2 + 1)$

B. $y = \ln(\sqrt{\sin x})$

C. $y = \ln(e^x)$

Example Four: Find the derivative of each

A. $y = \log_{10} x$

B. $y = \log_3 x$

C. $y = \log_4(x^2 + x)$

Example Five: Find the derivative of each

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

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

Example 6: Find $f'(x)$ of each:

A. $f(x) = x^x$

B. $f(x) = x^{\sin x}$

Example 7: Find the equation of the tangent line to the function at the given point.

A. $f(x) = (\sqrt{2})^x$ at $x = \sqrt{2}$

B. $s(t) = \ln t$ at $x = 5$

C. $f(x) = \ln(\sin x)$ at $x = \frac{\pi}{4}$

D. $f(x) = \log_3 x$ at $x = 1$