Derivatives of Exponential and Logarithmic Function

Warm-up

1. $y = \ln 5x$
2. $y = \ln x^2$
3. $y = x \ln x$

4. $y = (x^2 - 2)(3x + 4)$

Derivative of Logarithmic Functions ($y = \log_b x$)

We know that $\frac{d}{dx}[\ln x] =$ _____. We want to find $\frac{d}{dx}[\log_b x]$.

Use the change of base formula to change from base *b* to base *e*, then take the derivative to find a formula:

Examples

1. $y = \log_4(3x)$

2. $y = \log_5(x+1)$

Practice Problems

1. $y = \log_6(2x)$

2. $y = \log(x^2 + 2)$

Derivative of Exponential Functions ($y = b^x$)

Rewrite in log form:

Now take the derivative (implicitly):

Substitute $y = b^x$ Formula:

Derivatives of Exponential and Logarithmic Function

Derivative of the Special Case of the Exponential Function ($y = e^x$)

Formula:

Examples

3. $y = e^{-2x}$

4. $y = 2^{\sin x}$

5. $y = e^{\tan x}$

Practice Problems

3. $y = e^{x^3}$

4. $y = 3^{4x+1}$

5. $y = e^{\cos x}$

Logarithmic Differentiation: Use the properties of logarithms to simplify the differentiation.

Examples

6. $y = (x^2 - 2)(3x + 4)$

7. $y = \sqrt{\dfrac{x^2 - 2}{x^2 + 2}}$

8. $y = \dfrac{x^2 \sqrt[3]{7x - 14}}{(1 + x^2)^4}$

9. $y = \sqrt{(x-3)(x-4)(x-5)}$