

## Section 4.4: Derivatives of Exponential and Logarithmic Functions

### Section Objectives:

- Apply the chain rule to take derivatives of more complicated functions involving logarithms and exponentials.
- Use properties of logarithms to find  $\frac{d}{dx}(a^x)$  and then remember that general derivative rule.
- Use properties of logarithms to find  $\frac{d}{dx}(\log_a |x|)$  and then remember that general derivative rule.

### Practice Problems

Practice, Practice, Practice!

1. Find the derivative of  $f(x) = e^{3x^2+3x+1}$
2. Find the derivative of  $f(x) = \ln(3x + e^x)$
3. Find the derivative of  $f(x) = \frac{x}{e^{3x^2}+2}$
4. Find the derivative of  $f(x) = e^{x^2}(e^x)^2$
5. Find the derivative of  $f(x) = \ln(x^7) + \ln(x)^7$
6. Find the derivative of  $f(x) = \ln(\sqrt{e^x + 2} + 1)$

7. Let  $f(x) = 3^x$ .

(a) Rewrite this function as  $f(x) = e^{\text{something}}$ .

(b) Use the chain rule to take the derivative of the function above.

(c) Use this technique to find the derivative of the general function  $f(x) = a^x$ .

8. Let  $f(x) = \log_3(x)$ .

(a) Rewrite this function using only  $\ln(\text{something})$ , maybe more than once. Hint: Change of base formula.

(b) Use the chain rule to take the derivative of the function above.

(c) Use this technique to find the derivative of the general function  $f(x) = \log_a(x)$ .

**More Practice from Textbook 4.4:** You should do as many problems from each set (1-50, 51-62, 63-70, 71-76, 85-91), as needed until you are comfortable with these techniques. 63-70 are good practice for application problems.