

# BLC 190

Name: \_\_\_\_\_

## Worksheet 6

1. Evaluate each of the following:

(a)  $\log_5(25)$

(b)  $\log_{10}(1,000)$

(c)  $\ln\left(\frac{1}{e}\right)$

(d)  $\log_b(\sqrt{b})$  for  $b > 0$

2. Rewrite each of the following expressions as one logarithm:

(a)  $\log_2(x) + \log_2(y) - \log_2(z)$

(b)  $3\log_5(x^4) - 2\log_5(y) + \log_5(z)$

(c)  $2\ln(x+2) - \frac{1}{2}\ln(y)$

3. Solve the following equations:

(a)  $5^x = 9$

(b)  $3e^t = 15$

(e)  $4e^{2t} = 20$

(f)  $\log_2(x) = 5$

(g)  $\ln(2x) = 3$

(h)  $\log_2(x) + \log_2(x + 2) = 3$

4. Solve the following equation:

$$e^{2x} - 7e^x + 12 = 0$$

*Hint:* First, let  $a = e^x$ , and then solve for  $a$ .

5. Determine the behavior of the following exponential functions as  $x \rightarrow \infty$  and as  $x \rightarrow -\infty$ .

(a)  $y = 2^x$

- As  $x \rightarrow \infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .
- As  $x \rightarrow -\infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .

(b)  $y = \left(\frac{1}{3}\right)^x$

- As  $x \rightarrow \infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .
- As  $x \rightarrow -\infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .

(c)  $y = 1.01^x$

- As  $x \rightarrow \infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .
- As  $x \rightarrow -\infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .

(d)  $y = 0.99^x$

- As  $x \rightarrow \infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .
- As  $x \rightarrow -\infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .

(e)  $y = e^{-x}$

- As  $x \rightarrow \infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .
- As  $x \rightarrow -\infty$ ,  $y \rightarrow \underline{\hspace{2cm}}$ .

6. You deposit \$1000 in a bank account with a nominal interest rate of 6%/year.
- (a) Suppose that the interest compounds once per quarter (which means that it compounds four times per year). How much money will be in the account after 10 years?
  
  
  
  
  
  
  
  
  
  
  - (b) Suppose instead that the interest compounds monthly. How much money will be in the account after 10 years?
  
  
  
  
  
  
  
  
  
  
  - (c) Finally, suppose that the interest compounds continuously. How much money will be in the account after 10 years?
7. Susan deposits \$4500 in a bank account that earns 4.3% annual interest compounded continuously. When will the account contain \$5000?

8. A 12-oz can of soda is put into a refrigerator to cool. Its temperature in Fahrenheit after  $t$  minutes is given by the following formula:

$$T = 38 + 36e^{-.02t}$$

- (a) What is the initial temperature of the soda?
- (b) What is the temperature of the soda after 30 minutes?
- (c) When will the temperature of the soda be  $40^\circ$  F?
- (d) What is the eventual temperature of the soda? What does that say about the temperature inside the refrigerator? (*Hint:* Consider large values of  $t$  such as  $t = 1000$ ,  $t = 10,000$ , etc.)

9. At a college with 1800 students, some students decide to spread a rumor. The spread of the rumor is modeled by the following equation:

$$P = \frac{1800}{1 + 179e^{-0.4t}}$$

where  $P$  is the number of students who have heard the rumor after  $t$  hours.

- (a) How many students have heard the rumor after 3 hours?

- (b) How long does it take for 1700 students to hear the rumor?

- (c) How many students eventually hear the rumor? (*Hint:* Consider large values of  $t$  such as  $t = 1000$ ,  $t = 10,000$ , etc.)