

Name: _____

Date: _____

Unit 3 (Or is it 4?) Test

“Continuous effort- not strength or intelligence- is the key to unlocking our potential.”

-Winston Churchill

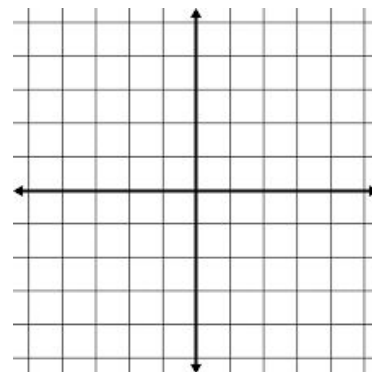
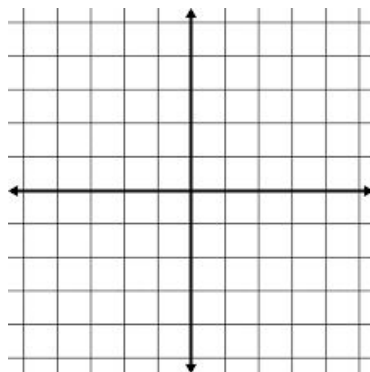
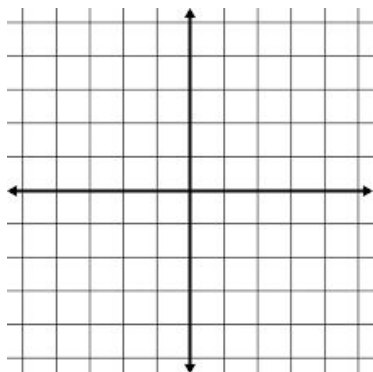
1. An exponential function, $f(x) = a^x$, is increasing (exponential growth) where a is _____ than 1 and decreasing (exponential decay) where a is _____ than 0 and _____ than 1.

2. Graph the following functions.

$$f(x) = 2^{-x}$$

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

$$f(x) = -4^x + 2$$



3. True or False?

- a. _____ Exponential functions always have a range of $(0, \infty)$.
- b. _____ Logarithmic and exponential functions are inverses of one another.
- c. _____ $\log(a) - \log(b) = \frac{\log(a)}{\log(b)}$.
- d. _____ The change of base formula states that $\log_b x = \frac{\log_a x}{\log_a b}$ or $\frac{\ln x}{\ln b}$.
- e. _____ Writing $\log_5 25 = 2$ in exponential form results in $5^2 = 25$.

4. Write the following equations in logarithmic form.

a. $e^m = d$

b. $49^{\frac{-1}{2}} = \frac{1}{7}$

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5. Write the following equations in exponential form.

a. $\log 1000 = 3$

b. $\ln 3 = y$

6. Find the domain of each logarithmic function.

a. $\log(x + 1)$

b. $\log(x^2 - 9)$

c. $\log(-x^2 + 2x + 8)$

7. State the Laws of Logarithms.

8. Use the Laws of Logarithms to expand the expression.

a. $\log \sqrt[3]{\frac{x+2}{x^4(x^2+4)}}$

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9. Combine into a single logarithm: $\ln x - 2 \ln(x^2 + 1) + \frac{1}{2} \ln(3 - x^4)$.

10. Find the exact and approximate solution to three decimal places of the equations below.

a. $2^{x-1} = 10$

b. $10^{x+3} = 36$

c. $5 \ln(3 - x) = 4$

d. $\log_2(x + 2) + \log_2(x - 1) = 2$

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11. Technetium-99 is used for brain scans. If a laboratory receives a shipment of 200g of this isotope, how much will remain after 24 hours if the half life of Technetium-99 is 6 hours?



12. Grace loves smoothies and she loves to drink them during Miss Wittrock's Pre-Calculus class. One day, Grace's smoothie has an initial temperature of 7°C and Miss Wittrock's room is a warm 25°C . Approximately 22 minutes later, Grace's smoothie has warmed up to 18°C . Use Newton's Law of Cooling to write a function for the melting of Grace's smoothie and find the temperature of her smoothie at the end of Miss Wittrock's class (90 minutes after the time Grace arrived).



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13. **Extra Credit:** Miss Wittrock is in a lot of debt from attending college. On her 25th birthday her parents tell her that they invested \$15,000 when she was 13 years old to pay for her college education. They share with Miss Wittrock that there is now \$47,162.75 in the account that she can use towards paying off her debt. Being the math wizard that Miss Wittrock is, she immediately wonders what the interest rate of her parents initial investment must have been. Find the interest rate of Mr. and Mrs. Wittrock's investment and assume that the account had been receiving continuously compounded interest.

