

Exponential and Logarithmic Functions**Unit Assessment**

Circle the letter of the best answer.

- The path of a marshmallow launched from a slingshot can be described by the equation $f(x) = -x^2 + 4x + 5$, where $f(x)$ is the height of the marshmallow and x is the number of seconds that have passed since the slingshot's band was released. Which of the following points shows the extremum for the function?
 - (0, 5)
 - (2, 9)
 - (0, -1)
 - (4, 5)

- The field hockey team is hosting a battle of the bands to raise money for new equipment. In the past, the profit from the battle of the bands could be modeled by the function $P(x) = -20(x - 20)(x - 10)$, where x represents the ticket price in dollars. What is a reasonable domain for this function?
 - $-10 \leq x \leq 20$
 - $-20 \leq x \leq -10$
 - $10 \leq x \leq 20$
 - $-20 \leq x \leq 10$

- What is the average rate of change of the function $f(x) = 5 \cdot 4^x$, between $x = 0$ and $x = 3$?
 - 5
 - 15
 - 105
 - 315

- What is the percent rate of change of y for each unit of x of the function $y = 250(0.81)^x$?
 - 81% decay
 - 19% decay
 - 81% growth
 - 119% growth

continued

5. Let $f(x) = 5x^2 + 8x + 3$ and $g(x) = 3^x$. Which statement correctly compares these functions?
- $g(x)$ is always greater than $f(x)$, because $g(x)$ is an exponential function.
 - $g(x) > f(x)$ for large values of x .
 - $g(x) > f(x)$ for values of x close to 0.
 - $f(x)$ is always greater than $g(x)$, because all of the coefficients are greater than or equal to 3.
6. What is the inverse of the exponential function $h(x) = 2 \cdot (3)^{4x}$?
- $h^{-1}(x) = 4 \log_3 x - 4 \log_3 2$
 - $h^{-1}(x) = \frac{\log_3 x}{4 \log_3 2}$
 - $h^{-1}(x) = \frac{4 \log_3 x}{\log_3 2}$
 - $h^{-1}(x) = \frac{1}{4} \log_3 x - \frac{1}{4} \log_3 2$
7. What is the value of x in terms of common logarithms for the exponential function $c(x) = 2 \cdot 6^{3x}$?
- $x = \frac{1}{3} \cdot \left(\frac{\log c - \log 2}{\log 6} \right)$
 - $x = \frac{1}{3} \cdot \left(\frac{\log 2 - \log c}{\log 6} \right)$
 - $x = 3 \cdot \left(\frac{\log 2 - \log c}{\log 6} \right)$
 - $x = 3(\log 2 - \log c - \log 6)$
8. What is the value of x in the exponential equation $2e^{2x} + 4 = 10$?
- 3
 - $\frac{1}{2}e^3$
 - $\log_3 2$
 - $\ln \sqrt{3}$

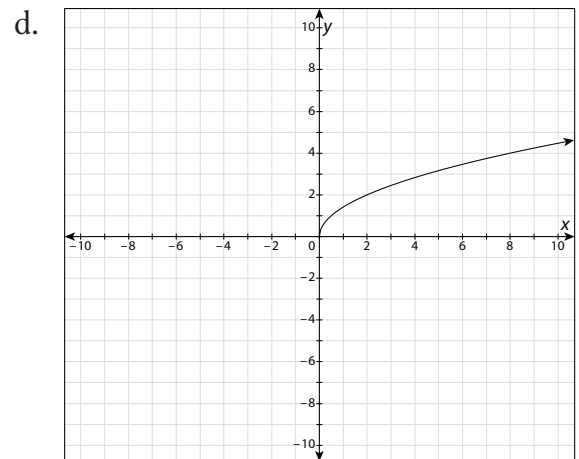
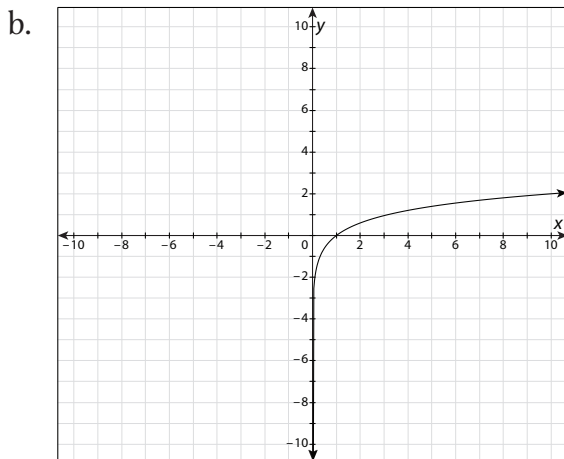
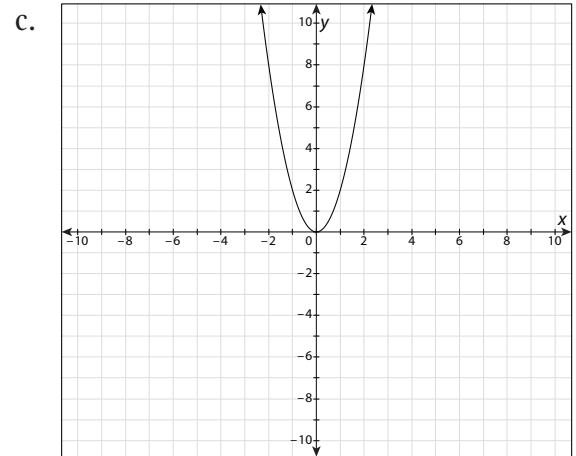
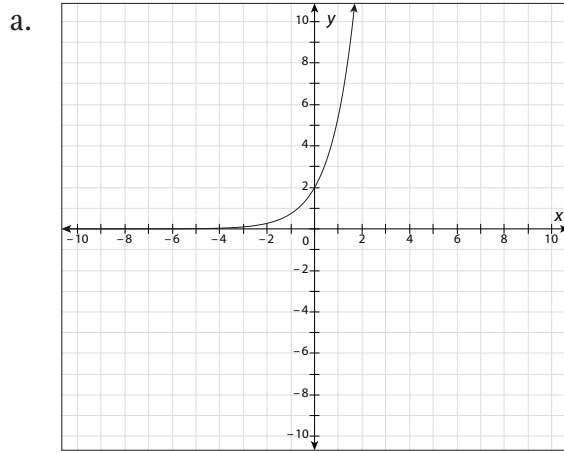
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9. Which graph represents a logarithmic function?



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10. A function for modeling earthquake intensity on the Richter scale is given by the equation $M_s = \log\left(\frac{A}{T}\right) + 1.5\log d + 3.2$, in which A is the amplitude of the ground-wave motion during the earthquake, T is the period of the ground wave, and d is the temperature in degrees. Which of the following shows another way that the logarithmic term in the function can be written?

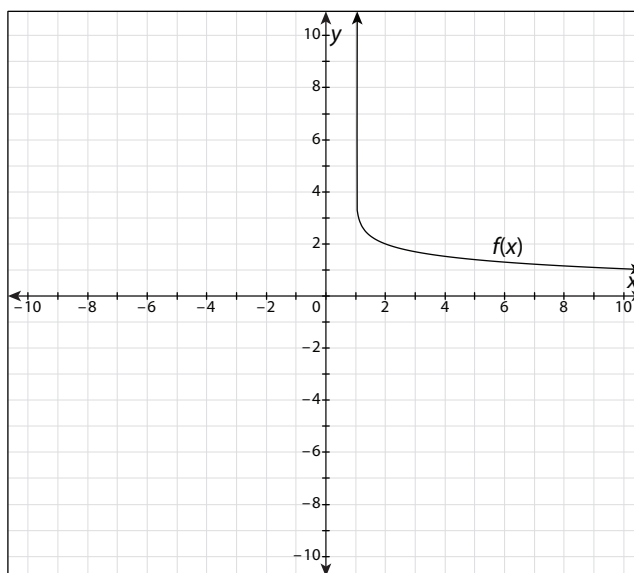
a. $M_s = 1.5\log\left(\frac{Ad}{T}\right) + 3.2$

b. $M_s = \log\left(\frac{Ad^{\frac{3}{2}}}{T}\right) + 3.2$

c. $M_s = \log\left(\frac{3.2Ad^{\frac{3}{2}}}{T}\right)$

d. $M_s = \log(A + 1.5d - T + 3.2)$

11. Which function does the graph represent?



- a. $f(x) = 1 + \log x$
- b. $f(x) = 2 + \log(x - 1)$
- c. $f(x) = 2 - \log(x - 1)$
- d. $f(x) = 2 \cdot \log(x - 1)$

continued

12. What is the inverse of the logarithmic function $g(x) = \frac{1}{3} \log_5 2x$?

a. $g^{-1}(x) = \frac{1}{2} \cdot 5^{3x}$

c. $g^{-1}(x) = 5^{\frac{3}{2}x}$

b. $g^{-1}(x) = \frac{1}{3} \cdot 5^{2x}$

d. $g^{-1}(x) = \frac{2}{3} \cdot 5^x$

Use the given information to solve problems 13–15.

13. A seagull drops a crab 144 feet onto the rocks below. The function $f(x) = -16x^2 + 144$ is used to model the height of the crab, with $f(x)$ representing the number of feet x seconds after the crab is dropped.

a. For what values of x is the function $f(x) = -16x^2 + 144$ increasing?

b. For what values of x is the function $f(x) = -16x^2 + 144$ decreasing?

c. What is the vertex and what does it mean in terms of this scenario?

d. What is a reasonable domain for this scenario?

e. What is the average rate of change in height between 1 and 2.5 seconds after the crab is dropped?

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14. The function that models the skunk population in a certain forest is $\frac{1000e^{0.2x}}{195+e^{0.2x}}$, where x is the number of years since the initial population of skunks arrived in the forest. How would you find the inverse function $f^{-1}(x)$, and what restrictions exist for x in this real-world situation?
15. The population of native freshwater fish in a river has increased as the concentration of synthetic chemicals in the river has decreased over the past year. The concentration of these chemicals, $f(x)$, is given by the exponential function $f(x) = 10^{-x}$, where x is the number of years since the synthetic chemical began decreasing. Write the inverse function and describe what $f^{-1}(x)$ and x represent in this inverse function.