

Name _____ Date _____ Period _____

Worksheet 4.1—Exponential and Logistic Functions

Show all work. All answers must be given as **simplified, exact answers!** No Calculators are permitted unless specified otherwise.

Multiple Choice

1. Which of the following functions is exponential?

(A) $f(x) = b^2$ (B) $f(x) = x^3$ (C) $f(x) = x^{2/3}$ (D) $f(x) = \sqrt[3]{x}$ (E) $f(x) = 8^x$

2. What point do all functions of the form $f(x) = b^x$ have in common?

(A) (1,1) (B) (1,0) (C) (0,1) (D) (0,0) (E) (-1,-1)

3. For $x > 0$, which of the following is true?

(A) $3^x > 4^x$ (B) $7^x > 5^x$ (C) $\left(\frac{1}{6}\right)^x > \left(\frac{1}{2}\right)^x$ (D) $9^{-x} > 8^{-x}$ (E) $0.17^x > 0.32^x$

4. If $f(x) = 2 - 3e^{4-7x}$, what is $\lim_{x \rightarrow -\infty} f(x)$?

(A) 0 (B) 2 (C) 3 (D) ∞ (E) $-\infty$

5. If $f(x) = 2 - 3e^{4-7x}$, what is $\lim_{x \rightarrow \infty} f(x)$?

(A) 0 (B) 2 (C) 3 (D) ∞ (E) $-\infty$

Short Answer

6. Sketch the functions $f(x) = \left(\frac{4}{3}\right)^x$ and $g(x) = \left(\frac{3}{4}\right)^x$ on the same set of axis. Describe the domain, range, end behavior, find intercepts, and describe how the functions are related.

7. Sketch the following functions by using transformations. Describe the domain and range.

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

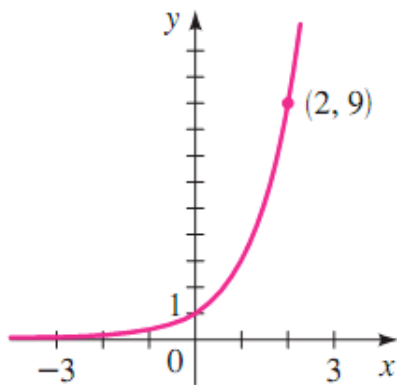
(b) $g(x) = 1 - 5 \cdot \left(\frac{5}{7}\right)^{2-x}$

(c) $h(x) = 7 \cdot 6^{2x-1} - 5$

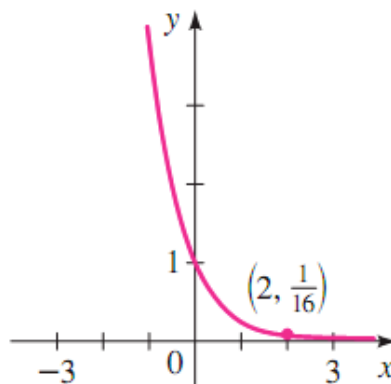
8. Let $f(x) = 3^x$. If $f(x)$ is vertically compressed by a factor of 9, what would the new equation, $g(x)$, be? The resulting graph can be equivalently obtained by a horizontal shift on $f(x)$. Describe this transformation, and show the work that leads to your answer.

9. Find the exponential function $f(x) = A \cdot b^x$ whose graph is given or whose points are given. Be sure to read the y -intercept of the graphs to get your second point.

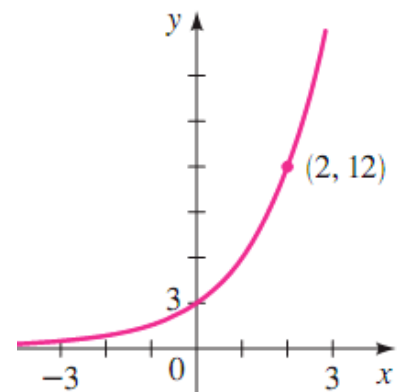
(a)



(b)



(c)



$$(d) (-2, 3) \text{ and } \left(5, \frac{1}{2}\right)$$

$$(e) (-1, 4) \text{ and } \left(\frac{3}{8}, 12\right)$$

10. Solve the following inequalities graphically.

$$(a) 9^x < 4^x$$

$$(b) \left(\frac{1}{3}\right)^x \geq \left(\frac{1}{2}\right)^x$$

11. Determine if each of the following functions is an exponential growth or decay function, then describe both end behaviors using limit notation.

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

$$(b) f(x) = \frac{1}{\left(\frac{1}{e}\right)^x}$$

$$(c) f(x) = \left(\frac{1}{0.75}\right)^{-x}$$

12. Determine which of the following, if any, exponential functions are equivalent. Justify your answer.

(a) I. $f(x) = 3^{2x+4}$

II. $g(x) = 3^{2x} + 4$

III. $h(x) = 9^{x+2}$

(b) I. $y_1 = 4^{3x-2}$

II. $y_2 = 2(2^{3x-2})$

III. $y_3 = 2^{3x-1}$

13. If $f(x) = 10^x$, show that $\frac{f(x+h) - f(x)}{h} = 10^x \left(\frac{10^h - 1}{h} \right)$

14. Calculator Permitted

(a) Compare the rates of growth of the functions $f(x) = 2^x$ and $g(x) = x^5$ by drawing the graphs of both functions in the following viewing windows. (Turn your xscl and yscl to zero).

(i) $[0, 5]$ by $[0, 20]$

(ii) $[0, 25]$ by $[0, 10^7]$

(iii) $[0, 50]$ by $[0, 10^8]$

(b) Find the solutions of the equation $2^x = x^5$, correct to three decimal places.