

Name: KEY

Unit 4: Exponential Functions Mock Test

1. In the standard form of an exponential function, $y = a(b)^x$:
- a. What is a ? *the initial value, y intercept*
 - b. What is b ? *the base; what determines a growth or decay, growth/decay factor*
 - c. How do you find b if you are given the rate (%)?
 - i. For Growth, b is: $(1 + r)$
 - ii. For Decay, b is: $(1 - r)$
 - d. What does x typically represent in word problems? *time*

2. Wilma and Walder's Weaving Wanders bought a piece of weaving equipment for \$60,000. It is expected to depreciate at an average of 10% per year.

- a) Is this a growth or decay model? decay
- b) Write an algebraic equation that models the situation: $y = 60,000(1 - .10)^t$
- c) Fill in the table's values for the value of the equipment for the next 4 years. (Round decimals to the nearest hundredth)
- d) What will the value of the equipment be in 10 years?

Years	0	1	2	3	4
Value of Equip.	60,000	54,000	48,600	43,740	39,366

$y = 60,000(1 - .10)^{10} = 20,920.71$

3. The population of termites in Mrs. Woodley's house is 200. A termite inspector tells Mrs. Woodley that the number of termites will quadruple every week until she pays for their removal.

- a) Is this a growth or decay model? growth
- b) Fill in the table values for the expected number of termites for the first 4 weeks. (Round to the nearest whole number)

Week	0	1	2	3	4
# of termites	200	800	3200	12,800	51,200

$y = 200(4)^t$

e) How many termites can Mrs. Woodley expect at the end of 9 weeks?

$52,428,800$

4. Miles bought a new boat for \$20,000 in 2000. The value of the boat depreciates 8.5% every year. What would the value of Miles' boat in 2009? (Let 2000 be year 0.)

$y = 20,000(1 - .085)^9 =$

5. State the translation that takes place from $f(x) = 3^x$ to each of the following.

$g(x) = 3^x + 8$
up 8

$g(x) = 3^{x-5} - 5$
right 5, down 5

$g(x) = -3^{x+1} + 1$
reflection, left 1, up 1

$g(x) = 3^{x-4}$
right 4

6. If the function $f(x) = 4^x$ is translated up 6 and left 2, write the new function, $g(x)$.

$g(x) = 4^{x+2} + 6$

7. If the function $f(x) = 1.5^x$ is translated down 4 and left 5, write the new function, $h(x)$.

$h(x) = 1.5^{x+5} - 4$

Determine if the function is growth or decay, and then identify the following:

8. $g(x) = 14(0.99)^x$

Growth or Decay

Factor: .99

Initial: 14

Rate: 1%

9. $h(x) = \left(\frac{3}{4}\right)^x$

Growth or Decay

Factor: $\frac{3}{4}$

Initial: 1

Rate: 25%

$\left(1 - \frac{3}{4}\right)$
 $(1 - b)$

10. $f(x) = \frac{1}{4}(8)^x$

Growth or Decay

Factor: 8

Initial: $\frac{1}{4}$

Rate: 700%

11. $g(x) = 4(1.34)^x$

Growth or Decay

Factor: 1.34

Initial: 4

Rate: 34%

Solve the following Exponential Functions:

12. $25^{x-2} = \frac{1}{5}$

$5^{2(x-2)} = 5^{-1}$

$$\begin{array}{r|l} 2x-4 & -1 \\ +4 & +4 \end{array}$$

$$\frac{2x}{2} = \frac{3}{2}$$

$x = \frac{3}{2}$

13. $27^{-x+3} \cdot 9^{x+1} = 81$

$3^{3(-x+3)} \cdot 3^{2(x+1)} = 3^4$

$3^{-3x+9} \cdot 3^{2x+2} = 3^4$

$3^{-3x+9+2x+2} = 3^4$

$3^{-x+11} = 3^4$

$$\begin{array}{r|l} -x+11 & 4 \\ -11 & -11 \end{array}$$

$$\frac{-x}{-1} = \frac{-7}{-1}$$

$x = -7$

14. $2^{x-1} \cdot 4^{-1} = 1$

$2^{x-1} \cdot 2^{2(-1)} = 2^0$

$2^{x-1} \cdot 2^{-2} = 2^0$

$2^{x-1-2} = 2^0$

$$\begin{array}{r|l} x-1-2 & 0 \\ x-3 & 0 \end{array}$$

$x = 3$

15. $\frac{7^{x-3}}{49^{x-3}} = 7$

$\frac{7^{x-3}}{7^{2(x-3)}} = 7^1$

$\frac{7^{x-3}}{7^{2x-6}} = 7^1$

$7^{(x-3)-(2x-6)} = 7^1$

$7^{x-3+(-2x+6)} = 7^1$

$7^{-x+3} = 7^1$

$$\begin{array}{r|l} -x+3 & 1 \\ -3 & -3 \end{array}$$

$$\frac{-x}{-1} = \frac{-2}{-1}$$

$x = 2$

16. $49^{2x-1} = 343$

$7^{2(2x-1)} = 7^3$

$7^{4x-2} = 7^3$

$$\begin{array}{r|l} 4x-2 & 3 \\ +2 & +2 \end{array}$$

$\frac{4x}{4} = \frac{5}{4} \quad x = \frac{5}{4}$

17. $\frac{1}{12} 2^{2x-4} = \frac{1}{144}$

$12^{-1(2x-4)} = 144^{-1}$

$12^{-2x+4} = 12^{2(-1)}$

$$\begin{array}{r|l} -2x+4 & -2 \\ -4 & -4 \end{array}$$

$$\frac{-2x}{-2} = \frac{-6}{-2}$$

$x = 3$

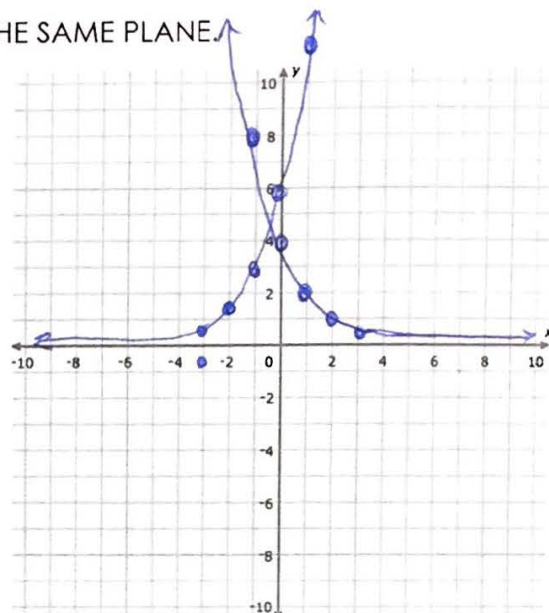
18. Complete the table for the functions and then graph it ON THE SAME PLANE.

$y = 6(2)^x$ $y = 6(2)^{-3}$ $y = 6(\frac{1}{8})$ $y = 6(2)^{-2}$ $y = 6(\frac{1}{4})$
 $y = 6(\frac{1}{2^3})$ $y = \frac{6}{8}$ $y = 6(\frac{1}{2^2})$ $y = \frac{6}{4}$

x	-3	-2	-1	0	1	2	3
y	$\frac{3}{4}$	$\frac{3}{2}$	3	6	12	24	48

$y = 4(\frac{1}{2})^x$ $y = 4(\frac{1}{2})^{-3}$ $y = 4(\frac{1}{2})^{-2}$ $y = 4(\frac{1}{2})^{-1}$
 $y = 4(8)$ $y = 4(4)$ $y = 4(2)$

x	-3	-2	-1	0	1	2	3
y	32	16	8	4	2	1	$\frac{1}{2}$



19. Write an exponential function that models the points in the table.

x	y
1	50
2	7.5
3	1.125
4	0.16875

Factor: .15
 Initial amount: 333.3
 Rate (%): 85%

Equation: $y = 333(.15)^x$

x	y
1	2
2	8
3	32
4	128

Factor: 4
 Initial amount: $\frac{1}{2}$
 Rate (%): 300%

Equation: $y = \frac{1}{2}(4)^x$

20. What is an **asymptote**, and how can you find the asymptote in **both** the parent function $f(x) = b^x$ and in the transformed function $g(x) = ab^{x-h} + k$?

an asymptote is a horizontal line your function gets close to but never crosses.
In a parent function the asymptote is always $y=0$ and in the transformed function, k represents the asymptote

Write the equation of the graph that corresponds to each equation.

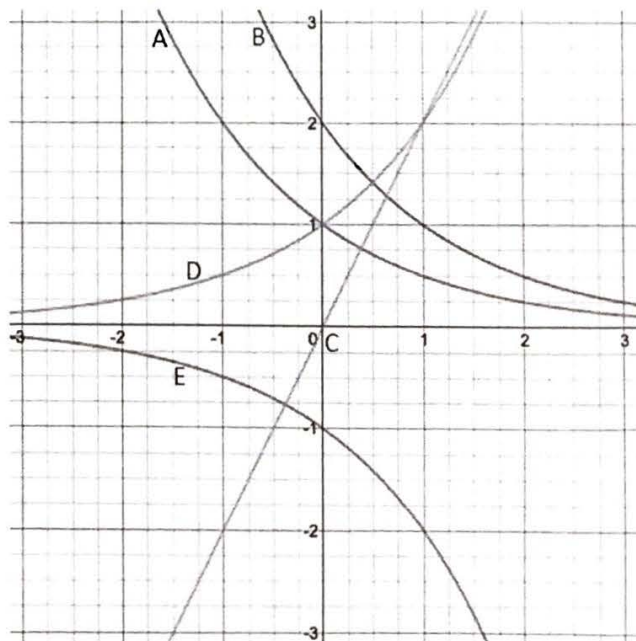
21. $y = 2(\frac{1}{2})^x$ B

22. $y = (\frac{1}{2})^x$ A

23. $y = 2^x$ D

24. $y = -2^x$ E

25. $y = 2x$ C



Answer the following about Geometric Sequences:

26. Find the formula for the nth term of the following geometric sequence: 3, 9, 27, 81, ...

$$y = a_n = 3 \cdot 3^{n-1}$$

27. Find the formula for the nth term of the following geometric sequence: -2, 10, -50, 250, ...

$$a_n = -2 \cdot (-5)^{n-1}$$

28. Lidia's parents have offered her two different options to earn her allowance for a 9-week period over the summer. She can either get paid \$30 each week, or \$1 the first week, \$2 the second week, \$4 the third week, and so on.

a) Clearly explain if the second option forms a geometric sequence or not.

1, 2, 4 ... Yes, because you have a common ratio of 2
 $\swarrow \searrow$
 $\times 2 \quad \times 2$

b) Show work and explain which option Lidia should choose.

$$y = 30x$$

$$y = 30(a)$$

$$y = \$270$$

This option earns her more money

x	y
1	1
2	2
3	4
4	8

$$y = 2^{x-1}$$

$$y = 2^{9-1}$$

$$y = 2^8$$

$$y = \$256$$

29. Find the common ratio for the following sequence, and then find the tenth term: 7, -7, 7, -7, ...

$$r = -1$$

$$a_{10} = 7 \cdot (-1)^{10-1}$$

$$\swarrow$$

$$x-1$$

$$a_{10} = -7$$

30. The fourth term for a sequence is 54, and the common ratio is -3. Use the information to find the eighth term. (Hint: You will need to find A_1 first.)

$$a_4 = 54$$

$$54 = a_1 \cdot (-3)^{4-1}$$

$$a_8 = -2 \cdot (-3)^{8-1}$$

$$\frac{54}{-27} = \frac{a_1 \cdot (-27)}{-27}$$

$$a_8 = -2 \cdot (-2187)$$

$$-2 = a_1$$

$$a_8 = 4,374$$