Lesson 2.04 Exponential Functions and their Properties

Students will be able to:

- Content Objective: Graph and write the equations of exponential functions in the form $y = ab^x$.

- Language Objective: Explain why an exponential equation represents exponential decay.
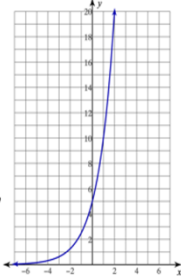
Warm Up

1. Rewrite each of the following in radical form. Then evaluate.

 a. $64^{\frac{7}{6}}$

 b. $125^{-\frac{2}{3}}$

2. Rewrite each of the following in exponential form. Simplify.

 a. $\sqrt[3]{27x^5}$

 b. $\sqrt[3]{(8x)^4}$
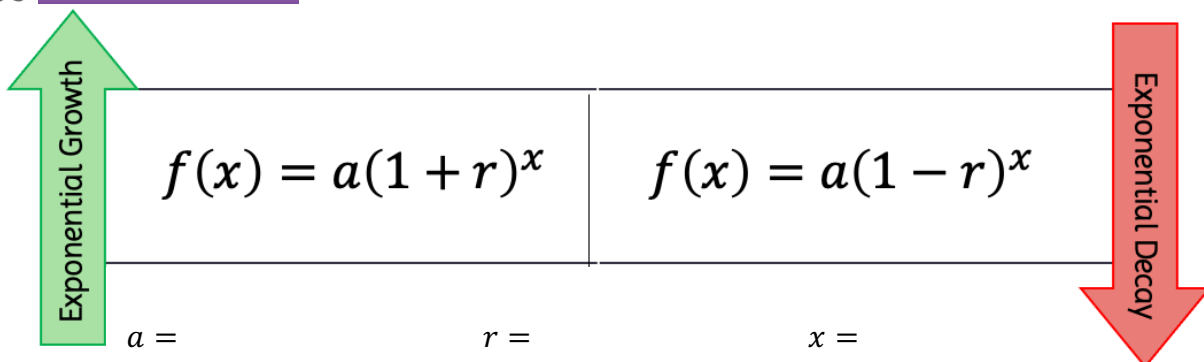
Vocabulary Review

Exponential Function

| Definition:	Graph:	Equation:
A function in the form $f(x) =$ Where $b > 1$ or $0 < b < 1$	This is an example of an increasing exponential graph with a y intercept at (0,5)	This is an example of a decreasing exponential graph with a y-intercept at (0,3) $y = 3\left(\dfrac{1}{2}\right)^x$

Graphic Organizer

Exponential Growth

$$f(x) = a(1+r)^x \qquad \qquad f(x) = a(1-r)^x$$

$a =$ $\qquad$ $r =$ $\qquad$ $x =$

Exponential Decay

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Skill 1: Graphing Exponentials

Sketch the graph of the function $f(x) = 2(3)^x$

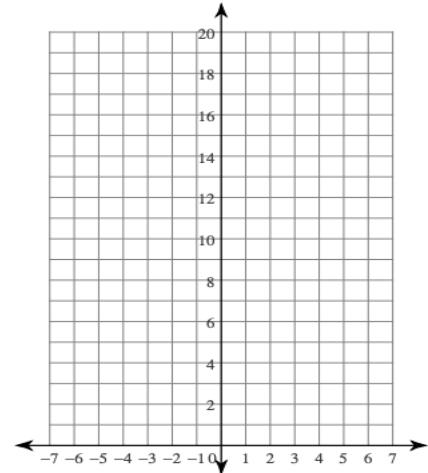| x	y
−2	
−1	
0	
1	
2	
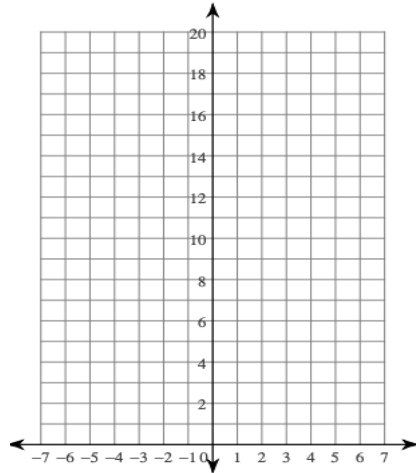
a.   Determine the y-intercept

b.   Is this an increasing or decreasing function?

Exercise 1: Graphing Exponentials

Sketch the graph of the function $f(x) = \frac{1}{2}\left(\frac{1}{4}\right)^x$

x	y
−1	
0	
1	
2	

a.   Determine the y-intercept

b.   Is this an increasing or decreasing function?

Write It Out

Which function represents exponential decay? Explain your reasoning for your choice.

(1) $y = 4^{-t}$

(2) $y = 3^{0.2t}$

(3) $y = 1.7^{4t}$
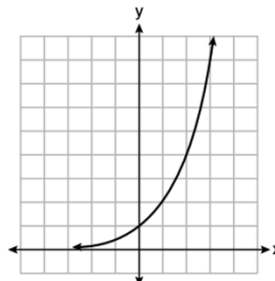
(4) $y = \left(\frac{1}{3}\right)^{-t}$
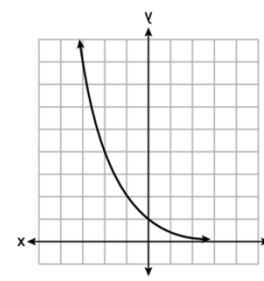
Explanation for your choice:

Skill 2: Transformations of Exponential Functions

Consider the function $y = g(x)$, defined by Graph A shown below. Which equation could be used to show Graph B

(1) $-g(x)$

(2) $g(-x)$

(3) $g(x - 1)$

(4) $g(x) - 1$

Graph A Graph B

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Exercise 2: Transformations of Exponential Functions

Describe the transformation applied to the graph of $q(x) = 3^x$ that forms the new function $p(x) = 3^{x-2} + 5$.

Skill 2: Growth/Decay Percentage

Given the exponential functions, identify whether the change represents growth or decay, and determine the percentage rate of change.

a. $y = 7600(1.262)^x$

b. $y = 26(0.98)^x$

c. $y = 400(0.37)^x$

Skill 2: Growth/Decay Percentage

Given the exponential functions, identify whether the change represents growth or decay, and determine the percentage rate of change.

a. $y = 800(1.372)^x$

b. $y = 16(0.75)^x$

c. $y = 900(0.87)^x$

Check Point

Which function represents exponential growth? Explain your reasoning for your choice.

(1) $y = 4^{-t}$

(2) $y = \left(\frac{1}{2}\right)^{0.2t}$

(3) $y = 1.7^{-4t}$

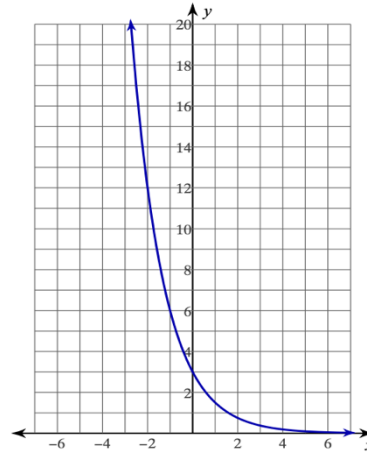(4) $y = \left(\frac{1}{5}\right)^{-t}$

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2.04 Problem Set

Name: _____

1. **Multiple Choice**

Which of the following represents the equation for the exponential function graphed below?

a) $y = 2(2)^x$

b) $y = 4(2)^x$

c) $y = 3\left(\frac{1}{2}\right)^x$

d) $y = \frac{1}{4}\left(\frac{1}{2}\right)^x$

2. Determine the value of $f(4)$ of an exponential equation passing through the points (0,4) and (1,8).

   a) 4   b) 64   c) 16   d) 0

3. Given the following table of values for an exponential function, determine the equation:

x	$f(x)$
3	24
4	48
5	96
6	192

4. Which of the following represents the depreciation of a $30,000 car at a rate of 5% each year?

(1) $y = 30000(1.5)^t$

(2) $y = 30000(1.05)^t$

(3) $y = 30000+(.05)^t$

(4) $y = 30000(0.95)^t$