Algebra II: 7.2 Notes
Date:

Name:
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key

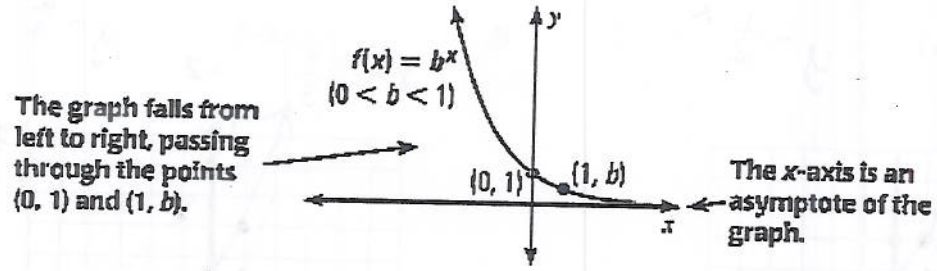
Objective: Graph and use exponential decay functions.

In Lesson 7.1 you studied exponential growth functions. In this lesson, you will study **exponential decay functions**, which have the form $y = ab^x$ where $a > 0$ and $0 < b < 1$. The base b of an exponential decay function is called the **decay factor**.

KEY CONCEPT

Parent Function for Exponential Decay Functions

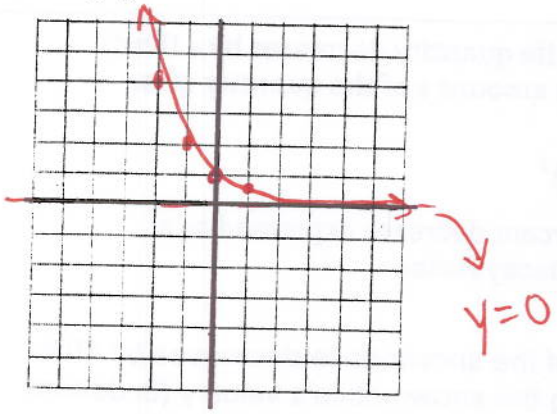
The function $f(x) = b^x$, where $0 < b < 1$, is the parent function for the family of exponential decay functions with base b. The general shape of the graph of $f(x) = b^x$ is shown below.



The domain of $f(x) = b^x$ is all real numbers. The range is $y > 0$.

Graph the function, identify the asymptote, and state the domain and range.

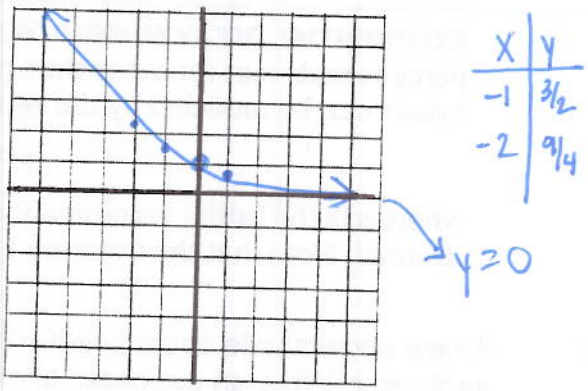
1. $y = \left(\frac{1}{2}\right)^x$



D: ℝ

R: $y > 0$

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



x	y
-1	3/2
-2	9/4

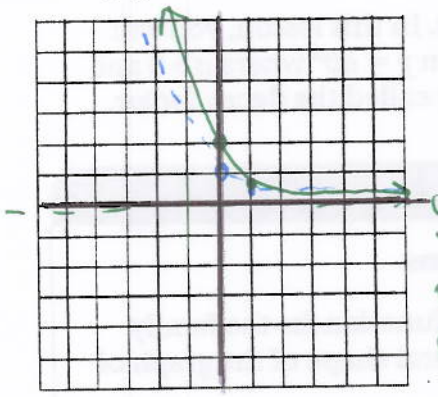
D: ℝ

R: $y > 0$

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

mult. y by 2

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

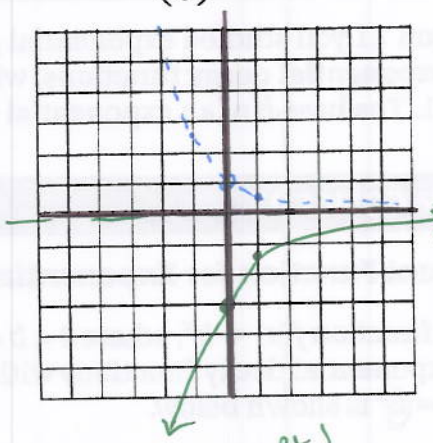


D: ℝ
R: $y > 0$

4. $f(x) = -3\left(\frac{2}{5}\right)^x$

$y = \left(\frac{2}{5}\right)^x$

$\frac{2}{5}\left(\frac{-3}{1}\right) = \frac{-6}{5}$

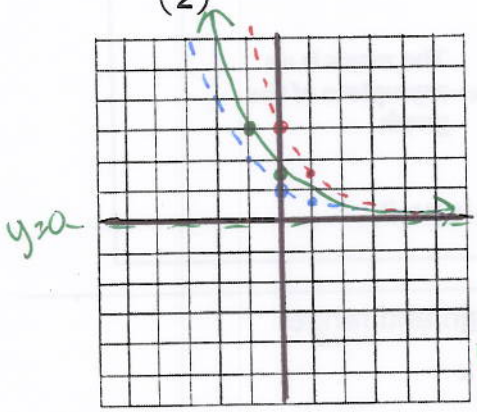


D: ℝ
R: $y < 0$

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

mult. by 3 ↓ left 1

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



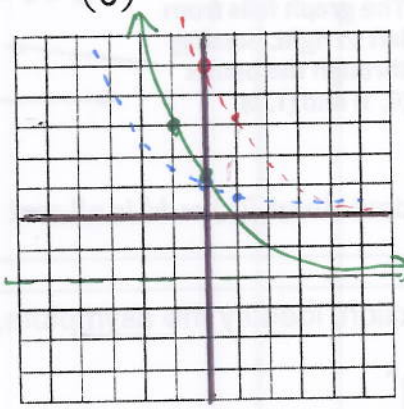
D: ℝ
R: $y > 0$

6. $y = 5\left(\frac{2}{3}\right)^{x+1} - 2$

↓ left 1 → down 2

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

$\left(\frac{2}{3}\right)\left(\frac{5}{1}\right) = \frac{10}{3}$



D: ℝ
R: $y > -2$

EXPONENTIAL DECAY MODELS When a real-life quantity decreases by a fixed percent each year (or other time period), the amount y of the quantity after t years can be modeled by the equation

$$y = a(1 - r)^t$$

where a is the initial amount and r is the percent decrease expressed as a decimal. Note that the quantity $1 - r$ is the decay factor.

7. A new snowmobile costs $4200. The value of the snowmobile decreases by 10% each year. Write an exponential model giving the snowmobile's value y (in dollars) after t years. Estimate the value after 3 years.

a = 4200, r = 0.1, t = 3

$y = 4200(1-0.1)^3$

$y = \$3061.80$

8. The value of the snowmobile has been decreasing by 7% each year since it was new. After 3 years, the value is $3000. Find the original cost of the snowmobile.

$3000 = a(1-0.07)^3$

$a = \$3729.69$