

Exponentials Study Guide

Key

Objective: Be able to identify exponential growth/ exponential decay.

1. Is it Exponential Growth or Decay?

- a. $f(x) = 7(2)^x$ Growth $\rightarrow b > 1$
- b. $f(x) = 10\left(\frac{1}{3}\right)^x$ Decay $\rightarrow b < 1$
- c. $f(x) = 2^{-x}$ Decay $\rightarrow f(x) = \left(\frac{1}{2}\right)^x$ $b < 1$
- d. $f(x) = 5(0.4)^x$ Decay $b < 1$

Objective: Be able to write an exponential function and find a value from it.

2. Write the Exponential Function for each table.

x	y
1	$\frac{3}{2}$
2	$\frac{9}{8}$
3	$\frac{27}{32}$
4	$\frac{81}{128}$

At 0, it would be 2 because $2 \cdot \frac{3}{4} = \frac{3}{2}$

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

x	y
-1	$\frac{1}{10}$
0	$\frac{1}{2}$
1	$\frac{5}{2}$
2	$\frac{25}{2}$
3	$\frac{125}{2}$

$f(x) = \frac{1}{2}(5)^x$

3. Mr. Allen bought a used Infiniti car for \$16,790. It is depreciating at a rate of 6% per year.

a. Write a function for this situation

$f(t) = 16,790(0.94)^t$

b. What is the average rate of change for the first two years? Interpret it in context.

$f(2) = 14,835.64$
 $f(0) = 16,790$

$\frac{14,835.64 - 16,790}{2 - 0} = \frac{-1,954.36}{2}$

-977.18

the value of the car goes down \$977.18 per year on average during the first two years

4. In the absence of predators, the number of squirrels on Vanderbilt's campus is tripling each year. The population begins with 250 squirrels.

a. Write a function for this situation.

$f(t) = 250(3)^t$

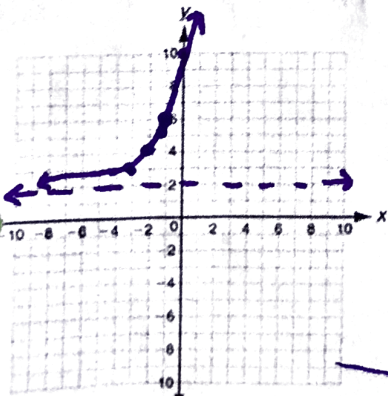
b. How long will it take the population to reach 10,000 squirrels?

≈ 3.5 years

Objective: Be able to graph exponential function transformations. (and know domain, range, end behavior, and asymptotes)

5. Graph the Exponential Function and describe its key features.

$y = 2^{x+3} + 2$ left 3, up 2



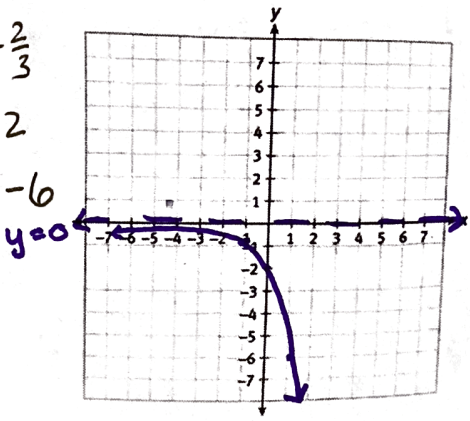
Domain	$(-\infty, \infty)$
Range	$(2, \infty)$
x - intercept	NONE
y - intercept	10
Asymptote	$y = 2$
End Behavior	$x \rightarrow \infty, f(x) \rightarrow \infty$ $x \rightarrow -\infty, f(x) \rightarrow 2$

parent: $f(x) = 2^x$

$-4 = \frac{1}{2} \cdot 2^{\frac{1}{2}}$
 $-3 \cdot 0 + 3$
 $-2 + 24$

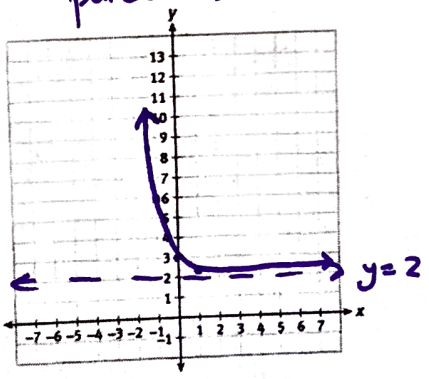
6. $f(x) = -2 \cdot 3^x$
 parent $f(x) = 3^x$
 Reflect across x axis
 Vertical stretch by 2

-1	$\frac{1}{3}$	$-\frac{2}{3}$
0	1	-2
1	3	-6



7. $f(x) = 4^x$
 $f(-x) + 2$
 parent $f(x) = 4^x$

1	$\frac{1}{4}$	$2\frac{1}{4}$
0	1	3
-1	4	6



Objective: Be able to write compound interest formulas two ways.

8. Ms. Bolus has \$25,000 invested at a rate of 1% compounded quarterly.

a. Write a compound interest function for the situation using t as your exponent. Round to four decimal places.

$f(t) = 25,000(1 + \frac{0.01}{4})^{4t} \rightarrow f(t) = 25,000(1.0025)^{4t} \rightarrow f(t) = 25,000[(1.0025)^4]^t$

b. Find out how much Ms. Bolus has in the bank after 6 years.

$\approx \$26,538.00$

$f(t) = 25,000(1.0100)^t$

Objective: Be able to interpret exponential functions written different ways.

9. a. Three physicists describe the amount of a radioactive substance, Q in grams, left after t years:

Physicist 1: $Q = 250(\frac{1}{2})^{\frac{t}{6}}$ Physicist 2: $Q = 250(0.8909)^t$ Physicist 3: $Q = 198.426(0.8909)^{t-2}$

a. WITHOUT graphing, show that all three of these are equivalent.

$Q = 250(\frac{1}{2})^{\frac{t}{6}}$
 $Q = 250(0.8909)^t$

$Q = 250(0.8909)^t$

$Q = 198.426(0.8909)^{-2}(0.8909)^t$
 $Q = 250(0.8909)^t$

b. Which expression highlights the decay rate each year? Why? What is the percent decay each year?

Physicist 2 $\rightarrow \approx 11\%$
 It is raised to the t power

c. Which of the expressions highlights what the amount of radioactivity is after 2 years?

Physicist 3

d. Which expression highlights the half-life (the time taken for the radioactivity of a specified isotope to fall to half its original value) of the radioactive substance? Why? What is the half-life?

Physicist 1 - because b is $\frac{1}{2}$
 half life is 6 years