Algebra 1

Lesson 8.6B

Write and Graph Exponential Decay Functions

Exponential Decay: A function that decreases by the same percent every time.
- The function does not have a constant rate of change.
- The graph decreases gradually at first and then more rapidly as x gets larger.

Decay Function $y = C(1-r)^t$ $\begin{cases} r = decay\ rate \\ t = time\ period \\ C = beginning\ amount \\ 1-r = decay\ factor \end{cases}$

Note – the decay factor is less than 1

Example 1.

Classify the models below as exponential growth or exponential decay. Identify the growth or decay factor and the percent increase or decrease per time period.

(*a*) $y = 12(1.12)^t$ GROWTH

(b) $y = 4(.50)^t$ Decay

(c) $y = 7\left(\frac{3}{4}\right)^t$ Decay

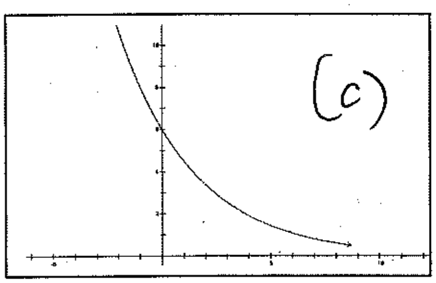
(d) $y = 25\left(\frac{5}{4}\right)^t$ GROWTH

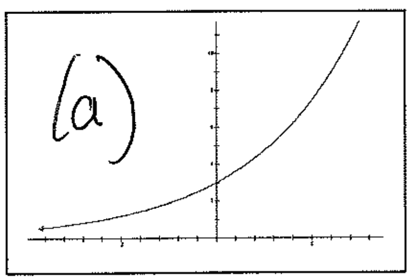
Example 2.
Match the function with the correct graph.

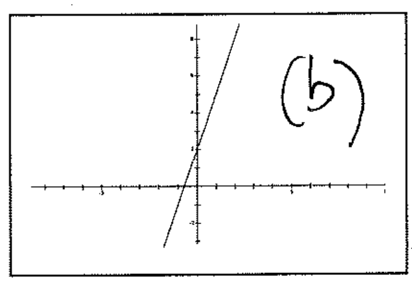
(a) $y = 3(1.2)^t$

(b) $y = 3x + 2$

(c) $y = 6(.75)^t$







Example 3. Depreciation.
You bought a used car for \$18, 000. The value of the car will be less each year because of depreciation. The car depreciates at a rate of 12% per year.

(*a*) Write an exponential decay model to represent this situation.

$y = 18{,}000(1-.12)^t$

$y = 18{,}000(.88)^t$

(*b*) Estimate the value of your car after 8 years.

$y = 18{,}000(.88)^8$

\$6,473.42

THE car is worth \$6,473.42 after 8 years.

Example 4. Cell Phones.
You purchase a cell phone for \$125. The value of the cell phone decreases by 20% annually.

(*a*) Write an exponential decay model to represent this situation.

$y = 125(1-.2)^t$

$y = 125(0.8)^t$

(*b*) Estimate the value of your phone after 3 years.

$y = 125(0.8)^3$

$y = 64$

THE phone is worth \$64 after 3 years.

Algebra 1

Lesson 8.5B

Write and Graph Exponential Growth Functions

Exponential Growth: A function that grows by the same percent every time. (Doubles, Triples, etc)
- The function does not have a constant rate of change.
- The graph increases gradually at first and then more rapidly as x gets larger.

Growth Function $y = C(1+r)^t$ $\begin{cases} r = growth\ rate \\ t = time\ period \\ C = beginning\ amount \\ 1+r = Growth\ factor \end{cases}$ **Note – the growth factor is greater than 1**

Example 1. Investment Problem

$8\% \rightarrow 0.08$

$y = C(1+r)^t$

You deposit \$500 in an account that pays 8% annual interest compounded yearly.

(*a*) Write a model for this investment problem using t as the time period.

$y = 500(1+.08)^t$

$y = 500(1.08)^t$

(*b*) Find the balance in the account after 6 years.

AFTER 6 YEARS, YOU HAVE \$793.44

(*c*) Find the balance in the account after 20 years.

AFTER 20 YEARS, YOU HAVE \$2,330.48

6 YEARS	20 YEARS
$y = 500(1.08)^6$	$y = 500(1.08)^{20}$
\$793.44	\$2,330.48

Example 2.

The owner of an original 1938 comic book bought it for \$55 in 1980. The value of the comic book increased at a rate of 2.8% per year.

(*a*) Write a model giving the value of the comic book after t years.

$y = 55(1+.028)^t$

$y = 55(1.028)^t$

(*b*) What was the approximate value of the comic book in the year 2005?

IN 2005, IT IS WORTH \$109.70.

(*c*) What is the approximate value of the comic book today?

TODAY, IT IS WORTH \$136.82.

2005	2013
$y = 55(1.028)^{25}$	$y = 55(1.028)^{33}$
\$109.70	\$136.82

Example 3.

In the year 2001 there were about 600 million computers in use worldwide. This number is increasing at a rate of 10% per year.

(*a*) Write a model giving the number of computers after t years.

$y = 600(1+.1)^t$

$y = 600(1.1)^t$

IN MILLIONS

(*b*) How many computers were there worldwide in the year 2008?

IN 2008, THERE WERE 1,169,230,260 COMPUTERS WORLDWIDE

$y = 600(1.1)^7$

$y = 1169.23026$ MILLION

$y = 1,169,230,260$

(*c*) How many computers are there today?

TODAY, THERE ARE 1,883,057,026 COMPUTERS WORLD

$y = 600(1.1)^{12}$

$y = 1883.057026$ MILLION