



## Warm Up

### Extra Examples wkst #1-4

### Homework Questions?

24.  **POPULATION GROWTH** A population of 30 mice is released in a wildlife region. The population doubles each year for 4 years. What is the population after 4 years?

$$y = 30(2)^t$$

17.  **BICYCLE RACING** In the Chapter Opener you learned that there is a relationship between the breathing rate of a cyclist and the bicycle speed.

Bicycle speed, $x$	0	5	10	15	20
Breathing rate, $y$	6.4	10.7	18.1	30.5	51.4

Let  $x$  represent the speed of the bike in miles per hour, and let  $y$  represent the cyclist's breathing rate in liters of air taken into the lungs per minute. The breathing rate of a cyclist can be modeled by  $y = 6.37(1.11)^x$ . What is the cyclist's breathing rate if the bike is traveling 19 miles per hour? 25 miles per hour?

$$y = 6.37(1.11)^{19} =$$

$$y = 6.37(1.11)^{25} =$$

15)  $\underline{3.58}$   
 Balance 400  
 6 yrs

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

$$400 = \frac{c(1+.035)^6}{(1.035)^6}$$

$$c = \frac{400}{(1.035)^6}$$

## Self Scoring Scale

4- I can *summarize* the concepts and explain it to others.

3- I can *apply* the concepts to answer questions correctly.

2- I can *apply* the concepts but with some *mistakes*.

1- I *need help* to know how to apply the concepts.

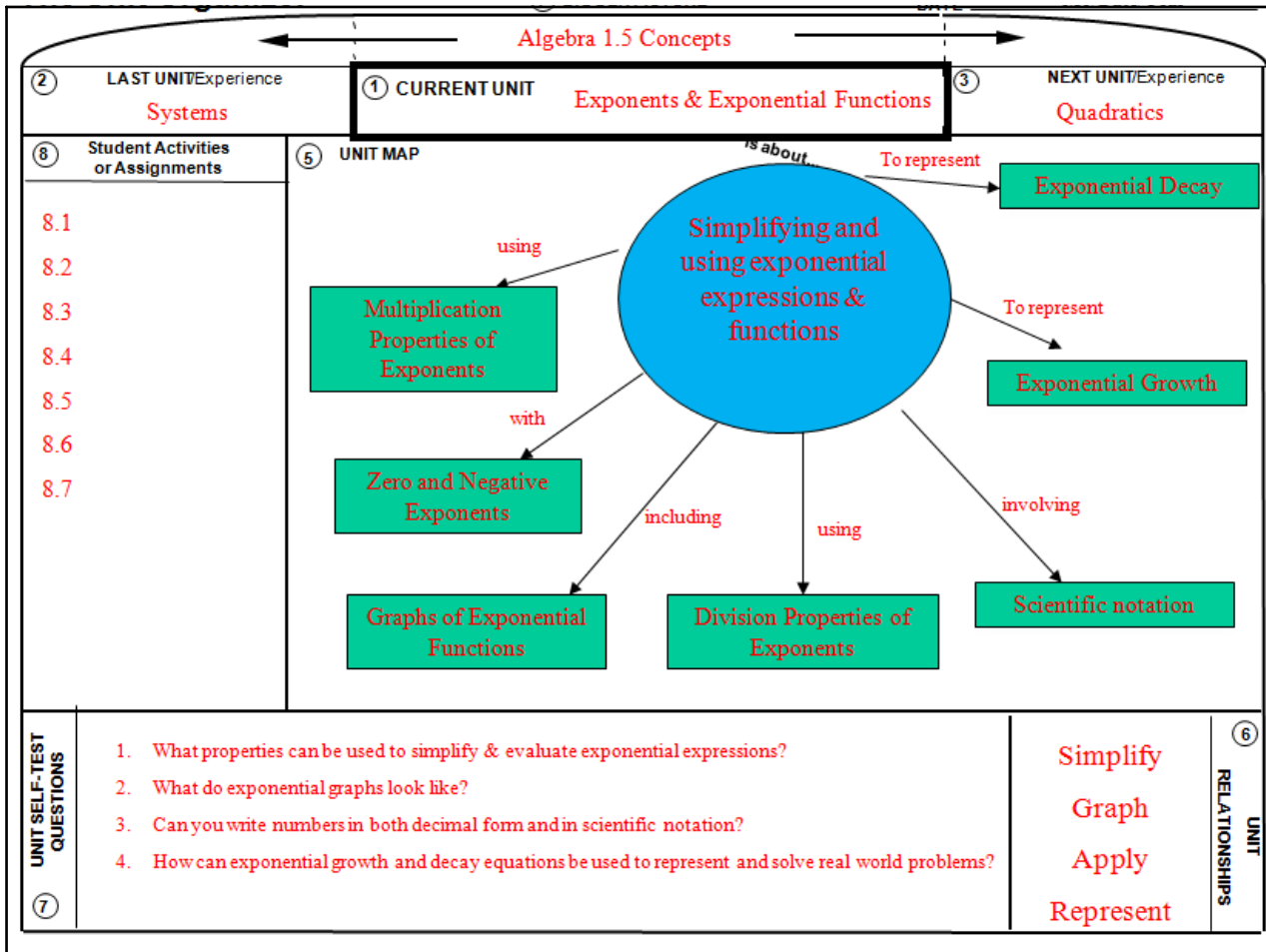
0- I *can't* apply the concepts even with help.

## 8.6 Exponential Decay Functions

### Goals:

- Write and use models for exponential decay
- Graph models for exponential decay

**EQ:** What is the model for exponential decay?  
(write formula and label the variables)



### Vocabulary

#### Exponential decay:

quantity that is decreasing for the same % for each time period

**EXPONENTIAL DECAY MODEL**

C is the initial amount. Begin →  $y = C(1 - r)^t$  t is the time period.

Total Balance →  $y = C(1 - r)^t$

The percent of decrease is  $100r$ . Rate of Dec.

$(1 - r)$  is the decay factor,  $r$  is the decay rate. To assure  $1 > (1 - r) > 0$ , it is necessary that  $0 < r < 1$ .

Growth  
 $(R) > 1$

Decay  
 $(R) < 1$

**Example 1: Writing an Exponential Decay Model**

**Depreciation** – A car is purchased for \$20,000. The value of the car will be less each year because of depreciation. The car depreciates (loses value) at the rate of 25% per year. Write an exponential decay model to represent the situation

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

$$y = 20000(1-.25)^t$$

$$y = 20000(.75)^t$$

$25\% = .25$

**Example 2: Using an Exponential Decay Model**

Use the model in Example 1 to estimate the value of the car in 5 years.

**Depreciation** – A car is purchased for \$20,000. The value of the car will be less each year because of depreciation. The car depreciates (loses value) at the rate of 25% per year. Write an exponential decay model to represent the situation.

$$y = 20000(.75)^t$$

$$= 20000(.75)^5$$

$$\approx 4746.09375\dots$$

$$\$4746.09$$

**Try It**

1. Verify the model you found in Example 1. Find the value of the car for each year by multiplying the value in the previous year by the decay factor.

Year	Value
0	20000
1	<del>20000</del> (0.75) = 15000
2	<del>20000</del> (0.75) <sup>2</sup> = 11,250
3	8437.5
4	6328.125
5	4746.09375

2. A used boat costs \$3200. The value of the boat will be less each year because of depreciation. The boat depreciates at the rate of 13% per year.

$$13\% = .13$$

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

$$y = 3200(1 - .13)^t$$

- b) Estimate the value of the boat in 3 years.

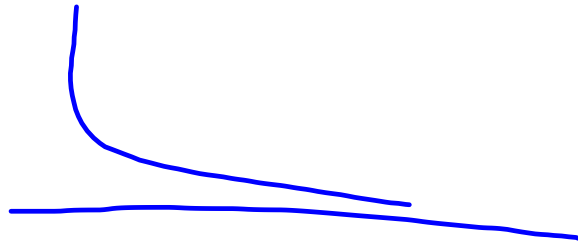
$$y = 3200(1 - .13)^3$$


$$\approx 2107.2096$$

$$\underline{\$2107.21}$$

## Warm Up

A store is having a sale on sweaters. On the first day the price of a sweater is reduced by 20%. The price will be reduced another 20% each day until the sweater is sold. Denise thinks that on the fifth day of the sale the sweater will be free. Is she right? Explain.



30.  **SUMMER CAMP** A summer youth camp had a declining enrollment from 1995 to 2000. The enrollment in 1995 was 320 people. Each year for the next five years, the enrollment decreased by 2%. Copy and complete the table showing the enrollment for each year. Sketch a graph of the results.

Year	1995	1996	1997	1998	1999	2000
Enrollment	320	313.6	?	?	?	?

$$y = 320(1 - 0.02)^x$$



**BASKETBALL** In Exercises 27–29, use the following information.

Each year in the month of March, the NCAA basketball tournament is held to determine the national champion. At the start of the tournament there are 64 teams, and after each round, one half of the remaining teams are eliminated.

29. **CRITICAL THINKING** If a team won 6 games in a row in the tournament, does it mean that it won the national championship? Explain your reasoning.

$$y = 64(.5)^6$$

$$\textcircled{y = 1}$$

**RECOGNIZING MODELS** Classify the model as *exponential growth* or *exponential decay*. Identify the growth or decay factor and the percent of increase or decrease per time period.

17.  $y = 24(1.18)^t$

18.  $y = 14(0.98)^t$

19.  $y = 35\left(\frac{5}{4}\right)^t$

20.  $y = 112(0.4)^t$

$\textcircled{21}$   $y = 9\left(\frac{2}{5}\right)^t$

22.  $y = 97(1.01)^t$

Decay

Decay Factor  $\frac{2}{5} = 0.4$

$1 - 0.4 = .6$  %       $60\%$



## Homework Questions?

### Example 3: Graphing an Exponential Decay Model

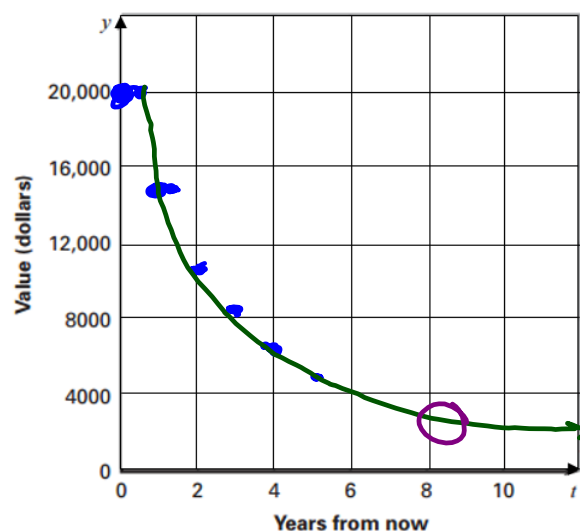
a) Graph the exponential decay model in Example 1.

**Depreciation** – A car is purchased for \$20,000. The value of the car will be less each year because of depreciation. The car depreciates (loses value) at the rate of 25% per year. Write an exponential decay model to represent the situation.

\**HINT: Use the table of values from Try It #1. Plot the points in the coordinate plane. Then draw a smooth curve through the points.*

b) Use the graph to estimate the value of the car in 8 years.

$\approx \$2000$



**Try It**

3. a) Graph the exponential decay model in **Try It #2**

A used boat costs \$3200. The value of the boat will be less each year because of depreciation. The boat depreciates at the rate of 13% per year.

$$y = 3200(1 - 0.13)^t$$

t	y
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0	3200
---	------

1	2784
---	------

2	2422.08
---	---------

3	2107.21
---	---------

t	y
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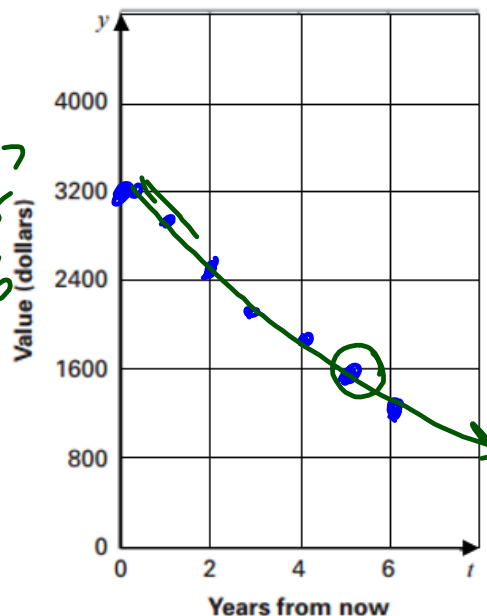
4	1833.27
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5	1594.95
---	---------

6	1387.6
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b) Estimate the value of the boat in 5 years.

≈ \$1600

**Summary**

**EQ:** What is the model for exponential decay?  
(write formula and label the variables)

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

Total Balance Begin  $\rightarrow$   $C$   $\leftarrow$  time  $t$   
 $r$   $\rightarrow$  Dec.

**8.6 Homework**

word problem wksts (make packet)