

Warm Up

February 7, 2019

1.) Using  $y = 6(1.085)^t$ , identify the following:

A. Initial Value

$$a = 6$$

B. Growth Factor

$$1.085$$

C. Rate

$$r = 8.5\%$$

2.) A sequence is shown below.

ARITHMETIC 32, 26, 20, 14, ...

$$d = -6 \rightarrow \text{Slope!}$$

0.85

Which explicit formula can be used to determine the  $n$ th term of the sequence?

~~A.  $a_n = 6n + 38$~~

~~B.  $a_n = 6n - 32$~~

C.  $a_n = -6n + 38$

D.  $a_n = -6n + 32$

## Exponential Growth HW Check

1.) Function:  $y = 4300(1.04)^t$

A. \$9,421.83      B. \$16,968.18

5.) Function:  $y=475(1.085)^t$

12 years: \$1,264.01

2.) Function:  $y=130,000(1.06)^t$

10 years: \$232,810.20

6.) Function:  $y=100(1.22)^t$

5 years: 270 frogs

3.) Function:  $y=40(1.03)^t$

10 years: \$53.76

7.) Function:  $y=10(1.8)^t$

5 hours: 188.96

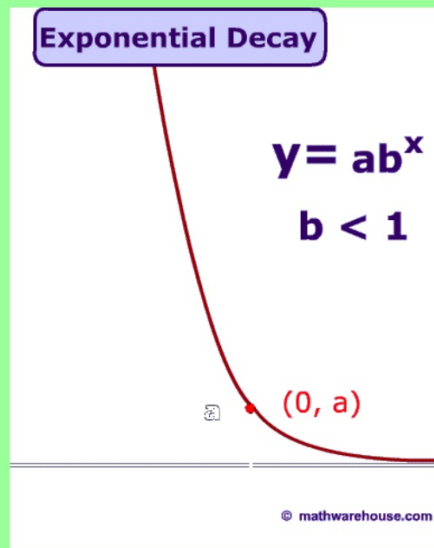
1 day: 13,382,588.54

4.) Function:  $y=2040(1.05)^t$

15 years: \$4,242.01

1 week:  $7.69 \times 10^{43}$

# Exponential Decay



## Exponential Decay

Occurs when a quantity decreasing by the same rate over time.

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

a = initial value

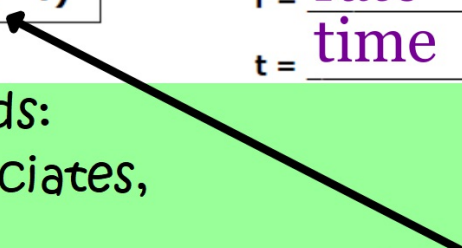
r = rate

t = time

Key Words:

Decreasing, depreciates,  
loses

decay factor  
less than 1



Label each exponential function model as growth or decay and identify the rate (%).

1.)  $y = 200(1.05)^5$  - growth,  $r = 5\%$

2.)  $y = 4(0.85)^{12}$  - decay,  $r = 15\%$

3.)  $y = 1200(1.085)^{120}$  - growth,  $r = 8.5\%$

4.)  $y = 36(0.91)^7$  - decay,  $r = 9\%$

5.)  $y = -2(1.09)^{24}$  - growth,  $r = 9\%$

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

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

$$a = \underline{\hspace{10em}}$$

$$(1 + r) / (1 - r) = \underline{\hspace{10em}} \quad (\text{growth} - >1; \text{decay} - <1)$$

$$r = \underline{\hspace{10em}}$$

$$t = \underline{\hspace{10em}}$$

Given  $f(x) = 0.60 (0.75)^x$ , identify the growth/decay factor, growth/decay rate, and the initial value.

Growth/Decay Factor:  $\underline{\hspace{10em}}$

Growth/Decay Rate:  $\underline{\hspace{10em}}$

Initial Value:  $\underline{\hspace{10em}}$

Given  $f(x) = 250 (1.07)^x$ , identify the growth/decay factor, growth/decay rate, and the initial value.

Growth/Decay Factor: \_\_\_\_\_

Growth/Decay Rate: \_\_\_\_\_

Initial Value: \_\_\_\_\_

7. The population of a town is decreasing at a rate of 1% per year. In 2000 there were 1300 people. Write an exponential decay function to model this situation. Then, find the population in 2008.

Step 1: Identify  $a$ ,  $r$ , and  $t$ .

$$A = 1300$$

$$R \text{ (percents to decimals)} = 1\%$$

$$T = \frac{2008}{2000} = 8$$

Step 2: Plug values into formula--  $y = a(1 - r)^t$ .

$$y = 1300(1 - .01)^t$$

$$y = 1300(.99)^t$$

Step 3: Solve for  $y$ .

$$y = 1300(.99)^8$$

$$y = 1199.57$$

≈ 1200 people

decay  
factor



8. The value of a car is \$18,000 and depreciating at a rate of 12% per year. Write an exponential decay function to model this situation. Then, find the value of the car after 10 years.

Step 1: Identify  $a$ ,  $r$ , and  $t$ .

$$A = 18000$$

$$R \text{ (percents to decimals)} = 12\%$$

$$T = 10$$

Step 2: Plug values into formula--  $y = a(1 - r)^t$ .

$$Y = 18000(1 - .12)^t$$

$$Y = 18000(.88)^t$$

Step 3: Solve for  $y$ .

$$Y = 18000(.88)^{10}$$

$$Y = \$5,013.01$$

9. A farmer buys a tractor for  $\$50,000$ . If the tractor depreciates 10% per year, write an exponential decay function to find the value of the tractor in 7 years.

Step 1: Identify  $a$ ,  $r$ , and  $t$ .

$$A = 50,000$$

$$R \text{ (percents to decimals)} = 10\%$$

$$T = 7$$

Step 2: Plug values into formula--  $y = a(1 - r)^t$ .

$$y = 50,000(1 - .1)^t$$

$$y = 50,000(.9)^t$$

decay  
factor

Step 3: Solve for  $y$ .

$$y = 50,000(.9)^7$$

$$y = \$23,914.85$$

## You Try:

10. An investment of \$8200 loses value at a rate of 2% per year. Write an exponential decay function to find the value of the investment after 9 years.

$$y = 8200(1 - 0.02)^t$$

$$y = 8200(.98)^t$$

11. The value of a book is \$58 and decreases at a rate of 7% per year. Write an exponential decay function to find the value of the book after 8 years.

$$y = 58(1 - 0.07)^t$$

$$y = 58(.93)^t$$

12. The population in Haywardsville is decreasing at a rate of 2.5% per year. If the population in 2000 was 28,000, what will be the expected population in 2015 if this rate of decrease continues?

Handwritten conversion of 2.5% to decimal. A red arrow points from the 2.5% to the decimal .025. A squiggly arrow points from the 2.5% to the decimal .025.

$$2.5\% \rightarrow .025$$

Handwritten conversion of 25% to decimal. A red arrow points from the 25% to the decimal .25. A vertical arrow points from the 25% to the decimal .25.

$$25\% \rightarrow .25$$

$$y = 28000(1 - 0.025)^t$$

$$y = 28000(.975)^t$$

Classwork:  
Exponential Decay  
Independent Practice  
WS #1-10