

Name: hey

Date: \_\_\_\_\_

$$A = P(1+r)^t$$

A = Amount at any given time

P = Principal (amount you start with)

r = rate (of increase or decrease)

t = time in years

$$A = P(1-r)^t$$

Growth

Decay

Change from % to decimal

Example 1

Twenty grams of Carbon is stored in a container. The amount  $C$  (in grams) of Carbon present after  $t$  years decreases by 1.2%.  $\rightarrow .012$   $P=20$   $r=.012$

A. Write a model for the amount of Carbon present in the container in terms of years since being contained.

$$C = 20(1 - .012)^t$$

$$C = 20(.988)^t$$

B. How much Carbon is present after 1500 years?

$C=?$

$P=20$   $t=1500$

$$C = 20(.988)^{1500}$$

$$C = .000000273 \text{ grams}$$

C. How long will it take for the Carbon to reach its half-life?  $\frac{1}{2}(20) = 10$

$C=10$

$P=20$

$t=?$

$$\frac{10}{20} = \frac{20}{20} (.988)^t$$

$$\log_{.988} .5 = \log_{.988} 1$$

$$t = \log_{.988} (.5)$$

$$t = 57.415 \text{ years}$$

D. How long will it take for there to be 5 grams of Carbon?

$C=5$

$P=20$

$t=?$

$$\frac{5}{20} = \frac{20}{20} (.988)^t$$

$$\log_{.988} .25 = \log_{.988} 1$$

$$t = \log_{.988} (.25)$$

$$t = 114.830 \text{ years}$$

Example 2

In the year 1990, kids everywhere collected Beanie Babies. There was such a demand that these critters skyrocketed in value. Katie bought a Beanie Baby for \$10.00. The stuffed animals' value increased at a rate of 7% per year.  $P=10$   $r=.07$

A.) Write an exponential growth model for the value of the Beanie Baby in terms of the number of years since the purchase.

$$B = 10(1 + .07)^t$$

$$B = 10(1.07)^t$$

B.) What was the value of the Beanie Baby after 2 years?

$$B = 10(1.07)^2$$

$$B = \$11.45$$

C.) How much is it worth today?

1990  $\rightarrow$  2017  
27 years

$$B = 10(1.07)^{27}$$

$$B = \$63.14$$

D.) How long did it take for Katie to double her original investment?  $\$10 \rightarrow \$20$

$$\frac{20}{10} = \frac{10}{10} (1.07)^t$$

$$\log_{1.07} 2 = \log_{1.07} 1$$

$$t = \log_{1.07} (2)$$

$$t = 10.245 \text{ years}$$

1. In 1990, the tuition at a private college was \$15,000. During the next 9 years, tuition increased by about 7.2% each year.

- a. Write a model giving the cost  $C$  of tuition at the college  $t$  years after 1990.

$$C = 15,000(1.072)^t$$

- b. What is the tuition in 2010?

$$C = \$60,254.14$$

- c. What year was the tuition \$20,000? Give the answer to 3 decimal places.

$$t = 4.134 \rightarrow 1994$$

2. You purchase a stereo system for \$830. The value of the stereo system decreases 13% each year.

- a. Write an exponential decay model for the value of the stereo system in terms of the number of years since the purchase.

$$S = 830(.87)^t$$

- b. What is the value of the system after 2 years?

$$S = \$628.23$$

- c. When will the stereo be worth half the original value?

$$\text{After } 4.977 \text{ years}$$

3. You have bought a new car for \$26,500. The value  $y$  of the car decreases by 18% each year.

- a. Write an exponential decay model for the value of the car.

$$C = 26,500(.82)^t$$

- b. Use the model to find the value of the car after three years.

$$C = \$14,611.25$$

- c. When will the car have a value of \$18,000? Give your answer to 3 decimal places.

$$\text{After } 1.951 \text{ years}$$