

8.8 Exponential Growth and Decay

The equation for exponential functions is:

$$y = ab^x, \quad b = (1 \pm r)$$

If b is greater than one

$$b > 1 \quad \text{growth}$$

If b is less than one but greater than zero

$$0 < b < 1 \quad \text{decay}$$

Growth or Decay?? Find the distance from 1!

Examples:

1. $y = 23.1 (1.02)^x$

growth

$$.02 = 2\%$$

2. $y = 800 (.95)^x$

decay

$$.05 = 5\%$$

3. $y = .05 (3.50)^x$

growth

$$2.5 = 250\%$$

Example:

Since 1995, the daily cost of patient care in community hospitals in the U.S. has increased 4% per year. In 1995, such hospital cost were an average of \$968 per day.

a. What was the initial cost? 968

b. What is the growth factor? $4\% .04 + 1 = 1.04$

c. Write an equation to model the cost of hospital care since 1995.

$$y = 968(1.04)^x$$

d. Use your equation to estimate the approximate cost per day in 2020.

$$968(1.04)^{25} = 2580 \text{ dollars}$$

Example:

Suppose your parents deposited \$1500 in an account paying 3.5% interests compounded annually (yearly) when you were born. Find the account balance after 18 years.

a. Initial amount? 1500

b. Growth factor? $3.5\% = .035 + 1$ 1.035

c. Write an equation. $y = 1500(1.035)^x$

d. Find the balance after 18 years.

$$y = 1500(1.035)^{18} = \$2,786.23$$

Example:

Since 1990 the number of gallons of whole milk each person in the U.S. drinks each year has decreased 4.1% each year. In 1980 each person drank an average of 16.5 gallons of whole milk per year.

a. Initial amount? 16.5

b. Decay Factor? $4.1\% = .041$ $1 - .041 = .959$

c. Write an equation to model the gallons of whole milk drunk per person.

$$y = 16.5(.959)^x$$

d. Use your equation to find the approximate consumption per person of whole milk in 2015.

$$y = 16.5(.959)^{35} = 3.81 \text{ gallons}$$

Example:

In 1995 the population of Washington D.C. was about 604,000 people. Since then the population has decreased about 1.8% per year.

a. What was the initial number of people?

604,000

b. What is the decay factor? $1 - .018$

- 1.8% $1 - .018 = (.982)$

c. Write an equation to model the population

$$y = 604000(.982)^x$$

d. Predict the number of people in D.C. in the year 2025

$$y = 604000(.982)^{30}$$

350,253 people

Homework: Pg 479 #1-9, 16, 17, 22-29,31-33