

Key

# EXPONENTIAL GROWTH AND DECAY

## Exponential Growth

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

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

a = initial amount

r = rate (percent rewrite in decimal form)

t = time

### Examples:

- The original value of an investment is \$1400, and the value increases by 9% each year. Write an exponential growth function to model this situation. Then, find the value of the investment after 25 years.

$$y = 1400(1 + 0.09)^t$$

$$y = 1400(1.09)^{25}$$

$$y = \$12,072.31$$

- The cost of tuition at a college is \$12,000 and is increasing at a rate of 6% each year. Write an exponential growth function to model this situation. Then, find the tuition cost after 4 years.

$$y = 12000(1 + 0.06)^t$$

$$y = 12000(1.06)^4$$

$$y = \$15,149.72$$

- The number of student athletes at a local high school is 300 and is increasing at a rate of 8% per year. Write an exponential growth function to model this situation. Then, find the number of student athletes after 5 years.

$$y = 300(1.08)^t$$

$$y = 300(1.08)^5$$

$$y = 440 \text{ athletes}$$

- Annual sales for a company are \$149,999 and are increasing at a rate of 6% per year. Write an exponential growth function to model this situation. Then, find the annual sales after 7 years.

$$y = 149,999(1.06)^t$$

$$y = 149,999(1.06)^7$$

$$y = \$229,543.04$$

- The population of a small town is 1600 and is increasing at a rate of 3% per year. Write an exponential function to model this situation. Then, find the population of the town after 10 years.

$$y = 1600(1.03)^t$$

$$y = 1600(1.03)^{10}$$

$$y = 2150 \text{ people}$$

- In 1985, there were 285 cell phone subscribers in Mayville. The number of subscribers increased by 75% per year after 1985. How many subscribers were in Mayville in 2008?

$$y = 285(1.75)^t$$

$$y = 285(1.75)^{23}$$

$$y = 110,845,988 \text{ people}$$

# Exponential Decay

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

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

$$a = \text{initial amount}$$

$$r = \text{rate}$$

$$t = \text{time}$$

## Examples:

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.

$$y = 1300(1 - 0.01)^t$$

$$y = 1300(0.99)^t$$

$$y = 1300(0.99)^8$$

$$y = 1199 \text{ people}$$

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.

$$y = 18000(1 - 0.12)^t$$

$$y = 18000(0.88)^{10}$$

$$y = \$5013.02$$

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.

$$y = 50000(0.9)^t$$

$$y = 50000(0.9)^7$$

$$y = \$23,914.85$$

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.

$$y = 8200(0.98)^t$$

$$y = 8200(0.98)^9$$

$$y = \$6,836.73$$

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.

$$y = 58(0.93)^t$$

$$y = 58(0.93)^8$$

$$y = \$32.46$$

12. The population in Haywardville 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?

$$y = 28,000(0.975)^t$$

$$y = 28000(0.975)^{15}$$

$$y = 19152 \text{ people}$$