

Exponential Growth and Decay Word Problems $y = P(1 \pm r)^t$

1. Write the growth model and find a bank account balance if the account starts with \$1000, has an annual rate of 4%, and the money is left in the account for (a) 12 years. (b) 24 years (c) 24 years at 5%

$$y = 1000(1 + .04)^x \quad \text{a) } 1000(1.04)^{12} \quad \text{b) } 1000(1.04)^{24} \quad \text{c) } 1000(1.05)^{24}$$

$$y = 1000(1.04)^x \quad \text{\$1601.03} \quad \text{\$2563.30} \quad \text{\$3225.10}$$

2. In 1985, there were 285 cell phone subscribers in the small town of Centerville. The number of subscribers increased by 75% per year after 1985. Write the growth model and calculate how many cell phone subscribers were in Centerville in 1994?

$$y = 285(1 + .75)^x = 285(1.75)^x \quad x = 9 \quad 285(1.75)^9$$

43,872

3. Bacteria can multiply at an alarming rate when each bacteria splits into two new cells, thus doubling. If we start with only one bacteria which can double every hour, write the growth model and calculate how many bacteria will we have by the end of one day? $1 \cdot 2^{24}$

$$y = 1(1 + 1)^x = 1 \cdot 2^x$$

16,777,216

4. Each year the local country club sponsors a tennis tournament. Play starts with 128 participants. During each round, half of the players are eliminated. How many players remain after 5 rounds?

$$y = 128(1 - .5)^x = 128(.5)^x \quad 128(.5)^5$$

4 players

5. The population of Winnemucca, Nevada, can be modeled by $P = 6191(1.04)^t$ where t is the number of years since 1990. What was the population in 1990? By what percent did the population increase by each year? What is the current population?

$$P = 6191(1.04)^0 \quad 1.04 - 1 = .04$$

6191 (pop in 1990) 4% increase

$$6191(1.04)^{26} = \text{\textcircled{17,164}}$$

6. You have inherited land that was purchased for \$30,000 in 1960. The value of the land increased by approximately 5% per year. What is the approximate value of the land in the year 2013?

$$y = 30000(1 + .05)^x = 30000(1.05)^x \quad 30000(1.05)^{53}$$

398,248

7. During normal breathing, about 12% of the air in the lungs is replaced after one breath. Write an exponential decay model for the amount of the original air left in the lungs if the initial amount of air in the lungs is 500 mL. How much of the original air is present after 10 breaths?

$$y = 500(1 - .12)^x = 500(.88)^x \quad 500(.88)^{10}$$

500 139 mL