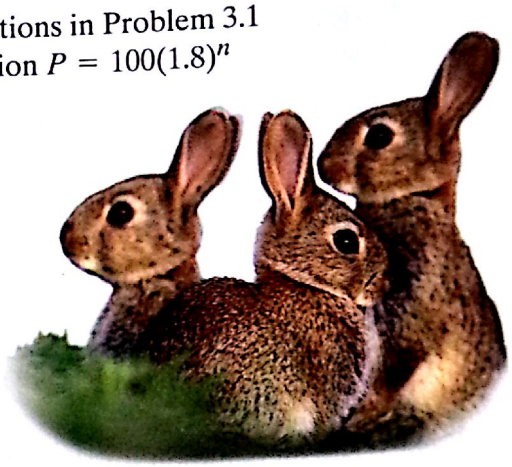
3.2 Investing for the Future

The yearly growth factor for one of the rabbit populations in Problem 3.1 is about 1.8. Suppose the population data fit the equation $P = 100(1.8)^n$ exactly. Then its table would look like the one below.



Rabbit Population Growth

n	P
0	100
1	$100 \times 1.8 = 180$
2	$180 \times 1.8 = 324$
3	$324 \times 1.8 = 583.2$
4	$583.2 \times 1.8 = 1049.76$

The growth factor of 1.8 is the number by which the population for year n is multiplied to get the population for the next year, $n + 1$.

You can think of the growth factor in terms of a percent change. To find the percent change, compare the difference in population for two consecutive years, n and $n + 1$, with the population of year n.

- From year 0 to year 1, the percent change is $\frac{180 - 100}{100} = \frac{80}{100} = 80\%$. The population of 100 rabbits in year 0 *increased* by 80%, resulting in 100 rabbits $\times$ 80% = 80 additional rabbits.
- From year 1 to year 2 the percent change is $\frac{324 - 180}{180} = \frac{144}{180} = 80\%$. The population of 180 rabbits in year 1 *increased* by 80%, resulting in 180 rabbits $\times$ 80% = 144 additional rabbits.

The percent increase is called the **growth rate.** In some growth situations, the growth rate is given instead of the growth factor. For example, changes in the value of investments are often expressed as percents.

Did You Know?

Some investors use a rule of thumb called the "Rule of 72" to approximate how long it will take the value of an investment to double. To use this rule, simply divide 72 by the annual interest rate. For example, an investment at an 8% interest rate will take approximately $72 \div 8$, or 9, years to double. At a 10% interest rate, the value of an investment will double approximately every 7.2 years. This rule doesn't give you exact doubling times, only approximations.

Problem 3.2 Growth Rates

When Sam was in seventh grade, his aunt gave him a stamp collection worth $2,500. Sam considered selling the collection, but his aunt told him that, if he saved it, it would increase in value.

A. Sam saved the collection, and its value increased by 6% each year for several years in a row.

1. Make a table showing the value of the collection each year for the five years after Sam's aunt gave it to him.
2. Look at the pattern of growth from one year to the next. Is the value growing exponentially?
3. Write an equation for the value v of the collection after n years.

B. Suppose the value of the stamps increased by 4% each year instead of by 6%.

1. Make a table showing the value of the collection each year for the five years after Sam's aunt gave it to him.
2. What is the growth factor from one year to the next?
3. Write an equation that represents the value of the stamp collection for any year.

C. 1. Find the growth factor associated with each growth rate.

a. 5% **b.** 15% **c.** 30%

d. 75% **e.** 100% **f.** 150%

2. How you can find the growth factor if you know the growth rate?

D. 1. Find the growth rate associated with each growth factor.

a. 1.5 **b.** 1.25 **c.** 1.1

2. How can you find the growth rate if you know the growth factor?

ACE **Homework starts on page 38.**