

**CHAPTER**  
**8**

# Compound Interest

## Get Set

Answer these questions to check your understanding of the Prerequisite Skills concepts on pages 420–421 of the *Foundations for College Mathematics 11* textbook.

### Decimals

1. Evaluate using a calculator.

a)  $270(0.18)(30)$

b)  $47\,200(0.04)(6.5)$

c)  $2800 + 2800(0.3)\left(\frac{3}{4}\right)$

### Percents

2. Write each percent as a decimal.

a) 15%

b) 6.5%

c) 1.13%

d) 46.4%

e) 0.3%

3. Evaluate. Express your answer as a decimal.

a)  $6\% \div 4$

b)  $30\% \div 2$

c)  $24\% \div 24$

4. Evaluate.

a) 4% of 100

b) 15% of 1200

c) 12.8% of 3000

### Exponents

5. Evaluate using a calculator. Round your answer to three decimal places.

a)  $(1.025)^{14}$

b)  $5000(1.12)^5$

c)  $1.18^{-5}$

### Simple Interest

6. Use the formula  $I = Prt$  to calculate the simple interest earned on each investment.

Recall,  $t$  represents the time in years and  $r$  represents the annual interest rate.

a)  $P = \$250$ ,  $r = 4.5\%$ ,  $t = 3$  years

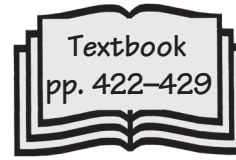
b)  $P = \$3000$ ,  $r = 8\%$ ,  $t = 6$  months

7. Calculate the value of the investment at the end of the term. Remember to add the interest and the principal together for the total.

\$5000 invested at 6% per year, simple interest, for 4 years

## 8.1

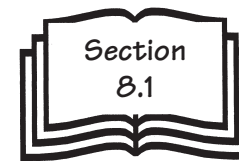
## Simple and Compound Interest



## Warm-Up

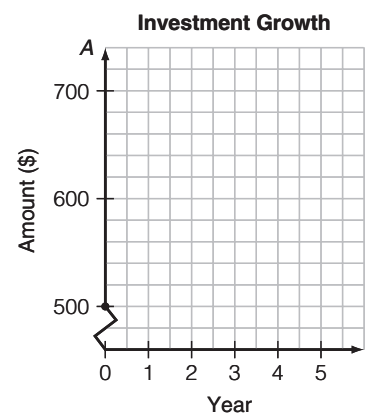
<p><b>1. Number Skills</b></p> <p>Evaluate.</p> <p>a) <math>4 \times 3 + 6 \times 4 - 2 \times 8</math></p> <p>b) <math>2 - [(6 + 2) \div 4]</math></p> <p>c) <math>9^2 + \sqrt{4} - 3</math></p>	<p><b>2. Algebra</b></p> <p>Simplify.</p> <p>a) <math>2x + 3(1 - x)</math></p> <p>b) <math>3(x + 1) - 2x</math></p> <p>c) <math>2x - (5 - x)</math></p>
<p><b>3. Relations</b></p> <p>Find the <math>x</math>-intercepts of the quadratic relation <math>y = x^2 + 7x + 12</math>.</p>	<p><b>4. Geometry/Measurement</b></p> <p>A large cylindrical tank has a radius of 5 m and height of 10 m. Determine the volume of the tank.</p>
<p><b>5. Data/Probability</b></p> <p>A bag contains 5 white balls, 3 green balls, and 8 red balls.</p> <p>a) What is the probability that you reach in and pull out a red ball?</p> <p>b) Suppose you pull out two balls. What is the probability that both balls are red?</p>	<p><b>6. Problem Solving</b></p> <p>The number 121 is a perfect square because <math>11^2 = 121</math>. What is the greatest three-digit perfect square?</p>
<p><b>7. Math Literacy</b></p> <p>What is the name for a sample selected simply because it is easily accessible. Hint: such samples may not be random, so their results are not always reliable.</p>	<p><b>8. Previous Section</b></p> <p>Evaluate.</p> <p>a) 8% of \$3000</p> <p>b) 12% of \$750</p>

## Practise



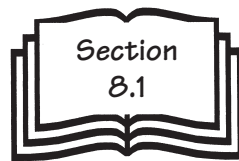
1. Use the table and the graph to show the growth of a \$500 investment at 6% per year, simple interest, and at 6% per year, compounded annually, for 5 years.

Year	Simple Interest Amount (\$)	Compound Interest Amount (\$)
0	500	500
1	$500 + 500(0.06) = 530$	$500(1.06) = 530$
2	$530 + 500(0.06) =$	$530(1.06) =$
3		
4		
5		



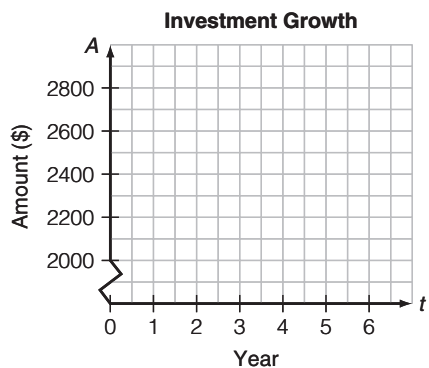
2. Peng Hao invested \$1000 at 5% per year, simple interest. Her brother, Peng Jin, invested \$1000 at 5% per year, compounded annually. Use the table to compare the values of their investments after each year for 5 years.

Year	Value of Peng Hao's Investment (\$)	Value of Peng Jin's Investment (\$)
0	1000	1000
1	$1000 + 1000(0.05) =$	$1000(1.05) =$
2		
3		
4		
5		



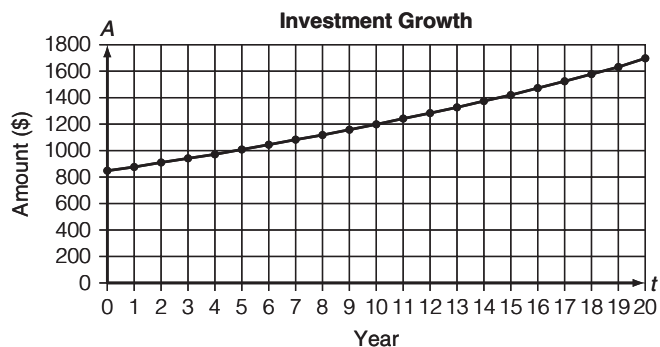
3. Six years ago, Hannah invested \$2000 at 4.3% per year, compounded annually, to help pay for her college education.
- a) Use the table and the graph to illustrate the growth of the investment over the 6 years.

Year	Amount (\$)
1	
2	
3	
4	
5	
6	



- b) Describe how this investment grows compared to a plan paying 4.3% per year, simple interest.

4. The graph illustrates the growth of an \$850 investment at 3.5% per year, compounded annually, over a 20-year period.
- a) Estimate the value of the investment after 5 years.

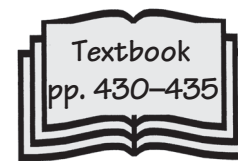


- b) Estimate the time required for the investment to grow to \$1700.

- c) How would the shape of the graph change if the annual interest rate was lower than 3.5% per year, but still compounded annually?

5. To save for a \$4000 television, Ivan invests \$3400 in a plan that pays 4.2% per year, compounded annually. How much will he need to add to this investment in 3 years to have enough to purchase the television?

## 8.2 Compound Interest

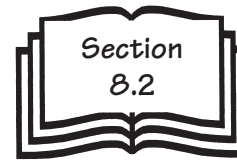


### Warm-Up

<p><b>1. Number Skills</b></p> <p>Write each percent as a fraction in lowest terms.</p> <p>a) 60%                                      b) 72%</p> <p>c) 42%                                      d) 55.5%</p>	<p><b>2. Algebra</b></p> <p>Simplify.</p> <p>a) <math>(2x + 3y) + (4x - 3y)</math></p> <p>b) <math>(3x - 4y) - (5x - 4y)</math></p> <p>c) <math>3(y - 2z) - 2(y - 3z)</math></p>
<p><b>3. Relations</b></p> <p>Express each linear relation in <math>y = mx + b</math> form.</p> <p>a) <math>2y - x = 3</math></p> <p>b) <math>x - 3y = 2</math></p>	<p><b>4. Geometry/Measurement</b></p> <p>A large rectangular pool has a length of 40 m, a width of 18 m, and a depth of 1.5 m. Find the volume of water in the pool when the pool is filled to the top.</p>
<p><b>5. Data/Probability</b></p> <p>What is the probability of rolling a pair of dice and getting the sum of 7?</p>	<p><b>6. Problem Solving</b></p> <p>Some prize money was shared among four people. Leah got <math>\frac{1}{2}</math> of the money, Tom got <math>\frac{1}{4}</math>, Danny got <math>\frac{1}{5}</math>, and Jeff got \$70. What was the total amount of the prize money?</p>
<p><b>7. Math Literacy</b></p> <p>Which measure of central tendency describes the value in a set of data that occurs most frequently?</p>	<p><b>8. Previous Section</b></p> <p>Alana invested \$12 000 in plan that pays 4% per year, compounded annually. How much will the investment be worth after 3 years?</p>

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

## Practise



1. Evaluate. Use a scientific calculator and round to two decimal places.

a)  $800(1.03)^3$                       b)  $1100(1.07)^7$

c)  $5500(1.005)^8$                       d)  $3200(1.029)^4$

2. Use the compound interest formula  $A = P(1 + i)^n$ . Evaluate, using a calculator.

- a) \$4000 at 6% per year, compounded annually, for 5 years

$P =$  \_\_\_\_\_,  $i =$  \_\_\_\_\_,  $n =$  \_\_\_\_\_

$A =$

- b) \$1200 at 8.4% per year, compounded semi-annually, for 3 years 6 months

$P =$  \_\_\_\_\_,  $i =$  \_\_\_\_\_,  $n =$  \_\_\_\_\_

$A =$

3. Determine the amount of a \$1000 investment at

- a) 5% per year, compounded semi-annually, for 6 years

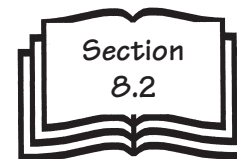
- b) 6.2% per year, compounded quarterly, for 4 years

4. To pay for a vacation. Keith borrowed \$5000, at 6% per year, compounded quarterly. The loan must be paid in full after 3 years.

- a) How much must Keith repay?

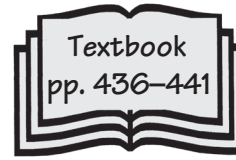
- b) How much interest does this repayment include?

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



5. A \$7000 investment earns interest at 5.9% per year, compounded quarterly, for 7 years.
- What is the value of the investment after 1 year? 2 years?
  - What is the interest earned in the 3rd year?
  - What is the interest earned in the 7th year?
6. Find the value of a \$7400 investment at 8% per year at the end of 4 years, if interest is compounded
- annually
  - semi-annually
  - quarterly
  - monthly
  - weekly
  - daily
7. When Francesca turned 8 years old, her uncle invested \$3000 at 6.5% per year, compounded semi-annually, to help pay for her education.
- What was the investment worth on Francesca's 11th birthday?
  - What was the investment worth on Francesca's 17th birthday?
8. Adrienne needs to borrow \$15 000. She plans to pay it back after 6 years.
- Her bank offers her two interest rates for the loan. Which rate should she choose?  
**Rate 1:** 9% per year, compounded semi-annually  
**Rate 2:** 8.4% per year, compounded quarterly
  - How much less interest will she need to pay if she chooses the rate from part a)?

## 8.3 Present Value



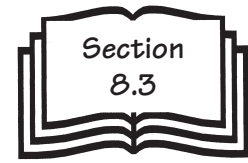
### Warm-Up

<p><b>1. Number Skills</b></p> <p>Round each number to two decimal places.</p> <p>a) 7.931                      b) 794.299</p> <p>c) 0.137                      d) 0.0015</p>	<p><b>2. Algebra</b></p> <p>Solve.</p> <p>a) <math>y + 3 = 11</math>                      b) <math>x - 3 = -1</math></p> <p>c) <math>\frac{x}{3} = -2</math>                      d) <math>2x = -10</math></p>
<p><b>3. Relations</b></p> <p>Find the <math>x</math>-intercepts and <math>y</math>-intercepts of the linear relation <math>x - 2y = 4</math>.</p>	<p><b>4. Geometry/Measurement</b></p> <p>Calculate the perimeter of each figure.</p> <p>a) a circle with radius 13 cm</p> <p>b) a rectangle with length 18 m and width 12 m</p>
<p><b>5. Data/Probability</b></p> <p>A die is rolled and a coin is tossed at the same time. What is the probability of rolling a 5 and tossing heads?</p>	<p><b>6. Problem Solving</b></p> <p>A circle has nine points on it. How many different chords can be drawn joining any two points?</p>
<p><b>7. Math Literacy</b></p> <p>What is the name for a value in a set of data that is far away from the other values?</p>	<p><b>8. Previous Section</b></p> <p>Sahar deposits \$3250 into an account that pays 5% per year, compounded quarterly. How much will the investment be worth after 3 years?</p>



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

## Practise



1. Evaluate. Round to two decimal places.

a)  $5720(1.025)^{-3}$

b)  $830(1.05)^{-6}$

2. Use the formula  $P = A(1 + i)^{-n}$  to calculate the present value of each amount.

- a) \$3000 needed in 3 years, invested at 6% per year, compounded semi-annually

$$A = \underline{\hspace{2cm}} \quad n = 3 \times 2 \quad i = 0.06 \div 2$$
$$= \underline{\hspace{2cm}} \quad = \underline{\hspace{2cm}}$$

$$P = \underline{\hspace{2cm}}$$

- b) \$995 needed in 2 years, invested at 10% per year, compounded quarterly

$$A = \underline{\hspace{2cm}} \quad n = \underline{\hspace{1cm}} \times \underline{\hspace{1cm}} \quad i = 0.10 \div \underline{\hspace{1cm}}$$
$$= \underline{\hspace{2cm}} \quad = \underline{\hspace{2cm}}$$

$$P = \underline{\hspace{2cm}}$$

- c) \$12 250 needed in 14 years, invested at 5% per year, compounded monthly

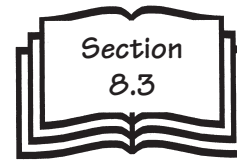
$$A = \underline{\hspace{2cm}} \quad n = \underline{\hspace{2cm}} \quad i = \underline{\hspace{2cm}} \quad P = \underline{\hspace{2cm}}$$

- d) \$9800 needed in 8 years, invested at 4% per year, compounded annually

$$A = \underline{\hspace{2cm}} \quad n = \underline{\hspace{2cm}} \quad i = \underline{\hspace{2cm}} \quad P = \underline{\hspace{2cm}}$$

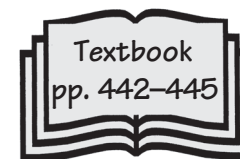
3. Sean borrowed some money at 7.5% per year, compounded semi-annually. After 3 years, he paid \$2244.92 to pay off the loan. What sum of money did Sean borrow?
4. What principal should be invested today to have \$1000 after 4 years if interest is paid at 2.8% per year, compounded quarterly?

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

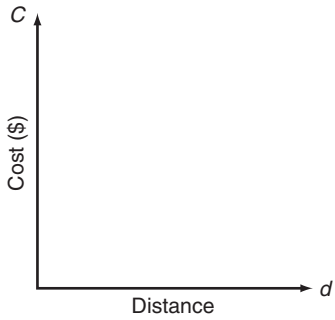


5. Anil and her husband Amir want to invest in a plan that will give their newborn daughter \$50 000 by her 20th birthday. If the plan offers a rate of 5.5% per year, compounded semi-annually, how much do they need to invest today?
6. A financial institution is willing to discount a \$25 000 loan by 3.84% per year, compounded semi-annually. The loan was originally due in 5 years.
  - a) How much is needed today to pay off the loan?
  - b) How much is the discount?
7. An investment fund pays 7.3% per year, compounded monthly. How much should a 25-year-old woman invest in the fund to have \$60 000 by her 40th birthday?
8. Nick took out a \$7000 loan, due in 4 years. If interest is 5.4% per year, compounded semi-annually, how much should Nick's creditor be willing to accept to pay off the loan today?
9. Katy will need \$40 000 in 3 years to expand her business. What is the equivalent value today, if inflation is projected to be approximately 2.5% per year, compounded annually?
10. Yi is purchasing a used vehicle from a used car lot. The car dealer offers her two payment plans.
  - Plan A:** pay \$8750 now
  - Plan B:** pay a \$1500 down payment now and \$7550 in 1 year.If interest is 4% per year, compounded semi-annually, which plan is the better deal?
  - Plan A:**
  - Plan B:**
11. Determine the number of years between the start of the loan and the repayment of the loan for each situation. Hint: use guess and check.
  - a) \$2412.66 was repaid for a loan of \$1500 at 2.4% per year, compounded monthly.
  - b) \$81 814.73 was repaid for a loan of \$58 000 at 7% per year, compounded semi-annually.

## 8.4 The TVM Solver

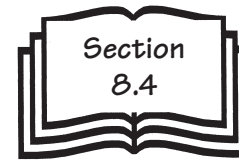


### Warm-Up

<p><b>1. Number Skills</b></p> <p>Estimate.</p> <p>a) <math>112 \div 54 + 43</math></p> <p>b) <math>\frac{212}{2} + 47 \times 2</math></p> <p>c) <math>\sqrt{142} + 23 \times 4</math></p>	<p><b>2. Algebra</b></p> <p>Solve.</p> <p>a) <math>3a + 1 = 22</math>                      b) <math>4b - 3 = -15</math></p> <p>c) <math>6c - 1 = 11</math>                        d) <math>\frac{d}{4} - 1 = 2</math></p>
<p><b>3. Relations</b></p> <p>The cost of a cab ride depends on the distance travelled. Sketch a graph of the relation.</p> 	<p><b>4. Geometry/Measurement</b></p> <p>A flagpole casts a 15-m shadow. The angle of elevation of the sun is <math>57^\circ</math>. What is the height of the flagpole?</p>
<p><b>5. Data/Probability</b></p> <p>The letters for the word TRIGONOMETRY are written on slips of paper and placed in a bag. What is the probability of drawing an T?</p>	<p><b>6. Problem Solving</b></p> <p>You are offered a 20% and a 30% discount on a pair of jeans. You can take the discounts in either order. What order will give you the lowest price?</p>
<p><b>7. Math Literacy</b></p> <p>What is the name for the difference between the greatest and least values in a set of data?</p>	<p><b>8. Previous Section</b></p> <p>How much should be invested today into an account paying 6% per year, compounded monthly, to have \$8700 in 2 years?</p>

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

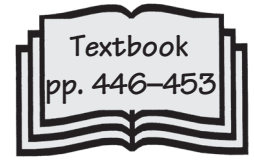
## Practise



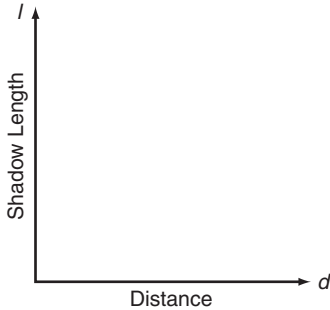
- Determine the value of a \$4500 investment after 8 years if interest is paid at 3.8% per year, compounded quarterly.
  - Set up the values for the TVM Solver:  
N = \_\_\_\_ (the number of years)  
  
I% = \_\_\_\_ (the annual interest rate as a percent)  
  
PV = \_\_\_\_ (the principal)  
  
PMT = 0 (always use 0 when there are no regular payments)  
FV = 0 (temporary value, this is what you want to find)  
P/Y = 1 (always use 1 when there are no regular payments)  
  
C/Y = \_\_\_\_ (the number of compounding periods per year)  
PMT: Choose END.
    - Enter the values into the TVM Solver. Move the cursor up to FV.  
Press **ALPHA** [SOLVE].  
Record the answer for the future value.
- Gary borrows \$7500 at 7.4% per year, compounded monthly. How much must he repay at the end of 4 years?
- A loan is worth \$83 500 is due in 7 years. If the creditor sold the loan to another creditor, discounted to 6% per year, compounded semi-annually, how much should the new creditor pay?
- Maria deposited \$2000 into an account paying 5.2% per year, compounded monthly. How long will it take for the money to grow to \$2650?
- How much money would you need to invest on your 18th birthday at 7.2% per year, compounded quarterly, to be a millionaire by the time you are 70 years old? 75 years old?

## 8.5

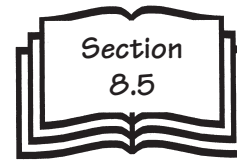
# Effects of Changing the Conditions on Investments and Loans



## Warm-Up

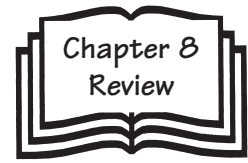
<p><b>1. Number Skills</b></p> <p>Order the fractions from least to greatest.</p> $\frac{1}{2}, \frac{1}{8}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$	<p><b>2. Algebra</b></p> <p>Solve for <math>x</math>.</p> <p>a) <math>2x + y = 3</math>                      b) <math>x + y = 2</math></p> <p>c) <math>3x + 2y = -1</math>                  d) <math>2x + 2y = 5</math></p>
<p><b>3. Relations</b></p> <p>The length of the shadow of a telephone pole on a sunny day depends on the time of day. Sketch a graph of this relation.</p> 	<p><b>4. Geometry/Measurement</b></p> <p>A 20-m ladder leans against a wall. The foot of the ladder makes a <math>68^\circ</math> angle with the ground. How far is the top of the ladder from the ground?</p>
<p><b>5. Data/Probability</b></p> <p>Gina has a deck of playing cards. She draws a card at random and replaces it. She does this 4 times and draws 4 spades. What is the probability that the fifth card Gina draws is a spade?</p>	<p><b>6. Problem Solving</b></p> <p>Two numbers differ by 6. If the numbers are squared and added, the result is 146. What are the numbers?</p>
<p><b>7. Math Literacy</b></p> <p>What is the name of the curve that fits closest to the data points in a scatter plot showing the relationship between two variables?</p>	<p><b>8. Previous Section</b></p> <p>Dmitri invests \$3300 in an account that pays 4% daily. How long will it take the investment to grow to \$4000? Use the TVM Solver.</p>

## Practise



1. Use a graphing calculator to compare the graphs of  $A = 2000(1.02)^n$  and  $A = 2000(1.06)^n$ . How does changing the compound interest rate from 2% per year to 6% per year affect the shape of the graph? What does this mean in terms of the value of the investment?
2. Calculate the future value of a \$20 000 investment over 12 years at 6% per year for each compounding period.
  - a) annually
  - b) semi-annually
  - c) monthly
  - d) weekly
  - e) daily
3. Tony hopes to have \$5000 in 2 years to buy a home theatre system. Find the amount he would need to invest at each interest rate to reach his goal.
  - a) 5% per year, compounded semi-annually
  - b) 6% per year, compounded quarterly
4. Tracy wants to invest \$36 000 for 6 years. Calculate the future value of her money for each interest rate.
  - a) 6.4% per year, simple interest
  - b) 6.0% per year, compounded monthly
5. If Sally deposits \$9000 into an investment account for 1 year at 8% per year, how much more interest will she earn by compounding
  - a) semi-annually instead of annually?
  - b) quarterly instead of annually?
  - c) monthly instead of annually?
6. Jayeed plans to invest \$9000 in a term deposit for 2 years. She has three choices.
  - Plan A:** 5.5% per year, simple interest
  - Plan B:** 5.2% per year, compounded semi-annually
  - Plan C:** 5.0% per year, compounded quarterlyWhich plan should she choose? Why?

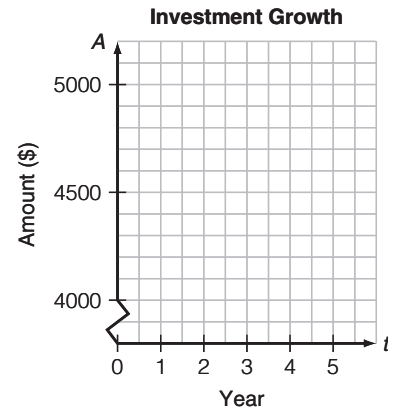
# Chapter 8 Review



## 8.1 Simple and Compound Interest, pages 422–429

1. Use the table and the graph to show the rate of growth of a \$4000 investment at both 4% simple interest and 4% annually, compounded annually, for 5 years.

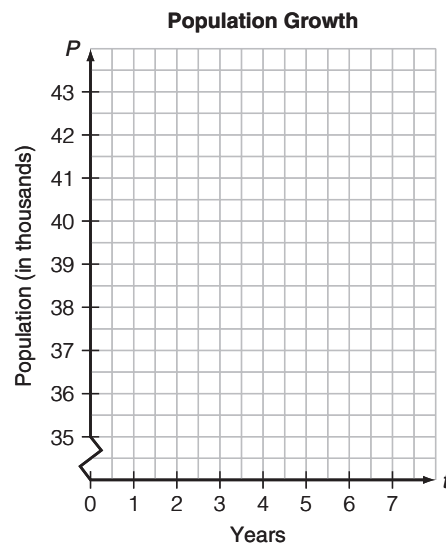
Year	Amount at 4% Simple Interest (\$)	Amount at 4% Compound Interest (\$)
0		
1		
2		
3		
4		
5		



2. The population of a small community of 35 000 is expected to grow by 2.3% per year.

- a) Use the table and the graph to show the population growth for the next 7 years.

Year	Population $P = 35\,000(1.023)^n$
1	
2	
3	
4	
5	
6	
7	

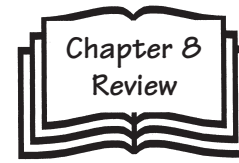


- b) How would the graph change if the population grew at a rate of 1.3% instead of 2.3%?

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

### 8.2 Compound Interest, pages 430–435

3. Determine the amount of each investment.
- a) \$800 at 6% per year, compounded quarterly, for 5 years
  
  - b) \$6800 at 7.2% per year, compounded monthly, for 6 years



4. Marin had \$10 000 to invest. He put \$4000 in an investment that pays 5.2% per year, compounded semi-annually, and the remaining amount in an investment that pays 6% per year, compounded quarterly. What will be the total value of these investments if he leaves the investments for 10 years?

### 8.3 Present Value, pages 436–441

5. Suppose you owe a sum of \$30 000 due in 6 years. Your creditor is willing to accept early payment of the loan by discounting it at 8.4% per year, compounded monthly. How much should your creditor be willing to accept to pay off the loan today?
6. Benaz wants to have \$9500 in 6 years. How much does she need to invest today at 4.8% per year, compounded quarterly, to meet her goal?

### 8.4 The TVM Solver, 442–445

7. How long will it take \$4000 to double at 8% per year, compounded quarterly?
8. How much would you need to invest on your 18th birthday at 4% per year, compounded quarterly, to have \$50 000 by your 60th birthday?

### 8.5 Effects of Changing the Conditions on Investments and Loans, page 446–453

9. Roy wants to have \$25 000 to buy a new car in 5 years. How much would he need to invest to reach his goal at
- a) 5.4% per year, compounded semi-annually
  
  - b) 4.4% per year, compounded quarterly