7.1 Explore Simple Interest and Compound Interest

Student Text Pages
346–354

Suggested Timing
75–110 min

Materials and Technology Tools
- calculators
- grid paper and rulers
- graphing software (optional)
- computers with spreadsheet software

Related Resources
- BLM G–1 Grid Paper
- BLM A–14 Self-Achievement Checklist
- BLM 7–3 Section 7.1 Explore Simple Interest and Compound Interest
- BLM 7–4 Section 7.1 Achievement Check Rubric

Teaching Suggestions

- Introduce the topic by discussing the difference between simple interest and compound interest. Explain that, with simple interest, the calculations are made on the original investment, or principal. With compound interest, interest is calculated at regular compounding intervals and added to the previous principal for the next compounding interval.

Investigate

- Students may work individually or in pairs.
- Encourage students to work through both methods if technology is available.
- Ensure that instructions are read clearly and followed closely.
- Stress the difference in the growth rates of simple interest and compound interest.
- Discuss as a class or in a group at the end to ensure big ideas have been grasped by students.

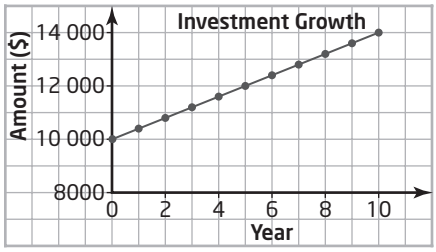
Investigate Responses (page 346-347)

Method 1

1.

Year	Principal, P ($)	Simple Interest Earned Each Year ($)	Accumulated Interest ($)	Amount at End of Year ($)
1	10 000	$10\,000(0.04)(1) = 400$	400	$10\,000 + 400 = 10\,400$
2	10 000	400	$400 + 400 = 800$	$10\,000 + 800 = 10\,800$
3	10 000	400	$800 + 400 = 1200$	$10\,000 + 1200 = 11\,200$
4	10 000	400	$1200 + 400 = 1600$	$10\,000 + 1600 = 11\,600$
5	10 000	400	$1600 + 400 = 2000$	$10\,000 + 2000 = 12\,000$
6	10 000	400	$2000 + 400 = 2400$	$10\,000 + 2400 = 12\,400$
7	10 000	400	$2400 + 400 = 2800$	$10\,000 + 2800 = 12\,800$
8	10 000	400	$2800 + 400 = 3200$	$10\,000 + 3200 = 13\,200$
9	10 000	400	$3200 + 400 = 3600$	$10\,000 + 3600 = 13\,600$
10	10 000	400	$3600 + 400 = 4000$	$10\,000 + 4000 = 14\,000$

2.

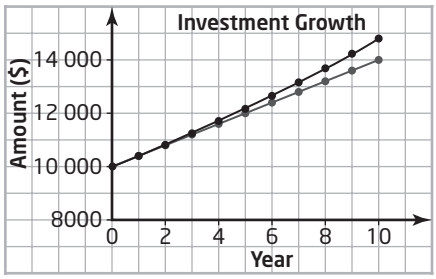


3. An investment earning simple interest is an example of a linear rate of growth. The first differences for the amount at the end of each year are constant.

4.

Year	Amount at Start of Year ($)	Compound Interest Earned Each Year ($)	Accumulated Interest ($)	Amount at End of Year ($)
1	10 000	10 000(0.04)(1) = 400.00	400.00	10 000 + 400.00 = 10 400.00
2	10 400	10 400(0.04)(1) = 416.00	400.00 + 416.00 = 816.00	10 000 + 816.00 = 10 816.00
3	10 816	10 816(0.04)(1) = 432.64	816.00 + 432.64 = 1248.64	10 000 + 1248.64 = 11 248.64
4	11 248.64	11 248.64(0.04)(1) = 449.95	1248.64 + 449.95 = 1698.59	10 000 + 1698.59 = 11 698.59
5	11 698.59	11 698.59(0.04)(1) = 467.94	1698.59 + 467.94 = 2166.53	10 000 + 2166.53 = 12 166.53
6	12 166.53	12 166.53(0.04)(1) = 486.66	2166.53 + 486.66 = 2653.19	10 000 + 2653.19 = 12 653.19
7	12 653.19	12 653.19(0.04)(1) = 506.13	2653.19 + 506.13 = 3159.32	10 000 + 3159.32 = 13 159.32
8	13 159.32	13 159.32(0.04)(1) = 526.37	3159.32 + 526.37 = 3685.69	10 000 + 3685.69 = 13 685.69
9	13 685.69	13 685.69(0.04)(1) = 547.43	3685.69 + 547.43 = 4233.12	10 000 + 4233.12 = 14 233.12
10	14 233.12	14 233.12(0.04)(1) = 569.32	4233.12 + 569.32 = 4802.44	10 000 + 4802.44 = 14 802.44

5.



6. Both graphs are increasing but the rate of change of the second (black) graph is increasing at a slightly greater rate each year. So, the difference between the two amounts is increasing every year.

7. The rate of growth for an investment earning compound interest is exponential. You can justify this in two ways. If you divide each year-end amount by the amount for the previous year, you get a constant ratio of 1.04. If you examine the first differences and second differences, neither is constant, which eliminates the possibility of the function being linear or quadratic.

Method 2

The use of a spreadsheet will deliver identical tables, graphs, and conclusions to those obtained for Method 1.

Examples

- Determine students' prior knowledge of calculating simple interest; for example, the use of the interest formulas $I = Prt$ and $A = P + I$.

- Time may not permit working through the examples in detail. Have students read through the examples independently or in small groups before reviewing the examples as a class.

Communicate Your Understanding

- In **question C1**, have students identify the flaw in Adrianna's thinking. Ask students to always convert a percent to a decimal for interest calculations and check that the solution is reasonable. By common sense, $360 is an unreasonable amount of interest for the GIC investment. Dylan does not calculate the interest earned but he is correct.
- You may wish to use **BLM 7–3 Section 7.1 Explore Simple Interest and Compound Interest** for remediation or extra practice.

Communicate Your Understanding Responses (page 352)

C1 Dylan is correct. If the investment pays 3% per year, the interest for one year must be 3% of $2000, which is $60 according to the simple interest formula. Six months is half of one year, so the correct amount would be half of $60, or $30. The error that Adrianna makes relates to the unit of t. The unit of t must be the same as the time unit specified for the interest rate, r. She uses t in months rather than years. Her answer would have been correct for a 6 year certificate.

C2 No matter how long the term of investment is, the simple interest is calculated based on the same principal invested at the beginning. Compound interest is calculated at regular compounding intervals and then added to the principal for the next compounding interval. The investment then earns interest on the interest already paid. So, the total amount of an investment earning compound interest is greater than the total amount of an investment earning simple interest at the end of the same term. This argument is valid as long as the same interest rate is applied to both situations. It is possible for simple interest to outperform compound interest over the same term if the simple interest rate is high enough to outperform the effect of compounding.

Practise, Connect and Apply, Extend

- While most questions are calculator driven, encourage students to reflect on the reasonableness of the answer provided by the calculator (similar to what Dylan does in **question C1**).
- Depending on the ability of the students, not all parts of all questions need be assigned.
- In **question 6**, ensure that students know that the management fee is subtracted from any earnings.
- **Questions 7, 9, and 11** specify the use of technology: a spreadsheet or a graphing calculator can be used if available.
- **Question 14** is an Achievement Check question. Provide students with **BLM 7–4 Section 7.1 Achievement Check Rubric** to help them understand what is expected.
- **Question 15** incorporates many of the concepts from this section and can be used as a formative assessment.

Achievement Check Sample Solution (page 354, question 14)

a) In the first year, the growth of option A is greater as it pays 4.4% of $5000, or $220 interest whereas option B pays 4.2% of $5000, or $210 interest.

b) Answers may vary. For example, it is difficult to predict whether the effect of compounding will offset the 0.2% more simple interest at the end of 5 years without calculating the difference in interest earned for the 5 years.

Common Errors

- Some students may have difficulty understanding the concept of compound interest.

R$_x$ Have students compare the growth columns in the Investigate. Highlight how the interest is added on to the previous amount with compound interest, but not with simple interest.

Ongoing Assessment

- While students are working, circulate to observe how well each works. This is an opportunity to observe and record individual student's learning skills.
- **Question 14** is an Achievement Check question. Use **BLM 7–4 Section 7.1 Achievement Check Rubric** as a summative assessment tool.

Accommodations

Visual–use a prepared template for the spreadsheet activity; provide larger copies of graphs

Motor–use technology for graphing

Memory–provide a list of definitions for key terms

Student Success

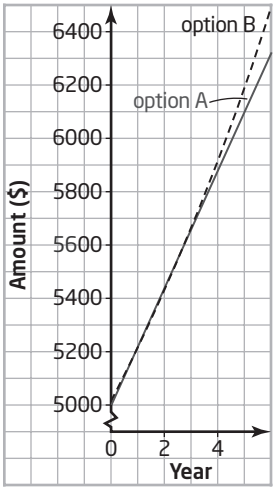
- Provide students with **BLM A–14 Self-Assessment Checklist** to help them find out, through their work in this section, what areas they could improve themselves.

c) **A:** 4.4% simple interest

Year	Amount at Start ($)	Interest ($)	Amount at End of Year ($)
1	5000	220	5220
2	5000	220	5440
3	5000	220	5660
4	5000	220	5880
5	5000	220	**6100**

B: 4.2% interest, compounded annually

Year	Amount at Start ($)	Interest ($)	Amount at End of Year ($)
1	5000	210	5210
2	5210	218.82	5428.82
3	5428.82	228.01	5656.83
4	5656.83	237.59	5894.42
5	5894.42	247.57	**6141.99**



d) The two investments are approximately equal in value after 3 years.

e) After 3 years, option B starts to have a greater growth in investment value than option A. The difference in growth increases as time increases. So, the difference between the values of the two investments will be greater if the term of the GIC is extended to 9 years.

Literacy Connections

- Encourage students to make a personal dictionary of financial terms as they work through this chapter.

Mathematical Processes Integration

The table shows questions that provide good opportunities for students to use the mathematical processes.

Process Expectations	Selected Questions
Problem Solving	6, 10, 12–14
Reasoning and Proving	5, 6, 10, 12, 14
Reflecting	5, 12, 14
Selecting Tools and Computational Strategies	1–15
Connecting	5–7, 9–12, 14, 15
Representing	5, 7, 9, 11, 13–15
Communicating	5–12, 14