8.2 Present Value of an Ordinary Simple Annuity

Student Text Pages
390–396

Suggested Timing
75–110 min

Materials and Technology Tools
- computer with Internet access
- TVM solver

Related Resources
- BLM A–9 Communication General Scoring Rubric
- BLM 8–5 Section 8.2 Present Value of an Ordinary Simple Annuity

Teaching Suggestions

- Some students may find it difficult to know when to apply the present value formula. The language used in the questions can be hard to follow, so students may have difficulty knowing if the problem involves present value or may have trouble figuring out the time periods involved. Provide discussion and explanations to help students identify when a present value problem presents itself.

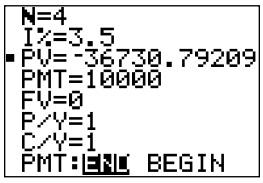
Investigate

- Students may work individually or in pairs.
- Ensure that instructions are read clearly and followed in detail.
- Discuss as a whole group to ensure the larger concepts have been grasped by students. Stress the connection to the concepts of the previous chapter.
- Students should be encouraged to use on-line calculators if available if they do not own a graphing calculator.

Investigate Responses (pages 390–391)

Method 1

7. The student should duplicate the screen capture shown in the text.



The present value of the four payments is $36 730.79.

8. Paula will need $36 730.79 in the bank one year before she starts university in order to be able to make four annual withdrawals of $10 000.

Method 2

Results for questions 1 to 7 should be identical to the results using Method 1.

8. a) The new present value will be $58 769.27. This value could also be obtained by multiplying the previous present value by 1.6. If the conditions of time and interest do not change, the present value of $1 is constant for those conditions. The size of the payment required and the present value required for that payment must be a linear proportion.

b) Answers may vary. Aside from financial constraints, Paula might choose to attend a local university due to a desire to stay close to family or friends. A fear of the new and unknown could also be a factor.

c) Answers may vary. A desire for independence, a wish to be with friends, choice of programs, and academic reputation could be factors in choosing a university out of town.

Example

- Stress the connection between the treatment of present value in the previous chapter and here.
- Work through the **Example** with the class; three methods are given.
- Some students will benefit from creating time lines.

Communicate Your Understanding

- These can be done as a whole group discussion.
- Help students obtain a clear understanding of the concept in **question C1** by working through one or two examples.
- An example may help to illustrate **question C2**. Often, people underestimate the effects of time. The earlier someone begins to save or invest money for a specific goal, the smaller the actual amount saved needs to be.
- You may wish to use **BLM 8–5 Section 8.2 Present Value of an Ordinary Simple Annuity** for remediation or extra practice.

Communicate Your Understanding Responses (page 395)

C1 Elise is not correct although she has a correct sense of the effect of a negative exponent. In the case of the present value of a single payment she would be correct. However, the annuity formula expresses the **sum** of the present values for a series of payments. As the individual present values are added, the sum will rapidly become larger than the value of a single payment. This is particularly clear if you consider the present values for the first two payments to be made. Unless interest is paid at a rate of greater than 100%, the present value of these two payments must be greater than the value of an individual payment.

C2 Answers may vary. In terms of planning for retirement, it makes it possible to identify the lump sum needed at the time a person retires to support a series of regular payments for the following years. When combined with the future value formula, the person can then make a savings plan to achieve the lump sum that will be required.

C3 In the first case, if you know the regular payment to be made on an item, the number of payments, and interest rate being charged, you can use the present value formula to find the value which was financed at the time of purchase. In this case, the bank gives you money now (the present value of the payments about to be made) and you make regular payments. If you want to receive regular payments, the formula and calculations are identical. The difference is in the direction the money travels. You start by investing a lump sum instead of borrowing it then you receive regular payments instead of paying them.

C4 Large expenses often have to be paid over time. Most people have to finance a home purchase over time, make regular payments to pay for motor vehicles, and large household items such as furniture, appliances, and home electronics. If you know the monthly payments you can afford and the time for which you are willing to pay them, you can use the present value formula to calculate how much you can afford to spend now. If you know the amount you have to spend now, you can use the present value formula to figure out combinations of payment sizes and repayment periods that will repay the debt you owe.

Practise, Connect and Apply, Extend

- For some students not all parts of all questions need be assigned. Other students may benefit from completing all the questions.
- Students should be encouraged to refer to the worked Example if any difficulties arise.
- Ensure students understand that **questions 2 to 4** relate to **question 1**.
- **Questions 5 to 11** can be solved easily using a TVM solver or an on-line calculator. The use of technology should be stressed throughout this chapter. It may benefit some students to research advertisements as an alternative approach or as a supplement to question 7. Some students may benefit from starting questions 7 to 9 and 11 by constructing a time line. Student should be encouraged to keep their notes and calculations separate for question 11, the Chapter Problem.
- **Question 12** should be assigned to students with strong algebraic skills.

Ongoing Assessment

- Assess students' mathematical communication. You may wish to use **BLM A–3 Communication General Scoring Rubric** to assist you.

Common Errors

- Some students may not understand why the exponent is negative in the present value formula.

R$_x$ If the derivation of the formula does not help, explain that working backwards in time is like going from right to left on the time line. In other words, moving on a number line in the negative direction.

Accommodations

Perceptual–provide a handout with colour-coded compounding period information

Language–encourage students to work in pairs for reading support

Mathematical Processes Integration

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

Process Expectations	Selected Questions
Problem Solving	7– 9, 11–13
Reasoning and Proving	10
Reflecting	13
Selecting Tools and Computational Strategies	2–13
Connecting	7–9
Representing	1, 2, 12
Communicating	4, 10