8.3 Present Value

Student Text Pages
436–441

Suggested Timing
80 min

Tools
• calculators

Related Resources
BLM 8-7 Section 8.3 Present Value
BLM A-9 Communication General Scoring Rubric

Link to Get Ready

Students should have completed **question 7** before proceeding with this section.

Warm-Up

1. Find i, the interest rate per compounding period, and n, the number of compounding periods, for each.
a) 4% per year for 2 years, compounded semi-annually
b) 6% per year for 5 years, compounded monthly
c) 8% per year for 3 years, compounded quarterly

2. Evaluate. Round your answers to four decimal places.
a) 3^{-1} **b)** 1.02^{-2} **c)** 1.06^{-10} **d)** 1.03^{-24} **e)** $200(1.04)^{-6}$

Warm-Up Answers

1. a) $i = 0.02$, $n = 4$ **b)** $i = 0.005$, $n = 60$ **c)** $i = 0.02$, $n = 12$
2. a) 0.3333 **b)** 0.9612 **c)** 0.5584 **d)** 0.4919 **e)** 150.0629

Teaching Suggestions

- Students find Present Value a difficult concept. It is not the mathematical formula that they find difficult, but understanding when to apply it. This is often because of the language skills involved and learning a sense of time. Provide discussion and explanations to help students identify when a present value problem presents itself.

Warm-Up

- Write the Warm-Up questions on the board or on an overhead. Have students complete the questions independently. Then, discuss the solutions as a class.

Section Opener

- Ask the students to read the opener. Ask them what they would do: would they pay the $2399.99 now or take the installment plan?. Have them record their answers, along with a rationale. Tell them they will return to this problem after the lesson.

Investigate

- This Investigate is important to help students understand growth factors, before applying them to compound interest and present value.

Investigate Answers (pages 436-437)

1. a) 1, 2, 4, 8, 16, 32, 64

b) 2

2. a) 8, 12, 18, 27, 40.5, 60.75, 91.125, 136.6875

b) 1.5

3. a) 3

b) 1458, 486

c) Divide the term 4374 by the growth factor 3 to get 1458. Repeat this step to get the second previous term.

4. a) By repeatedly dividing the growth factor 5, I can find the previous terms.

b) 1875, 375

Examples

- Remind students of the meanings of i and n. Go through the development of the present value formula. You may wish to use an example, such as Example 1 to illustrate the derivation of the formula. Comment that time is negative in the formula because, when finding the present value, we are working backwards in time.
- The Examples illustrate that investments and debts both use the same formula. Stress that one person's debt is another person's investment.

Key Concepts

- Review the formulas for amount and present value. Ask the students to relate each formula to a direction on the time line.

Discuss the Concepts

- **Question D1** is a good literacy question, getting students to explain *amount* and *principal* in their own words. Have students work in pairs to complete the question.
- **Question D4** gives an opportunity to discuss the opening TV advertisement more fully.

Discuss the Concepts Suggested Answers (page 439)

D1. *Amount* is the money value received or paid at the end of a term, while *principal* is the beginning value.

D2. Principal will have a smaller value (assuming the interest rate is positive), since $A = P(1 + i)^n$.

D3. Answers may vary. Sample answer: the value of i is 6% ÷ 4 or 0.015, n is 4 ×2 or 8. Try successive guesses for P in $A = P(1.015)^8$ until the value $A = 4000$ is obtained. Since the interest rate is small, the principal will not grow much in 2 years. You might try 3500 as the first guess for P. Alternatively, use the PV formula with $A = 4000$, $i = 0.015$, and $n = 8$. Key in 4000 [×] 1.015[y^x] − 8 [=]. The answer obtained is $3550.84.

D4. Answers may vary. Sample answer: Interest rates and payment periods should be taken into consideration.

Practise (A)

- **Questions 1 to 3** are important to consolidate learning of the basic concepts.

Common Errors

- Some students may not understand why the exponent is negative on 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 partners for reading support

Apply (B)

- Instruct students to look at their answers and determine, through estimation, whether their answers are reasonable.
- Remind students that the present value must be less than the amount.
- **Question 9** links to the Chapter Problem. It is a good ongoing case study of a family's investments. Remind students to keep the solution to this question handy as the methods they used may help them with the Chapter Problem Wrap-Up.

Extend (C)

- Assign the Extend questions to students who are not being challenged by the questions in Apply.
- In **question 14**, students will need to find the final amount at 4.2% and the present value of that amount at 4.8%.

Mathematical Process Expectations

Process Expectation	Questions
Problem Solving	10–16
Reasoning and Proving	10, 16
Reflecting	n/a
Selecting Tools and Computational Strategies	1–16
Connecting	n/a
Representing	n/a
Communicating	n/a

Ongoing Assessment

- Assess students' mathematical communication. You may wish to use **BLM A-9 Communication General Scoring Rubric** to assist you.

Extra Practice

- You may wish to use **BLM 8-7 Section 8.3 Present Value** for remediation or extra practice.