

7.3

Present Value

Student Text Pages

362–366

Suggested Timing

75 min

Materials and Technology Tools

- calculators

Related Resources

- BLM A–9 Communication General Scoring Rubric
- BLM 7–7 Section 7.3 Present Value

Teaching Suggestions

- As calculating the present value in this section can be thought of as the reverse of calculating the amount in Section 7.2, many of the strategies from Section 7.2 may be employed.
- Students may find present value a difficult concept. It is not the formula that they find difficult, but rather when they should apply the formula. Provide discussion and explanations to help students identify when a present value problem presents itself.

Investigate

- The trial-and-error method suggested may lead to a better understanding of the present value formula.

Investigate Responses (page 362)

Answers may vary.

1. A reasonable estimate might involve finding the simple interest on \$3000 at 4.5% per year for 2 years.

$$\begin{aligned} I &= Prt \\ &= \$3000(0.045)(2) \\ &= \$270 \end{aligned}$$

Subtract this amount from \$3000 to obtain an estimate in the range \$2700–\$2750.

2. All answers should be of the form:

$$FV = \text{Estimated present value} \times (1.00375)^{24}$$

For an estimate of \$2700,

$$\begin{aligned} FV &= \$2700(1.00375)^{24} \\ &\doteq \$2953.77 \end{aligned}$$

- 3.

PV	$FV = PV(1.00375)^{24}$	
Try \$2700.	$\$2700(1.00375)^{24} \doteq \2953.77	too low
Try \$2750.	$\$2750(1.00375)^{24} \doteq \3008.47	too high
Try \$2740.	$\$2740(1.00375)^{24} \doteq \2997.53	still low, but very close
Try \$2742.	$\$2742(1.00375)^{24} \doteq \2999.72	only \$0.28 short
Try \$2743.	$\$2743(1.00375)^{24} \doteq \3000.81	just \$0.81 over

A present value of \$2743 would guarantee a future value of \$3000.

Alternatively, you may use a graphing calculator to get a more accurate present value.

Enter $Y1 = (X,T,θ,n) 1.00375 \leftarrow 24$

Press $\left[2^{nd}\right]$ [TBLSET] to access TABLE SETUP.

Set **Indpnt** to **Ask**.

Press $\left[2^{nd}\right]$, **GRAPH**.

X	Y1
2750.0	3008.5
2742.0	2999.7
2742.3	3000.0
2742.5	3000.0

$X=2742.26$

An input value of \$2742.25 comes up a penny short. An input value of \$2742.26 comes up a penny over. To get at least \$3000, the present value is \$2742.26.

Examples

- Ensure that students work through both examples.
- Two common applications of present value are used in the examples. **Example 1** finds the present value of an investment when the future value is known or desired. **Example 2** finds the present value that will pay off a debt today, thereby eliminating further interest charged until the due date.
- Remind students of the meanings of i and n before substituting into the formula for present value.

Communicate Your Understanding

- For **question C1**, have students state or write the two different versions of the present value formula.
- Students could work in pairs on **question C2** and share their opinions with other student pairs.
- You may wish to use **BLM 7–7 Section 7.3 Present Value** for remediation or extra practice.

Communicate Your Understanding Responses (page 365)

- C1** To isolate the present value using the future value formula $FV = PV(1 + i)^n$, John should divide both sides of the equation by $(1 + i)^n$.

$$\frac{FV}{(1 + i)^n} = \frac{PV(1 + i)^n}{(1 + i)^n}$$

$$\frac{FV}{(1 + i)^n} = PV$$

John's formula $PV = \frac{FV}{(1 + i)^{-n}}$ is incorrect. He should have a positive exponent n in his formula.

- C2** The amount owed to a finance company on the due date reflects both the principal borrowed and the interest charged over the period of time that the money is not paid back. A finance company might accept a lesser payment before the due date if the money paid back can be lent to someone else to earn the same interest or more.

For example, a payment of \$2000 is due in 15 days and interest is charged at 10% per year, compounded daily. The finance company might accept an immediate payment based on the present value of \$2000 at this annual interest rate. In actual practice, the company may charge either a penalty or base the present value at a lower interest rate than 10% to ensure that the company would be earning more interest during the 15 days than expected.

Practise, Connect and Apply, Extend

- Depending on the skill level of the students, not all parts of all questions need be assigned.
- You may wish to demonstrate the skills required by doing the first part of **questions 1, 2, and 4**.
- For **questions 1 to 4**, ensure that students understand that the answer, the present value, must be less than the amount or the loan.
- **Questions 5 to 8** are fairly straightforward applications of the present value formula that reinforce the concept of present value without any unforeseen problems.
- For **questions 11 and 12**, students may benefit from employing earlier strategies such as drawing a time line. Ask students to sketch a time line to organize the information before attempting to make any calculations.

Common Errors

- Some students may be confused with present value and future value.
- R_x** Have students understand that when calculating present value, the answer must be less than the amount stated in the question.

Ongoing Assessment

- Assess students' mathematical communication based on their responses to the Communicate Your Understanding questions. You may wish to use **BLM A-9 Communication General Scoring Rubric** to assist you.

Accommodations

Gifted and Enrichment—for **question 12**, research the actual selling price of a house for sale and its minimum down payment; also research an actual investment option offered by a financial institution and find how much needs to be invested today for the minimum down payment in 5 years.

Student Success

- Remind students that they need to be sure of the meanings of FV , i , and n in the formula $PV = FV(1 + i)^{-n}$ before substituting the values of the variables to calculate present value.

Career Connections

- Draw students' attention to the Career Connection on page 366. Students who are interested in the account manager career described might also be interested in the following related careers:
 - bank teller
 - accounts payable clerk
 - accounts receivable clerk
 - payroll clerk
 - financial administrative assistant
 - financial analyst
 - accountant
- Ask students to choose one the related careers that interest them most. Research on the qualification and skills required for the job, such as university/college education or training.
- You may also ask students to list problems that they might have to solve or difficulties they expect to overcome in the job.

Mathematical Processes Integration

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

Process Expectations	Selected Questions
Problem Solving	3, 5–12
Reasoning and Proving	11
Reflecting	n/a
Selecting Tools and Computational Strategies	1–12
Connecting	3, 5–12
Representing	n/a
Communicating	11