
Challenge 1: Solution Guide

The questions in this challenge could be answered at any point in the chapter through research, but the answers will make more sense in section 2.12. After section 2.5, students should be familiar with the financial, but not necessarily mortgage, terms. When students research the Chapter Problem, remind them to read Challenge 1 and to research mortgages as well. As for the Chapter Problem, supervise students' visits to financial institutions. Some students may have Internet access at home. If resources are limited, ensure that answers are individual and that technical language is student friendly. Student answers will vary. Note that the following information is current as of February 28, 2001.

Joe and Anne want to buy a house that costs \$148 000. They know very little about mortgages or how to qualify for a mortgage. Here are some of their questions.

- *What does it mean to qualify for a mortgage?*

An applicant qualifies for a mortgage if

$$\frac{\text{mortgage payment} + \text{taxes} + \text{heating} + \text{hydro}}{\text{gross income}} \leq 32\%$$

and

$$\frac{\text{mortgage payment} + \text{taxes} + \text{heating} + \text{hydro} + \text{other debts}}{\text{gross income}} \leq 40\%$$

A notice of assessment (about income tax), pay stubs, or a letter of employment are documents that verify gross income.

- *What is the minimum down payment required for a mortgage?*

Five percent is the minimum down payment required for a mortgage; this adds 3.75% of the mortgage balance to the cost. If the down payment is less than 25%, mortgage insurance is required.

- *What are some of the advantages of making a larger down payment?*

For a larger down payment, the home buyer will not pay mortgage insurance, each payment is less, and the amortization period could be reduced. All these factors in turn reduce the interest paid. (Generally, a 25-year amortization period triples the cost of the dwelling.)

- *Can all or a portion of an RRSP be used as collateral or as a deposit?*

No. Up to \$20 000 of an individual's RRSP holdings can be used as a portion of the down payment, but an RRSP withdrawal must be replenished within 15 years.

- *What are the terms and conditions of a mortgage?*

Some of the terms and conditions of a mortgage are the interest rate; the amount; the amortization term or period; principal repayment; type (open, closed, or variable); portable; principal payback; double up; and pay own taxes.

- *Is it possible to make extra payments or to increase the payments? Is it also possible to change the terms of a mortgage or to make an "early renewal"?*

It is possible to make extra payments up to a pre-established limit without penalty; at some institutions, the limit is 20% per year of the original mortgage amount. If the mortgage is "open," it is possible to change the terms of the mortgage, but if the mortgage is "closed," it is not possible. It is possible to make an early renewal, depending on the financial institution (the mortgagee).

- *What are the current interest rates on mortgages? What is an affordable monthly mortgage payment?*

The newspaper of a large city supplies current interest rates, but often institutions offer rates up to 1% lower than quoted. An affordable monthly mortgage payment is about one-third of an individual's net income.

CHAPTER 2: RUBRIC FOR CHALLENGE 1

Assessment Category	Scores and Criteria			
	Passable level of achievement – below provincial standard LEVEL 1	Moderate level of achievement – below, but approaching provincial standard LEVEL 2	High level of achievement – at provincial standard LEVEL 3	Very high to outstanding level of achievement – above provincial standard LEVEL 4
Knowledge and Understanding				
Demonstration of understanding of a concept	Attempted solution demonstrates limited understanding of Canadian mortgages.	Solution demonstrates some evidence of understanding of Canadian mortgages.	Solution demonstrates sufficient evidence to show understanding of Canadian mortgages.	Detailed solution demonstrates thorough understanding of Canadian mortgages.
Thinking, Inquiry, Problem Solving				
Justification of reasoning and/or conclusion	Reasoning is evident but lacks consistency.	Reasoning is evident and logical in parts of the problem.	Reasoning is logical and consistent within the context of the problem.	Reasoning is logical and consistent and relates to broader context.
Communication				
Ability to read and interpret mathematics	The student gathers limited but accurate information from brochures or the Internet.	The student gathers some information from brochures or the Internet but has difficulty interpreting the information.	The student gathers sufficient information from brochures or the Internet and interprets the information correctly.	The student gathers complex information from brochures or the Internet and interprets the information fully.
Integration of narrative and mathematical forms (graphs, charts, and diagrams)	The student uses mathematical or narrative forms, but not both.	The student uses mathematical or narrative forms, but does not integrate them.	The student uses mathematical and narrative forms and integrates them.	The student chooses a variety of mathematical and narrative forms and integrates them.
Degree of clarity in explanations and justifications	Explanations and justifications lack clarity.	Explanations and justifications are understandable but lack clarity.	Explanations and justifications are clear.	Explanations and justifications are clear and thorough.
Application				
Use of concepts and procedures in an unfamiliar setting.	The student needs help to formulate a plan to begin the problem.	The student has some ideas about how to proceed but needs significant clarification to continue.	The student has a good idea about how to proceed and needs minimal clarification to continue.	The student proceeds through the problem with no outside intervention.

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Challenge 2: Solution Guide

Section 2.8 provides almost all of the mathematical tools for the solution of this challenge. The question will make sense after students have had some experience with annuities. Students could start the solution after section 2.5.

- (a) The endowment must yield \$1200 interest every three months to pay for the scholarship, without depleting the endowment. This arrangement is to continue “forever.”

Let the endowment be x . The scholarship equals the interest on the endowment.

$$\begin{aligned} I &= Prt \\ 1200 &= x(0.02)(1) \\ 60\,000 &= x \end{aligned}$$

A deposit of \$60 000 will yield \$1200 interest in three months at 8%/a, compounded quarterly. This arrangement would continue forever, as long as the interest rate remains constant.

- (b) In this situation, the endowment must grow to \$60 000 in 21 months so that it will earn \$1200 interest in the three months before the scholarship is granted. The endowment must then earn interest for 21 months, or seven quarters, to accumulate to \$60 000.

$$\begin{aligned} P &= A(1+i)^{-n} \\ P &= 60\,000(1.02)^{-7} \\ P &\doteq 60\,000(0.870\,560\,178\,6) \\ P &= 52\,233.61 \end{aligned}$$

\$52 233.61 deposited now will accumulate to \$60 000 in 21 months and, in 3 months from now, \$1200 can be awarded as a scholarship. This arrangement can continue forever.

CHAPTER 2: RUBRIC FOR CHALLENGE 2

Assessment Category	Scores and Criteria			
	Passable level of achievement – below provincial standard LEVEL 1	Moderate level of achievement – below, but approaching provincial standard LEVEL 2	High level of achievement – at provincial standard LEVEL 3	Very high to outstanding level of achievement – above provincial standard LEVEL 4
Knowledge and Understanding				
Performance of an algorithm by hand, mentally, or using technology	Some of algorithm performed but may contain inaccuracies.	Most of algorithm performed but may contain inaccuracies.	Algorithm performed completely; most computations generally correct.	Algorithm performed completely, accurately and verified or supported.
Demonstration of understanding of a concept	Attempted solution demonstrates limited understanding of interest and present value.	Solution demonstrates some evidence of understanding of interest and present value.	Solution demonstrates sufficient evidence to show understanding of interest and present value.	Detailed solution demonstrates thorough understanding of concept interest and present value.