F Math 12

2.1 Analyzing Loans p. 80

Name _____

Date _____

Goal: Solve problems that involve single payment loans and regular payment loans.

1. **collateral**: An asset that is held as security against the repayment of a loan.
2. **amortization table**: A table that lists regular payments of a loan and shows how much of each payment goes toward the interest charged and the principal borrowed, as the balance of the loan is reduced to zero.
3. **mortgage**: A loan usually for the purchase of real estate, with the real estate purchased used as collateral to secure the loan.

Investigate the Math

Lars borrowed $12 000 from a bank at 5%, compounded monthly, to buy a new personal watercraft. The bank will use the watercraft as **collateral** for the loan. Lars negotiated regular loan payments of $350 at the end of each month until the loan is paid off. Lars set up an **amortization table** to follow the progress of his loan.

Lars's Amortization Table

Payment Period (month)	Payment ($)	Interest Paid ($) $\left[\text{Balance} \cdot \left(\frac{0.05}{12}\right)\right]$	Principal Paid ($) [Payment − Interest]	Balance ($)
0				12 000.00
1	350	50.00	300.00	11 700.00
2	350	48.75	301.25	11 398.75

How much will Lars still owe at the end of the first year?

A. Complete Lars's amortization table for the first year.

Payment Period (month)	**Payment ($)**	**Interest Paid ($)** $\left[Balance \cdot \left(\frac{0.05}{12}\right)\right]$	**Principal Paid ($) [Payment – Interest Paid]**	**Balance ($)**
2	350	48.75	301.25	11 398.75
3	350			
4	350			
5	350			
6	350			
7	350			
8	350			
9	350			
10	350			
11	350			
12	350			

B. At the end of the first year,

i) how much has Lars paid altogether in loan payments?

ii) how much interest has he paid altogether?

iii) how much of the principal has he paid back?

C. At the end of the first year, what is the balance of Lars's loan?

Example 1: Solving for the term and total interest of a loan with regular payments (p.81)

As described on page 80, Lars borrowed $12 000 at 5%, compounded monthly. After 1 year of payments, he still had a balance owing.

a) In which month will Lars have at least half of the loan paid off?
b) How long will it take Lars to pay off the loan?
c) How much interest will Lars have paid by the time he has paid off the loan?

N =

I% =

PV =

PMT =

FV =

P/Y =

C/Y =

Example #2: Solving for the future value of a loan with a single loan payment (p.83)

Trina's employer loaned her $10 000 at a fixed interest rate of 6%, compounded annually, to pay for college tuition and textbooks. The loan is to be repaid in a single payment on the maturity date, which is at the end of 5 years.

a) How much will Trina need to pay her employer on the maturity date? What is the accumulated interest on the loan?

b) Graph the total interest paid over 5 years. Describe and explain the shape of the graph.

c) Suppose the interest was compounded monthly instead. Graph the total interest paid over 5 years. Compare it with your annual compounding graph from part b).

N =

I% =

PV =

PMT =

FV =

P/Y =

C/Y =

Example #3: Solving for the present value and interest of a loan with a single payment (p.86)

Annette wants a home improvement loan to renovate her kitchen. Her bank will charge her 3.6%, compounded quarterly. She already has a 10-year GIC that will mature in 5 years. When her GIC reaches maturity, Annette wants to use the money to repay the home improvement loan with one payment. She wants the amount of the payment to be no more than $20 000.

a) How much can she borrow?

b) How much interest will she pay?

Solve by hand and then check using the TVM Solver

Example #4: Solving for the payment and interest of a loan with regular payments (p. 87)

Jose is negotiating with his bank for a **mortgage** on a house. He has been told that he needs to make a 10% down payment on the purchase price of $225 000. Then the bank will offer a mortgage loan for the balanceat 3.75%, compounded semi-annually, with a term of 20 years and with monthly mortgage payments.

a) How much will each payment be?
b) How much interest will Jose end up paying by the time he has paid off the loan, in 20 years?
c) How much will he pay altogether?

N =

I% =

PV =

PMT =

FV =

P/Y =

C/Y =

Example #5: Relating payment and compounding frequency to interest charged (p.89)

Bill has been offered the following two loan options for borrowing $8000. What advice would you give?

> Option A: He can borrow at 4.06% interest, compounded annually, and pay off the loan in payments of $1800.05 at the end of each year.
>
> Option B: He can borrow at 4.06% interest, compounded weekly, and pay off the loan in payments of $34.62 at the end of each week.

N =

I% =

PV =

PMT =

FV =

P/Y =

C/Y =

In Summary

Key Ideas

- The large majority of commercial loans are compound interest loans, although simple interest loans are also available.
- The cost of a loan is the interest charged over the term of the loan.
- A loan can involve regular loan payments over the term of the loan or a single payment at the end of the term.
- The same formulas that are used for investment situations are also used for loans with a single payment at the end of the term:
  - For a loan that charges simple interest, $A = P + Prt$ or $A = P(1 + rt)$
  - For a loan that charges compound interest, $A = P(1 + i)^n$
- Technology can be used to determine unknown variables in compound interest loan situations for both single payment loans and regular payment loans.

Need to Know

- The interest that is charged on a loan will be less under any or all of these conditions:
  - The interest rate is decreased.
  - The interest compounding frequency is decreased.
  - Regular payments are made.
  - The regular payment amount is increased.
  - The payment frequency is increased.
  - The term is decreased.
- An amortization table is a payment schedule for a loan with regular payments. It shows what happens in each payment period. It shows the amount of each payment, the interest and the principal portion of each payment, and the balance of the loan. An amortization table can be created with spreadsheet software.

Payment Period	Payment ($)	Interest Paid ($)	Principal Paid ($)	Balance ($)
0				
1				
2				

- With each payment period, the interest paid decreases while the principal paid increases. This occurs because each payment decreases the balance of the loan, so the interest on the remainder of the balance will be less on the next payment. Also, because the payment amount stays the same, more of the payment goes toward paying off the principal, since less is being paid toward the interest.
- Technology can be used to investigate and analyze "what if" situations that involve borrowing money.

HW: 2.1 pp. 92-96 #3, 5, 7, 11, 12, 14 & 18