

# Lesson 3: Basic Loans Using Compound Interest

## Financial Mathematics Lesson #3: Basic Loans Using Compound Interest

### Review

Complete the following. If necessary, use your notes from Lessons 1 and 2 of this unit:

a) An annuity is a series of equal payments made at regular time intervals.  
There are different forms. For example:

- A **regular savings** plan can be considered an investment annuity. *L2*
- Paying off a **loan** or a **mortgage** with regular payments is a form of loan annuity.
- **Retirement income** is often received in the form of an annuity.

b) Using TVM to solve non-annual compound interest problems:

P/Y represents the # of payments (PMT) made to the investment or loan.

- For questions with no payments, make P/Y the same as the C/Y value.
- For questions with payments, the P/Y value is equal to the # of payments made in one year.

c) Using TVM to Solve Annuity Problems

An annuity involves making equal periodic payments.

Note the following points when solving annuity problems with TVM:

- The P/Y value is equal to the number of payments made in one year (unlike questions with no periodic payments).
- The PV (present value, or initial amount) may be zero, or not. If PV is zero, it indicates there is no initial amount, but there are regular periodic payments. If PV is a number other than zero, then an initial sum of money was invested (or borrowed) together with regular periodic payments.



Consider the following loan problem:

"Thomas Cruiser borrows \$7 500 from a bank to buy a used car. The bank issuing him the loan charges 8.25% interest per year compounded monthly. If Thomas makes \$175 monthly payments at the end of each month for four years, how much of the loan does he have left to repay?"

a) Why would this type of loan be considered an annuity?

regular payment (\$175) at a regular interval (monthly)

b) Complete the following to answer the question in the scenario using TVM Solver.

What is the PMT value and why is it negative?  
 PMT = -175  
 negative → out-of-pocket payment

What is the PV value and why is it positive?  
 PV = 7500, positive because money is gained into-pocket

Why does P/Y = 12 and C/Y = 12?  
 P(Y) = 12 payments/year  
 C(Y) = 12 compounded monthly

Periods  
 Explain why the entry for N is 4\*12 = 48.  
 4 years every month payments

N=48
I%=8.25
PV=7500
PMT=-175
FV=-508.5299781
P/Y=12
C/Y=12
PMT: [ ] BEGIN

c) How much does Thomas still owe the bank at the end of four years?

\$508.53

d) Adjust the TVM solver so that Thomas pays off the loan. How many months does it take Thomas to pay off the entire loan, with the same monthly payments? Round up to the nearest month.

set FV=0, solve for N(periods) 51 months of payments

e) How much did the car really cost Thomas?

51(175) = \$8925 < \$7500 car  
 1425 interest



Darma Asphalt applied for a loan to have her basement developed. The contractors she hired estimated that it would cost her approximately \$13 700 to develop the basement. Darma had already saved \$7 000 towards home improvements. She received a loan for the remaining amount and paid it off in four years with payments of \$175 made at the end of each month. What was the annual rate of interest (to the nearest tenth of a percent) if the interest was compounded quarterly?

N=4x12
I%*
PV=6700
PMT=-175
FV=0
P/Y=12
C/Y=4
PMT: [ ] BEGIN

13700 - 7000 = \$6700 needs to borrow

interest: 11.7%

Note: need advance calc on FNcalculator.com

\* Annual Rate Annually  
 Periods 40 monthly

Complete Assignment Questions #1 - #7

### Consumer Credit

**Consumer credit** occurs when an item is purchased and payment for it is made at a later date. There are usually interest charges, which result in the consumer paying more for the item than the original purchase price.

The amount of interest paid is called the **finance charge**.



Class Ex. #3

Ginger buys a drum set advertised at \$2 950. She arranges to pay for it in 24 monthly installments of \$170.

- a) How much did Ginger pay for the drum set?

$$24(170) = \$4080$$

- b) Calculate the finance charge.

$$4080 - 2950 = \$1130$$



Class Ex. #4

Chad sees the following T.V. advertisement:

**Home Theatre System:**

**Option A: \$5000 now**

**Option B: No payment for 12 months then 36 monthly payments of \$205**

**Option C: 12.5% down plus 48 payments of \$130**

Chad has only \$1000 available. Which option is less costly?

Option A: \$5000 *he can't afford this*

$$\text{Option B: } 36(205) = \$7380$$

$$\text{Option C: } 5000(0.12) = 600 \checkmark$$

$$48(130) = \underline{6240}$$

$$\$6840$$

Option C is best for him

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### Credit Cards

Most people have a **credit card**, which allows them to access consumer credit. In effect, using a credit card to pay for purchases is similar to borrowing money. Although similar to loans and mortgages, there are major differences in using a credit card.

- If you choose to pay off the balance on the card by an agreed date, then there is no interest charge.
- If you choose not to pay for the item by the agreed date, then interest is charged and the item you purchased ends up costing more because of the interest charges.
- The interest rate on purchases made by credit card is a great deal more than the interest rate on a small loan or mortgage.
- Unlike a small loan or mortgage, the consumer must make a minimum payment each month and then has the option of paying off as much of the remainder of the credit card balance as desired.
- You can use a credit card to borrow money in the form of cash, but interest is charged immediately at a much higher rate than a bank loan.

### Credit Card Charges

Well-known Canadian credit card companies are similar in the way they apply credit card charges.

An example of credit card terms and charges is given below. These will vary from credit card company to credit card company.

- No interest is charged if the entire balance is paid within 25 days of the billing date (except for cash advances).
- Interest is charged at a rate of 18% per annum on the entire previous monthly balance if the entire balance is not paid by the due date.
- Interest on balance owing is calculated from the date the transaction was posted until, but not including, the current statement date. To stop interest accumulation, contact the credit card company for your payout balance for that day and make the full payment.
- Interest on cash advances is calculated from the day the money was withdrawn.
- The minimum monthly payment is 3% of the statement balance or \$10, whichever is greater.



Note

To answer the class examples and assignment questions,  
use the above credit card terms and charges.



Matt received the following credit card statement.

Statement Date	Payment Due Date	Minimum Payment	Overdue Payment	Total Minimum Payment Due
Dec. 23	Jan 16	\$37.88	\$0.00	\$37.88
Date of Trans	Date of Post	Transaction		Debits/ Credits (-)
		Previous Balance		\$1728.44
11/23	11/25	Electronics	Extraordinaire	\$858.56
11/24	11/26	Dairy King		\$14.25
11/28	11/30	Hurlies Gas		\$32.71
12/07	12/10	Shoppers Paradise Dept Store		\$31.26
12/14	12/14	Payment Thank-you		\$1728.44-
12/20	12/21	Groceries for Less		\$325.79
New Balance				<u>1262.57</u>

- a) Explain the entry \$1728.44 -. **payment**      b) Calculate the new balance. **\$1262.57**
- c) Explain how the entry \$37.88 was determined. **3% of \$1262.57 is more than \$10**
- d) Why may the date of posting be different from the date of transaction? **some transaction take a few days to process**



Bidisha wants to buy a \$400 game console with her new credit card. It is the only item she buys on the credit card for that month.

- a) What is the minimum monthly payment on the statement? **3% of \$400 → 400(0.03) = \$12, greater than \$10**
- b) Bidisha receives her first statement. She pays the amount 5 days after the due date. What will her interest charge be?  
 $A = P(1+i)^n$      $i = \frac{0.18}{365}$      $n = 5$      $400.99 - 400 = 0.99$  **interest**  
 $A = 400(1 + \frac{0.18}{365})^5 = 400.99$      $I = A - P$
- c) If Bidisha makes payments of \$15 each month, use **TVM Solver** to determine how long it will take her to pay off her credit card.  
**34 months to pay off**  
 solve for N  
 I = 18%    FV = 0  
 PV = 400    P/Y = 12  
 PMT = -15    C/Y = 365    BEGIN  
**N = 34**

Complete Assignment Questions #8 - #13

## Assignment

1. Jody has saved \$2 200 towards the cost of a new car. The car she plans to buy costs \$19 757 and she needs to take out a loan to pay the balance. The loan must be paid off in four years and interest is charged at 8.2% per annum compounded semi-annually.

a) Determine the payment she must make at the end of each month.

N=  
I%=  
PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT: END BEGIN

b) How much did the car cost her?

2. Lee has to borrow \$7500 to build a new deck. He can only afford payments of \$250 at the beginning of each month. The bank charges interest at 7.8% per annum compounded annually.

a) How much will he owe after 2 years?

b) In which month will he finally pay off the loan?

N=  
I%=  
PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT: END BEGIN

N=  
I%=  
PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT: END BEGIN

c) If Lee is required to make a full payment in the last month, how much interest does he pay for the loan?

3. Lucy has saved \$3 500 towards the cost of a new car. The car she plans to buy costs \$21 575 including GST and she needs to take out a loan to pay the balance. The loan must be paid off in four years and interest is charged at 8.3% per annum compounded monthly.

a) Determine the payment she will make at the end of each month.

N=  
I%=  
PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT: END BEGIN

b) How much does the car cost her? Assume the purchase price of the car includes taxes and all applicable fees.

4. Melissa negotiated the purchase price of a boat for \$14 700. She plans to finance the boat over a four year term and she estimates that she can afford monthly payments of \$350 on her line of credit. Interest is compounded monthly.

N=  
I%=  
PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT: END BEGIN

- a) What will be her interest rate?  
b) How much interest will she have paid over the term of the loan?  
c) Assuming the purchase price of the boat includes taxes and applicable fees, what was the real cost of the boat?

5. Irwin borrows \$5 000 from a bank, at 4% p.a. compounded monthly, to be repaid in monthly payments of \$100.

- a) How much does Irwin owe the bank after three years?

N=  
I%=  
PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT: END BEGIN

- b) How long will it take Irwin to pay off the loan, to the nearest month rounded up?

N=  
I%=  
PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT: END BEGIN

6. Spencer borrows \$6 750 for home improvements. He can afford payments of \$250 at the end of each month. The bank charges interest at 6.92% per annum compounded monthly.

- a) How much will he owe after 2 years?      b) How many months (rounded up) will it take to pay off the loan?

N=  
I%=  
PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT: END BEGIN

N=  
I%=  
PV=  
PMT=  
FV=  
P/Y=  
C/Y=  
PMT: END BEGIN

- c) Based on the answer in b), if Spencer is required to make a full payment in the last month, how much interest does he pay for the loan?



7. Outlook Audio has a special on Cinemax Home Theatre systems. The system can be purchased for \$8 999.99 or with a down payment of 20% followed by 36 monthly payments of \$250.

The Blair family has decided that they will purchase the system by paying the down payment. However, before agreeing to using the Outlook Audio deferred payment plan, Mrs. Blair goes to her local bank to inquire about a loan for the remaining amount after the down payment.

The bank offers Mrs. Blair a 3 year loan at 7.72% per annum compounded monthly. If the bank payments are made at the end of each month, which of the two methods of financing is more economical and by how much?


Outlook Audio

Bank

N=
I%=
PV=
PMT=
FV=
P/Y=
C/Y=
PMT: END BEGIN

8. Jane sees the following ad in a local newspaper.

- a) How much is the down payment?

	<p><b>\$2499.99 or 15% down + 12 payments of \$199.99</b></p>
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- b) What is the total cost of the computer using the installment method?

- c) Calculate the difference between the two payment options.

9. Isabel received the following credit card statement.

Statement Date	Payment Due Date	Minimum Payment	Overdue Payment	Total Minimum Payment Due
July 26	<b>A</b>	<b>B</b>	\$0.00	<b>C</b>
Date of Trans	Date of Post	Transaction	Debits/ Credits (-)	
		Previous Balance	\$0.00	
06/30	07/02	Theatre Tickets	\$107.00	
07/04	07/04	Robert's Diner	\$27.89	
07/09	07/10	Quik Gas	\$33.71	
07/16	07/17	Riverfront Grocery Store	\$178.95	
07/16	07/16	Big Al's Towing and Repair	\$493.26	
07/18	07/20	Simpson's Electronics	\$38.71	
		<b>New Balance</b>	<u>          </u>	

- a) Calculate the new balance.
- b) Determine the entries for positions A, B, C.

10. Pierre has a balance owing of \$37.58 on his credit card. What is his minimum payment?

11. A certain type of projection television can be purchased for the advertised price of \$3500 or by a down payment of 20% of the advertised price plus 25 monthly installments of \$135. Determine the difference in cost between the two methods and express the difference as a percentage of the advertised price, to the nearest 1%.

Use the following information to answer the next two questions.

Hale buys a set of golf clubs advertised at \$1 050. He makes a \$200 down payment and pays 36 monthly installments of \$28.50.

**Numerical Response**

12. The amount, to the nearest dollar, that Hale paid for the golf clubs is \_\_\_\_\_.

(Record your answer in the numerical response box from left to right.)

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13. The finance charge expressed as a percentage of the advertised price, to one decimal place, is \_\_\_\_\_.

(Record your answer in the numerical response box from left to right.)

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**Answer Key**

1. a) \$429.14      b) \$22 798.72      2. a) \$2 221.27      b) 34 months      c) \$1000  
 3. a) \$443.81      b) \$24 802.88      4. a) 6.7%      b) \$2100      c) \$16 800  
 5. a) \$1818.20      b) 55 months      6. a) \$1333.61      b) 30th month      c) \$750  
 7. Bank's plan is more economical by \$911.16      8. a) \$375.00      b) \$2 774.88      c) \$274.89  
 9. a) \$879.52      b) A - Aug. 19, B - \$26.39, C - \$26.39  
 10. \$10      11. \$575, 16%      12. 

1	2	2	6
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      13. 

1	6	.	8
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