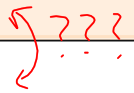
Change of plans!

05-Jun : Mon	7.5 - Mortgages
06-Jun : Tue	Review Day (or end of 7.5)
07-Jun : Wed	Assignment Day 1
08-Jun : Thu	Assignment Day 2
09-Jun : Fri	Review Day
12-Jun : Mon	Test



7.5 Problem Solving - Mortgages

TVM Solver for Mortgage Calculations

N is always # pmts Except $A = P(1+i)^n$

N = Total number of payments (# of payments X # of years)
I% = Annual interest rate as a percent
PV = Present value, or Amount of the mortgage
PMT = The payment amount (a negative value (-) for mortgages)
FV = Future value ("0" for paid-off mortgage, otherwise balance of the mortgage)
P/Y = Number of payments per year
C/Y = Number of compound periods per year
PMT: = END for mortgages

Important Notes:

- In Canada, mortgage interest is always compounded semi-annually, but in the U.S., mortgage interest is compounded monthly. Payments may be made at a different time i.e. monthly or bi weekly, so P/Y and C/Y do not need to match.
- Always input C/Y = 2 after P/Y, or the calculator automatically resets C/Y to match the P/Y.
- Cash outflows, like Mortgage Payments, are negative.
- Cash inflows, like the Mortgage Amount, are positive.
- The most common term for mortgages is a five year term. After 5 years you must renew the mortgage, which means taking out a new mortgage at current interest rates for the balance owing after 5 years.

Mortgage Vocabulary

mortgage	mortgage payment	mortgagor	mortgagee
mortgage broker	principal	equity	collateral
down payment	payment frequency	accelerated payment	amortization period
fixed rate	variable rate	CMHC	mortgage insurance
land transfer tax	home inspection fee	closing costs	length of term

Mortgage: A special loan that has a "lien" as security.
Mortgagor: The borrower of the money.
Mortgagee: The lender of the money.
Principal: The amount of money borrowed.
Equity: The home's current market value.
Collateral: Something forfeited if you default on a loan.
Down Payment: Reduction from principal.
Payment Frequency: How often you pay.
Accelerated Payment: Monthly payment divided by 4 weeks - squeezes in an extra payment per year which means less interest paid!
Amortization Period: Amount of time to repay a mortgage in full.
Fixed Rate: Interest rate is locked in for a certain amount of time.
Variable Rate: Interest rate fluctuates with the market.
CMHC: Canadian Mortgage and Housing Corporation - A government agency that manages the rules of mortgages.
Length of term: The amount of time you commit to a rate and lender.

Ex. 1 You have a $173,500 mortgage, with monthly payments, at 3.2%/a over 25 years.

a) Calculate the monthly payments.

N= 25×12
I%= 3.2
PV= 173500
PMT= ⇒ −838.99
FV= 0
P/Y= 12
C/Y= 2 *ALWAYS*
PMT: END BEGIN

b) How much money have you paid over the first 5 years?

Amt paid = 12×5×838.99
= 50 339.40

(This is Principal + Interest)

c) How much of the money paid was from the principal?

N= 5×12
I%= 3.2
PV= 173 500
PMT= −838.99
FV= ⇒ −148 863.83
P/Y= 12
C/Y= 2
PMT: END BEGIN

∴ Principal paid = 173500 − 148863.83
= $24 636.17

d) How much of the money paid was interest?

Total pd : # 50 339.40
Total principal : $24 636.17

∴ I = 50 339.4 − 24636.17
= $25 703.23

∴ You paid $25 703.23

e) How much money have you paid over the 25 years?

Total = 838.99 × 25 × 12
= $251 697

∴ Total paid is $251 697

f) How much interest will you pay over 25 years?

Interest = 251697 − 173500
= 78 197

∴ Total interest $78197

g) From your answers, do you pay off more interest or more principal in the first 5 years of your mortgage? Last 5 years?

More interest
Less principal

Less interest
More principal

Ex. 2 Given an interest rate of 5% for a mortgage of $250 000, determine your monthly payments and compare the total amount of interest paid if you amortize the mortgage over 20 years and over 25 years. Discuss the pros and cons between both options.

20 years

N= 20×12
I%= 5
PV= 250000
PMT= ⇒ −1642.81
FV= 0
P/Y= 12
C/Y= 2
PMT: END BEGIN

Total paid = 1642.81 × 20×12
= 394 274.40

Better option if you can afford it.

25 years

N= 25×12
I%= 5
PV= 250000
PMT= ⇒ −1454.01
FV= 0
P/Y= 12
C/Y= 2
PMT: END BEGIN

= 1454.01 × 25×12
= 436 203

Ex. 3 Given an interest rate of 5% for a mortgage of $250 000, use your monthly p ayments from Ex. 2 (with amortization period of 25 years) and halve the amount. This will now be your bi-weekly and semi-monthly payments. Compare how long it will take to pay off the mortgage using bi-weekly vs. semi-monthly payments. Discuss why one frequency of payment is better than the other. Do you think the home owner will find a significant difference in the payments on a weekly basis?

$\frac{1454.01}{2}$
= 727.01

bi-weekly (26)

N= ⇒ 558.43
I%= 5%
PV= 250 000
PMT= −727.01
FV= 0
P/Y= 26
C/Y= 2
PMT: END BEGIN

N = #yrs × #pmts

#yrs = $\frac{N}{\#pmts}$

= $\frac{558.43}{26}$

≈ 21.5

semi-monthly (24)

N= ⇒ 598.8
I%= 5
PV= 250 000
PMT= −727.01
FV= 0
P/Y= 24
C/Y= 2
PMT: END BEGIN

#yrs = $\frac{N}{\#pmts}$

= $\frac{598.8}{24}$

≈ 24.95

Diff = 24.95 − 21.5
≈ 3.5

∴ Paying bi-weekly shaved 3.5 years off the mortgage.

Ex. 4 Ms. Mes makes monthly payments on a $ 72 000 mortgage over 25 years at 11.125% for 5 years. After 2 years, she decides to increase the monthly payment by $100 and at the end of the 4th year she is able to make an extra principal payment of $ 2000.

a) What is the principal balance owing at the end of 5 yrs? 4 screens needed to complete!

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

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

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

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

b) By how long has the amortization period of the mortgage been shortened?

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

Homework
Handout 7.5
Using the TVM Solver for Mortgage Calculations

Textbook always assumes monthly payments.