# 7.5 Problem Solving - Mortgages

### **TVM Solver for Mortgage Calculations**

> N is always  $\neq pmts$   $E \times ept \qquad n$  A = P(1+i)Ν = Total number of payments (# of payments X # of years)

1% = 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.

The borrower of the money. Mortgagor: The lender of the money. Mortgagee:

> Principal: The amount of money borrowed. The home's current market value. Equity:

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 1%=3.2 PV=173500 PMT= 2000 - 838.99 FV=0 P/Y=12 C/Y=2 \*ALWAYSA PMT: END BEGIN b) How much money have you paid over the first 5 years?

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

d) How much of the money paid was interest?

Total pd: 
$$$50339.40$$
Total pd:  $$24636.17$ 

Total principal:  $$24636.17$ 
 $=$25703.23$ 

Total principal:  $$24636.17$ 

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

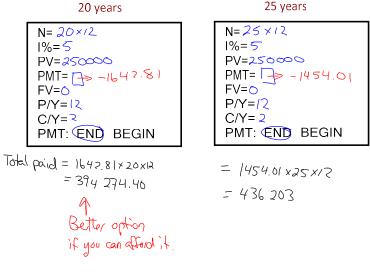
Total = 838.99 x 25 x/2

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

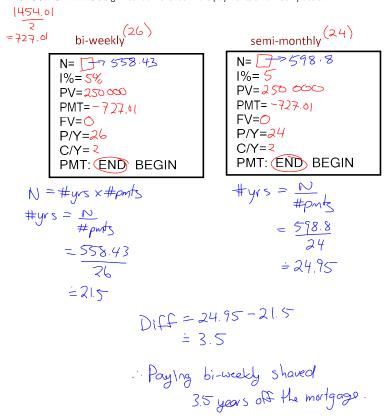
g) From your answers, do you pay off more interest or more principal in the first 5 years of your mortgage? Last 5 years?

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.



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?



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 4<sup>th</sup> year she is able to make an extra p rincipal payment of \$2000.

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the 4<sup>th</sup> year she is able to make an extra p rincipal payment of $ 2000.
 1 Find monthly payment
                                 The Remaining after lump
Sum + 1 yr pmts.
2 How much last after 2 yrs
3 How much left after
      2, yrs at increased pmt.
a) What is the principal balance owing at the end of 5 yrs? 4 screens needed to complete!
                                    N= 2 ×1 2
    N = 25 \times 12
    1%=11,125
                                    1%=11.125
    PV=72 ∞
                                    PV= 72 ∞
    PMT= 7-2-699.21
                                    PMT= -699.21
                                    FV= -7075491
    FV=()
                                    P/Y = 12
    P/Y=12
    C/Y=2
                                    C/Y= 2
                                    PMT: END BEGIN
    PMT: END BEGIN
    After 2 yrs, loanis
              7075491
    N=2\times/2
                                     N= \ x12
    1%=11,125
                                     1%=11,125
                                     PV=66541.22 -2000
    PV=70754.91
                                     PMT= -799.21
    PMT=-799.21
    FV= -66541.22
                                    FV= 13-61837.82
    P/Y=12
                                     P/Y= 12
    C/Y= ?
                                     C/Y= >
    PMT: END BEGIN
                                     PMT: END BEGIN
                    .: Her lan is worth $61837.82
 b) By how long has the amortization period of the mortgage been shortened?
      N= 133.9
                                 N = \#yrs \times \#pmts/yr
      1%= 11.125
                               \frac{1339}{12} = #yrs
      PV= 61 837.82
     PMT=-799.21
      FV=
      P/Y=1>
                               11.16 = #yrs
      C/Y= 2
      PMT: END BEGIN
                              Total = 11.16 +5
 Original loan was
    for 25 years!
  Diff = 25-16.16 : She shortered
                           her mortgage by
                                  8.84 years!
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# Homework Handout 7.5 Using the TVM Solver for Mortgage Calculations

Textbook always assumes monthly payments.

