7.5 Problem Solving - Mortgages

TVM Solver for Mortgage Calculations

→ loan for property / house

- 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   2] *different*
- 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. 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.

→ amount of time bank guarantees interest rate for

- 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.

★ Amortization Period → time to pay off the entire mortgage
(25 years)

Mortgage Vocabulary

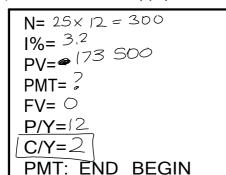| mortgage	mortgage payment	mortgagor	mortgagee
mortgage broker	principal	equity	collateral
down payment	payment frequency	accelerated payment	amortization period
fixed rate	variable rate	CMHC	mortgage insurance
land transfer tax	home inspection fee	closing costs	length of term

→ chunk of $ you pay off at the beginning
~~2~~ 10% downpayment

$300 000
↓ 10%
down payment $30 000

Amount of mortgage
= $270 000

Ex. 1 You have a $173,500 mortgage, with monthly payments, at 3.2%/a over 25 years.
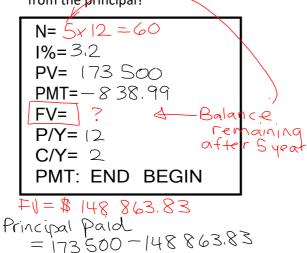
→ term (5 years)

a) Calculate the monthly payments.

N= 25 × 12 = 300
I%= 3.2
PV= 173 500
PMT= ?
FV= 0
P/Y= 12
C/Y= 2
PMT: END BEGIN

PMT: $ 838.99

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

5 × 12

838.99 × 60
= $50 339.40

Principal (mortgage)
$24 636.17

Interest

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

N= 5 × 12 = 60
I%= 3.2
PV= 173 500
PMT= −838.99
FV= ?   ← Balance remaining after 5 years
P/Y= 12
C/Y= 2
PMT: END BEGIN

FV = $ 148 863.83
Principal Paid
= 173 500 − 148 863.83
= $24 636.17

d) How much of the money paid was interest?

50 339.40 − 24 636.17
= $25 703.23

Sum

$\Sigma \text{Int}(1, 60)$
= $25 703.23

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

= 838.99 × 300
= $251 697.00

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

251 697 − 173 500
= $78 197

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

Interest
1st 5 years
$~25 000

Total $78 000
last 5 years
$\Sigma \text{Int}(240, 300)$
= $3 853.48

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= 250 000
PMT= ?
FV= 0
P/Y= 12
C/Y= 2
PMT: END BEGIN

PMT = $1642.81

Total Paid = 1642.81 × 240
          = 394 274.40
Σ − 250 000

Interest Paid Σ Int (1, 240)
= $144 274.40

Advantage − Pay less Interest

25 years

N= 25 × 12
I%= 5
PV= 250 000
PMT= ?
FV= 0
P/Y= 12
C/Y= 2
PMT: END BEGIN

PMT = $1454.01

Interest : $186 203.00

Advantage : Monthly payment more affordable

Ex. 3 Given an interest rate of 5% for a mortgage of $250 000, use your monthly payments 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?

monthly payment $1454.01 ÷ 2 = 727.01

bi-weekly

N= ?
I%= 5
PV= 250000
PMT= −727.01
FV= 0
P/Y= 26
C/Y= 2
PMT: END BEGIN

N = 558.43

# of years
$\frac{558.43}{26}$
= 21.5 years
Pay off faster

∴ Interest paid is less.

semi-monthly

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

N = 598.78

$\frac{598.78}{24}$
= 24.95 years