# Lesson 4: Mortgages

## Financial Mathematics Lesson #4: Mortgages

## Mortgages

A **mortgage** is a special type of loan that is used to purchase property. The property itself is used as **collateral** - which the lending institution uses to recover its loan in the event that the borrower does not pay back the loan. The person borrowing the money is called the **mortgager** and the institution lending the money is called the **mortgagee**.

### Amortization

Complete the chart.

To **amortize** a mortgage is to repay a mortgage in equal periodic payments over a given period of time.

The **amortization period** is the time it would take to completely pay off the mortgage if the interest and periodic payments remained constant. It is common to have amortization periods of 15, 20, or 25 years.

The **term** of the mortgage is the length of time the mortgage agrees to make the mortgage payments to the bank. In the past, the term of the mortgage and the amortization period were the same thing.

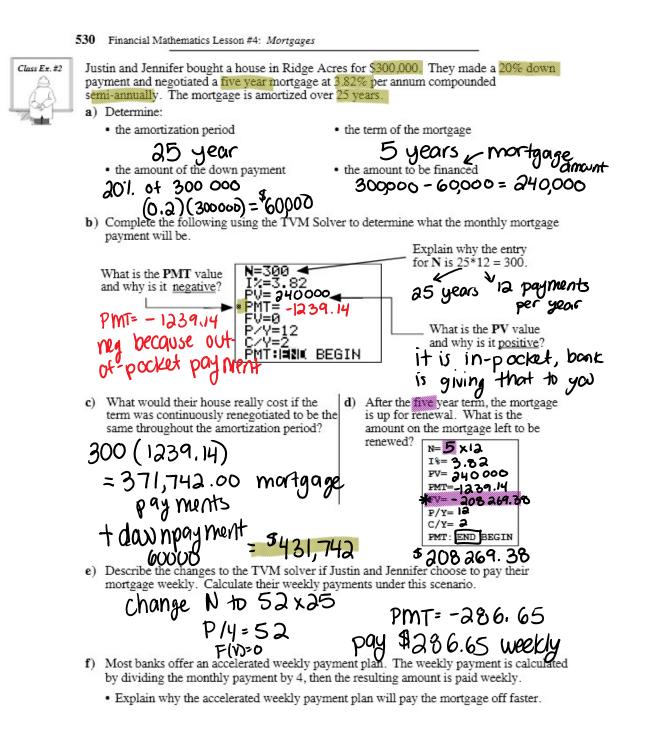
Today, with fluctuating interest rates and the desire of lending institutions to increase profits, the **term** of a mortgage has taken a different meaning. An amortization period is still given as the period of time it would take to pay off the loan, but the term of the loan can be a much shorter period of time. At the end of the term, a new mortgage agreement is negotiated with the lending institution and a new amortization period may result, with a different interest rate.



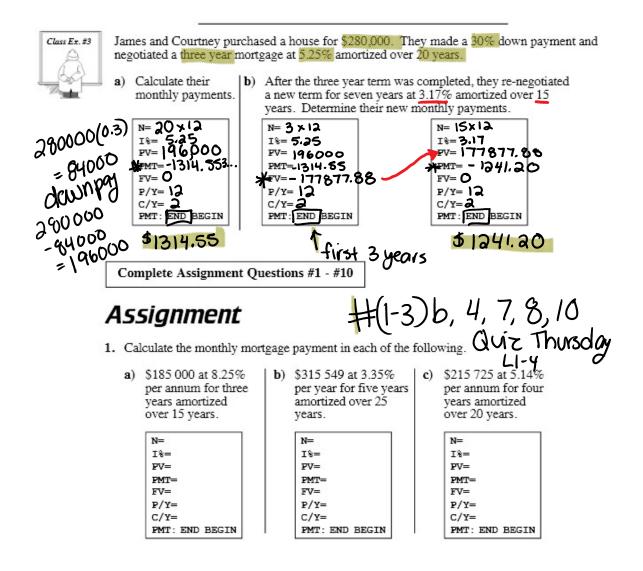
- By Canadian law, mortgage interest must be calculated at most semi-annually. Therefore, for mortgages, C/Y will always be 2, and most of the time P/Y is 12, which represents monthly payments.
- · Payments are made at the end of the month for mortgages and loans.



Scenario	Amortization Period	Term		
<ul> <li>a) A three year mortgage at 5.25% amortized over 25 years.</li> </ul>	25	3		
b) A mortgage negotiated for five years at 4.20%. If payments are continued at this rate, the loan will be paid off in 15 years.	15	5		



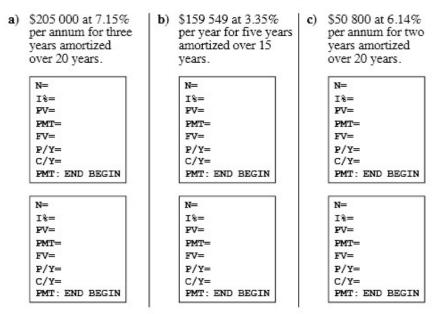
- · What would be the weekly payment using the accelerated weekly payment plan?
- Assuming that the interest rate remains the same throughout the amortization period, determine how long it will take to pay off the mortgage using the accelerated weekly payment plan.



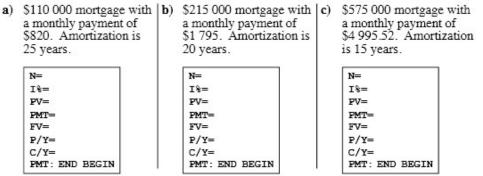
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2. Calculate the remaining amount left on the loan after the term has been completed.



3. Calculate the interest rate, to the nearest 0.01%, on the term of the mortgage.



- A land development company purchased a rental property for \$279 000. They made a 10% down payment and negotiated a five year mortgage at 6.95% amortized over 25 years.
  - a) Determine:

· the amortization period

- · the term of the mortgage
- the amount of the down payment
   the amount to be financed

b)	Determine the monthly payment.	<b>c</b> )	What would the rental property really cost if the term was continuously renegotiated to be the same throughout the amortization	d)	After the five year term, the mortgage is up for renewal. What is the amount of the mortgage left to be renewed?
Γ	N= 1%=		period?		N= 1%=
	PV=				PV=
	PMT= FV=				PMT= FV=
	P/Y=				P/Y=
	C/Y= PMT: END BEGIN				C/Y= PMT: END BEGIN

5. Audrey bought a condominium for \$132 500. She made a 15% down payment and negotiated a three year mortgage at 7.75% per annum compounded semi-annually. The mortgage is amortized over 25 years. Determine:

a)	the term of the mortgage	<li>b) the amortization period</li>	
c)	the amount to be financed	d) the monthly mortgage payment	N= I% PV

e) the total amount paid for the condominium if the interest rate remained at 7.75% throughout the amortization period

N=
1%=
PV=
PMT=
FV=
P/Y=
C/Y=
PMT: END BEGIN

 Vancouver Credit Union offers a \$115 000 mortgage amortized over 20 years at 8% per year compounded semi-annually.

a)	Determine the monthly payments.		<ol> <li>Calculate the total amount to be paid.</li> </ol>	c)	Calculate the amount of interest to be paid.
	N=				to be paid.
	1%=				
	PV=				
	PMT=				
	FV=				
	P/Y=	d)	What would happen to t	onthly payments and the total	
	C/Y=		to be paid if the mortgag	e was	s amortized over 25 years?
	PMT: END BEGIN		(No calculations are requ		

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- 7. Kim is shopping for a \$105 000 mortgage. Two banks gave her the following options:
  - Grand Bank: a two year term at 7.72% amortized over 10 years
  - · Bank for Less: a five year term at 7.35% amortized over 15 years
  - a) Which option has the lower monthly payment?

Grand Bank	Bank For Less			
N=	N=			
1%=	1%=			
PV=	PV=			
PMT=	PMT=			
FV=	FV=			
P/Y=	P/Y=			
C/Y=	C/Y=			
PMT: END BEGIN	PMT: END BEGIN			

- b) Assuming the interest rate remains the same over the amortization period of each loan, determine the total amount of interest paid for each option.
- c) Even though the monthly payments are higher, why might Kim choose Grand Bank?
- d) Even though the total amount of interest paid is higher, why might Kim choose Bank for Less?
- 8. Tera and Bill purchased an acreage with a large house close to the city limits of a major city. The acreage and home were sold to them for \$752 000. From the sale of their old house plus savings they had accumulated, they were able to make an 86% down payment. Tera and Bill negotiated a seven year mortgage at 4.10% amortized over 20 years for the remaining amount.
  - a) State: i) the amortization period
     ii) the term of the mortgage

b)	Determine the monthly payment.	<b>c</b> )	What would their house really cost if the interest rate remained at 4.1% throughout the amortization period?	The seven year term of the mortgage is up for renewal. What is the amount on the mortgage left to be renewed?
Г	N=			N=
	I%=			1%=
	PV=			PV=
	PMT=			PMT=
	FV=			FV=
	P/Y=			P/Y=
	C/Y=			C/Y=
	PMT: END BEGIN			PMT: END BEGIN

9. In 2011, Phil and Stephanie moved into a new home and assumed a \$137 000 mortgage amortized to the year 2026 at 5.89% per annum compounded semi-annually for a three year term. At the end of the three year term, the mortgage rate had increased by 1.5%. They renegotiated their mortgage for a further three year term at this new rate. Calculate the monthly payment for their renegotiated mortgage if the mortgage was still to be paid in full by the year 2026.

N=	N=	N=
1%=	1%=	1%=
PV=	PV=	PV=
PMT=	PMT=	PMT=
FV=	FV=	FV=
P/Y=	P/Y=	P/Y=
C/Y=	C/Y=	C/Y=
PMT: END BEGIN	PMT: END BEGIN	PMT: END BEGIN

 Andrea would like to take out a mortgage for \$125 000 amortized over 25 years at 6.5% per annum. The bank has presented her with two options.

The first option is to make 12 monthly payments per year for 25 years. The second option is to make 52 weekly payments per year for 25 years.

How much will Andrea save over the full amortization by using the weekly payments instead of the monthly payments?



#### Answer Key

	\$189 362.67	b)	\$114 017 10	- 2						
			\$114 917.1U	c)	\$48 C	22.98				
3. a)	7.72%	b)	8.11%	c)	6.559	5				
4. a)	amortization is 2	5 ye	ars, term is 5 y	ears,	down	payment is	\$27 90	0, financed am	ount	is \$251 100
	\$1751.00									
5. a)	3 years b)	25	years	0	:) \$11	2 625	d)	\$841.67	e)	\$272 376
6. a)	\$952.61 b)	\$22	8 626.40	c)	\$113	626.40				
d)	monthly payment	ts de	crease, overall	cost	of hous	e increases				
7. a)	Bank for Less		b) Grand Ba	nk –	* \$45 2	13.60, Ba	nk for l	Less → \$67 42	3.80	
c)	Because the over	all in	nterest paid out	will	be \$23	2 210.20 le	ess.			
d)	Because she may	only	y be able to affe	ord th	ne lowe	r monthly	paymen	t.		
8. a)	i) 20 year amortiza	ation	ii) 7 year ter	m	b)	\$641.61	c)	\$800 706.40	d)	\$77 645.89
			.\$518.00							

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