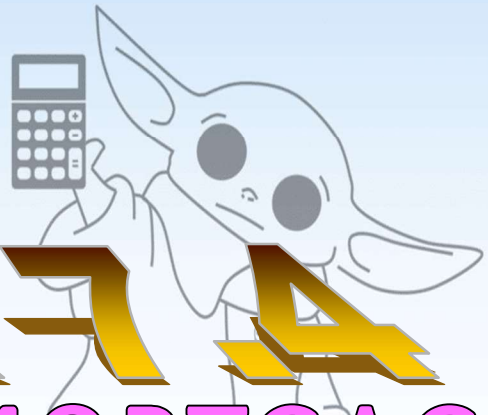
ST. JEAN DE BREBEUF MATHEMATICS



CHAPTER 14

THE CONDITIONS OF A MORTGAGE

CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

KEY CONCEPTS

A shorter amortization period means larger payments but less total interest

There are a number of strategies for reducing the time needed to pay off a mortgage and for reducing the total interest paid

A **pre-approved mortgage** is the maximum amount that can be borrowed from a lending institution to purchase a house
→ used to determine the maximum house price a buyer can afford

CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 1 *Change the Payment Frequency*

Carla's monthly mortgage payment will be **$1250.88**. She was advised that she could pay down the mortgage faster by changing the frequency of the payments.

Using the definitions provided for each payment frequency, complete the table by calculating the amount of each *regular* payment and the amount paid in one year

PAYMENT FREQUENCY / DEFINITION	METHOD OF CALCULATION	AMOUNT OF PAYMENT PER INTERVAL	AMOUNT PAID IN ONE YEAR
Semi-monthly → **2x** per month → 24 payments year	$\frac{\text{Monthly payment}}{2}$	$\frac{1250.88}{2}$ $= \$625.44$	625.44 x 24 = **$15 010.56**

CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

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PAYMENT FREQUENCY / DEFINITION	METHOD OF CALCULATION	AMOUNT OF PAYMENT PER INTERVAL	AMOUNT PAID IN ONE YEAR
Bi-weekly → Every other week → 26 payments per year	$\frac{Monthly\ payment \times 12}{26}$	$\frac{1250.88 \times 12}{26}$ $= \$577.33$	577.33 x 26 **= $15 010.58**
***Accelerated* bi-weekly** → based on *average* bi-weeks per month → Every other week → 26 payments per year	$\frac{Monthly\ payment}{2}$	$\frac{1250.88}{2}$ $= \$625.44$	625.44 x 26 **= $16 261.44**

CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 1 *Change the Payment Frequency*

Carla's monthly mortgage payment will be **$1250.88**. She was advised that she could pay down the mortgage faster by changing the frequency of the payments.

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PAYMENT FREQUENCY / DEFINITION	METHOD OF CALCULATION	AMOUNT OF PAYMENT PER INTERVAL	AMOUNT PAID IN ONE YEAR
Weekly → Payment made every week → 52 payments year	$\frac{Monthly\ payment \times 12}{52}$	$\frac{1250.88 \times 12}{52}$ $= \$288.66$	288.66 x 52 **= $15 010.32**
***Accelerated* Weekly** → Based on *average* number of weeks per month → Every week → 52 payments year	$\frac{Monthly\ payment}{4}$	$\frac{1250.88}{4}$ $= \$312.72$	312.72 x 52 **= $16 261.44**

CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 1 *Change the Payment Frequency*

Which payment frequency pays the mortgage the fastest? **Accelerated weekly**

PAYMENT FREQUENCY / DEFINITION	METHOD OF CALCULATION	AMOUNT OF PAYMENT PER INTERVAL	AMOUNT PAID IN ONE YEAR
Weekly → Payment made every week → 52 payments year	$\frac{Monthly\ payment \times 12}{52}$	$\frac{1250.88 \times 12}{52}$ $= \$288.66$	288.66 x 52 **= $15 010.32**
Accelerated **Weekly** → Based on *average* number of weeks per month → Every week → 52 payments year	$\frac{Monthly\ payment}{4}$	$\frac{1250.88}{4}$ $= \$312.72$	312.72 x 52 **= $16 261.44**

CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 2 *Changing the Amortization Period*

Danilo and Kyoko receive approval from their bank for a pre-approved mortgage of **$167 000** for the townhouse they wish to purchase. The current annual interest rate for a *five*-year fixed term mortgage is **6.09%**.

(a) Using the TVM Solver, determine the **monthly payment** for a **20-year** amortization period (assume *semi-annual* compounding on the interest)

12

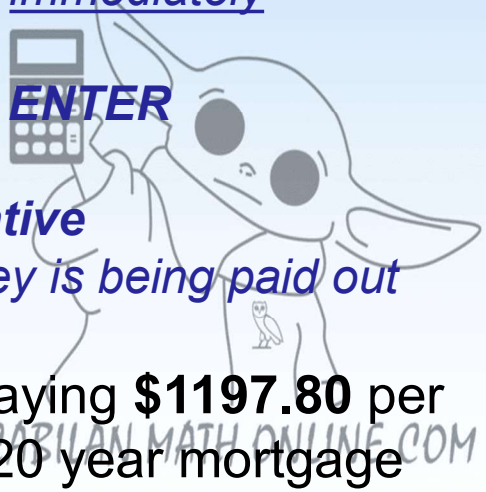
2

N = 20 × 12	
I% =	6.09
PV =	167 000
PMT =	−1197.80
FV =	0
P/Y =	12
C/Y =	2

*Mortgage is entered as **present value***
→Mortgage is a loan
→Needs to be paid immediately

*Press **ALPHA** then **ENTER***

*Expressed as **negative***
→Represents money is being paid out



They will be paying **$1197.80** per month on a 20 year mortgage

CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 2 *Changing the Amortization Period*

Danilo and Kyoko receive approval from their bank for a pre-approved mortgage of **$167 000** for the townhouse they wish to purchase. The current annual interest rate for a *five*-year fixed term mortgage is **6.09%**.

N =	240
I% =	6.09
PV =	167 000
PMT =	– 1197.80
FV =	0
P/Y =	12
C/Y =	2

(b) Using your value from **(a)**, calculate the **total amount paid** for the mortgage over the 20 years

12 monthly payments x 20 years
*= **240 payments***

Total = n x PMT
= # of payments x payment amount
= 240 x 1197.80
= 287 472

*Danilo and Kyoko will be paying a total of **$287 472** on a 20 year mortgage*

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CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 2 *Changing the Amortization Period*

Danilo and Kyoko receive approval from their bank for a pre-approved mortgage of **$167 000** for the townhouse they wish to purchase. The current annual interest rate for a *five*-year fixed term mortgage is **6.09%**.

12

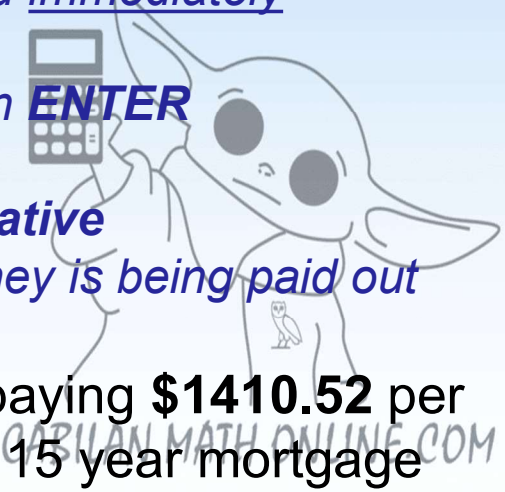
(c) Determine the monthly payment for a **15-year** amortization period

N = ~~15~~ 180	12
I% =	6.09
PV =	167 000
PMT =	~~0~~ 1410.52
FV =	0
P/Y =	12
C/Y =	2

*Mortgage is entered as **present value***
→Mortgage is a loan
→Needs to be paid immediately

*Press **ALPHA** then **ENTER***

*Expressed as **negative***
→Represents money is being paid out



They will be paying **$1410.52** per month on a 15 year mortgage

CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 2 *Changing the Amortization Period*

Danilo and Kyoko receive approval from their bank for a pre-approved mortgage of **$167 000** for the townhouse they wish to purchase. The current annual interest rate for a *five*-year fixed term mortgage is **6.09%**.

N =	180
I% =	6.09
PV =	167 000
PMT =	– 1410.52
FV =	0
P/Y =	12
C/Y =	2

(d) Using your value from **(c)**, calculate the **total amount paid** for the mortgage over the 15 years

12 monthly payments x 15 years
*= **180 payments***

Total = n x PMT
= # of payments x payment amount
= 180 x 1410.52
= 253 893.60

*Danilo and Kyoko will be paying a total of **$253 893.60** on a 15 year mortgage*

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CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 2 *Changing the Amortization Period*

N = 240	N = 180
I% = 6.09	I% = 6.09
PV = 167 000	PV = 167 000
PMT = – 1197.80	PMT = – 1410.52
FV = 0 Part **(a)**	FV = 0 Part **(c)**
P/Y = 12	P/Y = 12
C/Y = 2	C/Y = 2

(e) Compare your answer from **(a)** and **(c)**. How much <u>more</u> is the monthly payment for the **15 year** mortgage compared to the **20 year** mortgage?

Find the difference between the two payments
= 1410.52 – 1197.80
= $212.72

*The monthly payment for a 15 year mortage is **$212.72** more*
→ <u>Shorter</u> amortization, <u>higher</u> monthly payment

CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 2 *Changing the Amortization Period*

(f) Compare your answers from **(b)** and **(d)**. How much <u>less</u> would Danilo and Kyoko have to pay by choosing the **15 year** mortgage?

15 year mortgage = $253 893.60 *20 year mortgage = $287 472*

Find the difference

= 287 472 – 253 893.60

*= **$33 578.40***

*The total amount paid for a 15 year mortgage is **$33 578.40** less than the 20 year mortgage*

→ *<u>Shorter</u> amortization, <u>smaller</u> total amount paid*

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CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 3 *Change the Amount of the Payment*

Arnold purchased his home five years ago and his mortgage is now up for renewal.

(a) Use the TVM Solver to determine the **weekly** payment for a mortgage of **$183 000** at **5.39%** interest per year for a **20-year** amortization period (assume *semi-annual* compounding of the interest)

52

2

*Mortgage is entered as **present value***
→Mortgage is a loan
→Needs to be paid immediately

*Press **ALPHA** then **ENTER***

*Expressed as **negative***
→Represents money is being paid out

N =	20 × 52
I% =	5.39
PV =	183 000
PMT =	0 **– 285.98**
FV =	0
P/Y =	52
C/Y =	2

They will be paying **$285.98** *per week* on a 20 year mortgage

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CHAPTER 7.4 THE CONDITIONS OF A MORTGAGE

EXAMPLE 3 *Change the Amount of the Payment*

Arnold purchased his home five years ago and his mortgage is now up for renewal.

12

(b) Arnold plans to renew his mortgage for **$183 000**. He chooses to increase his **monthly** payment to **$1600** per month. Use the TVM Solver to determine the **length of time** needed to pay the mortgage in full (assume *semi-annual* compounding of the interest)

2

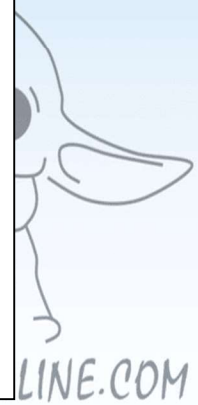
*Press **ALPHA** then **ENTER***

*Mortgage is entered as **present value***
→Mortgage is a loan
→Needs to be paid immediately

*Expressed as **negative***
→Represents money is being paid out

N =	160.0548
I% =	5.39
PV =	183 000
PMT =	– 1600
FV =	0
P/Y =	12
C/Y =	2

It would take Arnold **160 months** to pay the mortgage in full!



HOMEWORK

(Using graphing calculator)
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