

Everyone Wants a Mortgage

A note to teachers:

This is a simple, fascinating and to many students, 'shocking' financial mathematics investigation.

The investigation was originally written with NSW Northern Beaches students in mind. It was also deliberately written somewhat 'tongue-in-cheek' to maximize the engagement of the original target audience.

You may desire to change the wording of the investigation to better suit the geography and nature of your students. If you require the original word document for this purpose feel free to contact www.casioed.net.au

'Everyone Wants A Mortgage' has been organized into three documents as an attempt to save on photocopying. The document following this page is written as a guide for the teacher and would be ideal to be projected for students during the lesson. The 'Questions Only' document, designed to be the student handout, is identical to this document but with the explanatory text removed. Finally the solutions document is available with screenshot instructions.

This investigation contains some 'shocking' conclusions for engaged students. It is also an investigation that can be enormously enjoyable for the teacher to deliver. For this reason a teacher-directed delivery may be most appropriate.

In regard to the 'Thinking Outside The Box' section (Q17-22) it would be appropriate for a class discussion to occur in regard to the differences in the value of money currently compared to that of 40 years into the future and how this difference affects the answers to Qs 18-22.

If you are not yet familiar with TVM or RUN modes you may like to first work through 'Self-Guided_9860_TVM' and/or Self-Guided_9860_RUN. Both are at www.casioed.net.au

NOTE: If you desire to modify this activity and therefore desire the original word document you may request it by emailing casio.edusupport@shriro.com.au.

Everyone Wants a Mortgage (for a home near the ocean!!)



If you hadn't already noticed, buying a home is not a cheap exercise. In fact, it is rather expensive. And it has become increasingly expensive over recent decades.

Rarely do people have enough money to buy a home outright. This is why home loans are the common route to buying a home.

A federal inquiry into mortgage finance may recommend borrowers be required to put up a deposit of 20 per cent.

The parliamentary economics committee has called the snap inquiry into home lending as the number of people defaulting on mortgages continues to rise.

Despite low unemployment figures, economic growth and high consumer confidence, personal bankruptcies went up by 17 per cent in the 2006-07 financial year.

SMH July 18, 2007

A home loan is called a mortgage. In order to be eligible for a mortgage a home buyer usually needs to be able to pay a certain percentage of the cost of the home themselves. This is called a deposit.

In simple terms, for example, if you wanted to buy a \$500 000 home and the required deposit was 10%, you would have to provide \$50 000 towards the

cost of the home. The bank would provide you with the remaining \$450 000. Your mortgage would therefore be \$450 000.

In recent years mortgages which do not require a deposit have become available. The article excerpt above suggests that the increase in no-deposit mortgages has contributed to the 2006 – 2007 rise in personal bankruptcies. You might like to discuss with your class why this might be.

Mortgage Scenario One

Let's assume you are married, are both 28 years of age and you want to buy your first home. You both grew up on the Northern Beaches in Sydney in a fabulous house and this is where you and your spouse want to own your own home. It is very important to you both that you buy a 'spectacular' home in a 'spectacular' location and you are both prepared to work hard in order to pay for it.



After spending every weekend for two months looking at houses you both arrive at two realizations:
One) You will not be able to buy a home as spectacular as you had hoped, and
Two) You will need to pay more than you had intended.

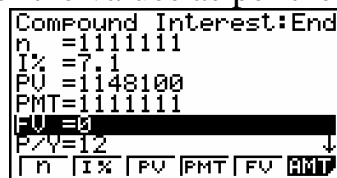
It turns out that the kind of home you were hoping to buy in the kind of location in which you were hoping to live would cost you around \$1 600 000. Both your parents and your spouse's parents have decided to give you \$100 000 in total to help you buy your first home. You and your spouse have \$50 000 saved towards your home. You have decided that the most you are prepared to compromise is to purchase a home worth around \$1 100 000.

After another month or two of weekends you both 'fall in love' with a house that is 'divine' and quite good value. This is the home you must have! It unfortunately costs \$1 290 000 but you both sense that this is 'meant to be'. You are both hopeful of receiving promotions at work in the near future and you decided that somehow you will manage the repayments.

You approach Easy-Money Bank who are willing to loan you the money provided you have a deposit of at least 10%.

- 1) a) Do you have enough money for the deposit?
 b) What is the largest percentage deposit could you make?
- 2) You decide to pay a deposit of 11% and use the rest of the money to buy some new furniture.
 - a) What is the size of your deposit?
 - b) How much money do you have to spend on furniture?
 - c) What is the size of your mortgage? (How much money is Easy-Money Bank lending you?)

Easy-Money Bank will loan you the \$1 148 100 at 7.1% interest compounding monthly. Use TVM and trial and error to investigate the minimum monthly repayments. (We do not know how long it will take to pay off the mortgage yet). Enter the values as per the next screen,



pressing EXE after each entry.

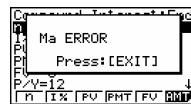
NOTE: '1111111' entries are used to mean 'you can have any number here'.

To determine the minimum possible payment you could theoretically make enter a value for PMT and check the resulting 'n'. If the PMT value is too small (ie less than the interest generated during the month) an error message will appear.

For example, by entering PMT = -100 (clearly not enough to cover interest



for the first month) and then pressing 'n' (F1) the following



error message appears



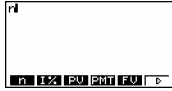
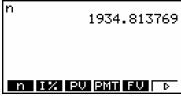
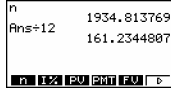


Try PMT = -1000. Ie Another error message!!

Spend a few minutes trying different values for PMT.

- 3) a) Find the minimum value for PMT. ie Find the smallest PMT value that will generate an 'n' value rather than an error message.

b) By following the instructions below convert your answer from 3a) into years.

Enter RUN mode. Press VARS,  press  (F6) Press TVM (F4) then n (F1) , then EXE . Then \div 12, EXE .

4) a) Use run mode to calculate the amount of interest generated in the first month.

b) Explain why a payment of \$5000 generates an error message on the calculator.

5) Use TVM to calculate the size of your repayments if you are to pay the loan off in 20 years.

You realize that you cannot afford the repayments over 20 years.

6) Use TVM to calculate the size of your repayments if you are to pay the loan off in 30 years. How old will you both be in 30 years time?

You realize you will not be able to afford the repayments over 30 years.

7) Use TVM to calculate the size of your repayments if you are to pay the loan off in 40 years. How old will you both be in 40 years time?

8) The maximum duration that Easy-Money Bank will allow is 40 years. You decide to make monthly payments of \$7300.

a) How many months will it take you to pay off the loan?

b) Use the instructions given for Q3b to calculate the duration of the loan in years.

How much of each \$7300 payment actually reduces the loan and how much of each \$7300 is paid to the bank as interest?

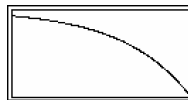
We will now generate a graph of 'Remaining Principle' vs 'Time'. This will also give us a breakdown for each payment into (how much is paid as) Interest and (how much reduces the) Principle.

```
Compound Interest:End
n = 452.087885
i% = 7.1
PV = 1148100
PMT = -7300
FV = 0
P/Y = 12
|n| i% |PV| PMT |FV| AMT
```

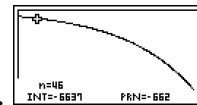
Return to the following screen and press AMT (F6).

```
Amortization :End
PM1 = 1
PM2 = 2
n = 451.8901094
i% = 7.1
PV = 1148000
PMT = -7300
|BAL| INT |PRN| EINT |EPRN| AMT
```


Enter PM1 = 1 and PM2 = 2



Press BAL (F1), then GRPH (F6)



9) Press Trace (SHIFT-F1) and investigate the graph.

Use  to trace the graph. What the numbers mean?

10) Arrow back to $n = 1$ (the first payment of \$7300). How much interest do you pay in the first month and by how much is your loan reduced in that month?

11) Consider $n = 18$ (the 18th payment of \$7300). How much interest do you pay in the 18th month and by how much is your loan reduced in that month?

12) Consider the first payment after paying off the loan for 10 years. How much of your \$7300 payment is interest and by how much is your loan reduced?

13) In which month is the principal first reduced by a greater amount than the amount of interest paid in that month? How many years is this?

- 14) Using RUN mode (and recalling TVM values when necessary) calculate
- The total amount you have spent paying off your loan.
 - The total amount you paid for your \$1 300 000 home (not including 40 years worth of repairs and renovations)
 - The total amount of interest you have paid.
 - Calculate the interest paid as a percentage of the original loan.
- 15) OPTIONAL INVESTIGATION: By constructing a budget calculate an approximate combined gross income you and your spouse will require in order to repay the loan, maintain a car or two, feed your family, entertain, travel and generally have a nice life.

Mortgage Scenario Two

Consider the following mortgage scenario:

- Home value = \$650 000
- Deposit = 20%
- Interest = 7.2%
- Duration of loan = 25 years
- Compounding period = monthly

- 16) a) Calculate the size of the mortgage
- b) Calculate the size of the repayments
- c) In which month is the principal first reduced by a greater amount than the amount paying off interest? (refer to the steps outlined for Q9)
- d) Calculate the total cost of the house
- e) Calculate the total interest paid
- f) Calculate the total interest as a percentage of the loan amount

Thinking 'outside the box' in regard to owning a home

Let's reconsider Mortgage Scenario One. What if you investigated the possibility of renting for 40 years instead of paying off a mortgage. What if you were to pay rent but invest the difference between \$7300 (the monthly cost of the mortgage in Scenario One) and the cost of renting.



Assume the cost of renting a house equivalent to the one you bought in Scenario One is \$6000 per calendar month (roughly \$1500 per week).

Assume the average interest rate you obtain on your long term investment (annuity) is 12%

17) How much money will you invest monthly in your annuity?

18) What will be the Future Value of your investment after 452 months (the duration of the mortgage in Scenario One)

19) What if the average cost of renting was \$7000 a calendar month, meaning you could only invest \$300 per month. What would be the size of your investment after 452 months?

20) What if you 'downsized' and decided to rent a less extravagant house. Let's say you rented a house for \$4000 per calendar month. If you invested the difference as in Q18 what would be the value of your investment after 452 months?

21) What are some disadvantages of renting rather than owning?

22) What are some advantages of renting rather than owning?