

Everyone Wants a Mortgage – Instructions and Solutions

Instructions	Screenshots
<p>NOTE: these screenshots are generated in Linear Input mode. To ensure your calculator is in Linear Input mode Go to RUN (MENU then 1) then SET UP (SHIFT MENU). The cursor will be at Input Mode. Press F2 (Linear)</p> <p>Q1a) YES. 10% deposit is \$129 000 and you have \$150 000</p> <p>Q1b) Largest % deposit = 11.6% (Fig1)</p> <p>Q2a) Deposit is 11% of house price: \$141 900 (Fig2)</p> <p>Q2b) Money for furniture: \$150000 minus deposit = \$8100 (Fig3)</p> <p>Q2c) Mortgage = house price minus deposit = \$1 148 100 (Fig4)</p> <p>Q3a) The smallest whole-number payment amount is \$6793 per month (Fig5) However, this is hypothetical because a mortgage taking 1935 months to pay off would not be permitted!</p>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> <p>Fig1</p> <pre>150000-1290000x100 11.62790698</pre> <p style="text-align: right;">n I% PV PMT FV ▾</p> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> <p>Fig2</p> <pre>1290000x0.11 141900</pre> <p style="text-align: right;">n I% PV PMT FV ▾</p> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> <p>Fig3</p> <pre>1290000x0.11 141900 150000-Ans 8100</pre> <p style="text-align: right;">n I% PV PMT FV ▾</p> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px;"> <p>Fig4</p> <pre>1290000-141900 1148100</pre> <p style="text-align: right;">n I% PV PMT FV ▾</p> </div> <div style="border: 1px solid black; padding: 2px;"> <p>Fig5</p> <pre>Compound Interest:End n = 1934.813769 I% = 11 PV = 1148100 PMT = -6793 FV = 0 P/Y = 12</pre> <p style="text-align: right;">n I% PV PMT FV PMT ↓</p> </div>

Q3b) The convenient way to convert 1935 months to years is:

Go to RUN mode (MENU then 1) press VARS (F6) (Fig6)

Then press \square then TVM (F4) (Fig7)

Recall 'n' with F1 then EXE (Fig8)

Now divide this by 12 and press EXE as per Fig9. We can see that this mortgage would take 161 years to pay off (rather a burden on your great grand children!)

Q4a) First-month's interest: Use AC to clear the screen. You should have PV on F3 (If you don't go through the steps for Q3b ie VARS F6 TVM (F4)

Press PV (F3) then EXE (Fig10)

The first months interest will be: 7.1% of PV \div 12 (Fig11)

First-month's interest = \$6792.93

Fig6



Fig7



Fig8

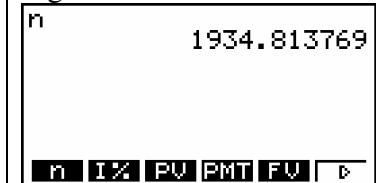


Fig9

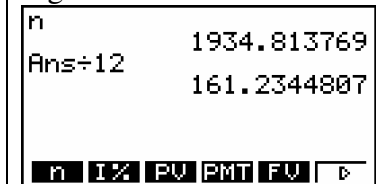


Fig10

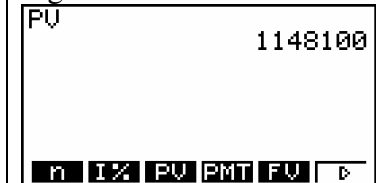
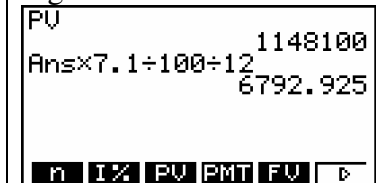


Fig11



Q4b) \$5000 is less than the amount of interest generated in the first month. Therefore, the principle (the amount still owing) would increase, instead of decrease. You would never pay off the loan using monthly payments of \$5000!

Q5) **Return to TVM (MENU TVM EXE F2)**

Enter the values as per Fig12, pressing EXE after each entry.

NOTE: PMT = 1111111 means that whatever value appears here is irrelevant as it will be over-written when we solve for PMT.

Press PMT (F4) Payments are \$8970.25pm (Fig13)

Q6) **Press EXIT. Change n to 360. Press EXE** (Fig14)

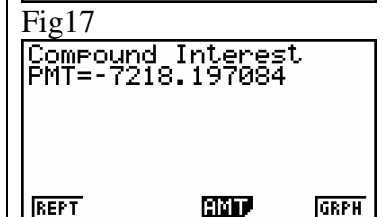
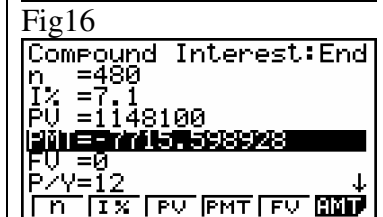
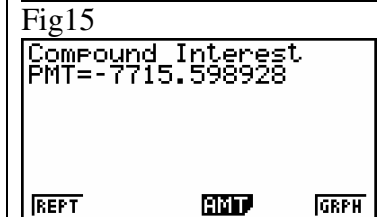
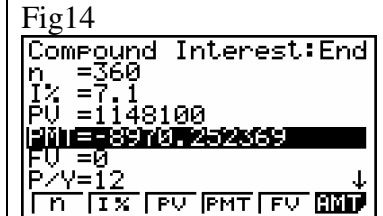
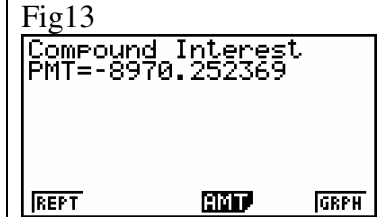
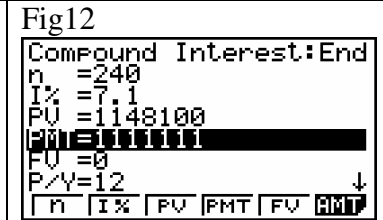
Press PMT (F4) (Fig15)

Payment = \$7715.60 pm (Fig15); you will both be 58 years old.

Q7) **Press EXIT. Change n to 480** (Fig16)

Press PMT (F4) (Fig17)

Payment = \$7218.20 pm (Fig17); you will both be 68 years of age.



Q8)a) **Press EXIT. Change PMT to -7300** (Fig18)

Press n (F1) (Fig19)

ANS = 452 months

Q8b) **MENU RUN VARS**  **(F6) TVM (F4) n (F1)** (Fig20)

Press EXE ÷ 12 EXE (Fig21) ANS: 37.7 years (Fig21)

Q9) Return to the TVM screen **(MENU TVM F2) then press AMT** (F6)

Enter PM1 = 1 and PM2 = 2 (Fig22)

Press BAL (F1) (Fig23)

Fig18
Compound Interest:End
n =452
I% =7.1
PV =1148100
PMT=-7300
FV =0
P/Y=12
| n | I% | PV | PMT | FV | AMT | ↓

Fig19
Compound Interest
n =452.0877865

| REPT | | AMT | | GRPH |

Fig20
n

| n | I% | PV | PMT | FV | ▸ |

Fig21
n 452.0877865
Ans÷12 37.67398221

| n | I% | PV | PMT | FV | ▸ |

Fig22
Amortization :End
PM1=1
PM2=2
n =452.0877865
I% =7.1
PV =1148100
PMT=-7300
| BAL | INT | PRN | EINT | EPRN | AMT | ↓

Fig23
Amortization :End
BAL=1147082.85

| REPT | | AMT | | GRPH |

Press GRPH (F6)

To trace the graph **Press SHIFT F1** (Fig24) This is a graph of Principal vs Time. The numbers state how much of the payment is interest (INT) and how much actually goes to paying off the loan (PRN)

Q10) You pay \$6792 interest and ONLY \$507 off your loan!!!!!! (Fig24)

Q11) You pay \$6739 interest and \$560.50 off your loan!! (Fig25)

Q12) ie the 121st month. You pay \$6270 interest and \$1029 off your loan!! (Fig26)

Q13) ANS: in the 336th month the amount the principal is reduced by exceeds the interest amount. This is the final month of the 28th year (Fig27)

Q14a) The total of loan repayments ie PMT x n:

Press MENU RUN VARS F6 TVM (F4) PMT (F4) x -1 EXE (top line of Fig28) This is the positive payment value.

Multiply this by 'n' to give total of repayments: **x n EXE** (middle line of Fig28) Total of repayments = \$3 300 240.84 !!

Q14b) Add to this the deposit: **+ 141900 EXE** (bottom line of Fig28) ie the total spent buying the house = \$3 442 140.84 !!

Q14c) The total interest paid is the previous answer minus the loan minus the deposit: **-PV - 141900** (bottom line Fig29)
ANS = \$2 152 140.84 interest!!

Fig24

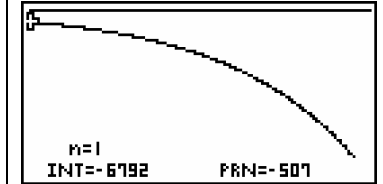


Fig25

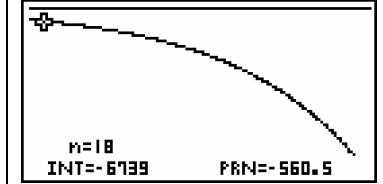


Fig26

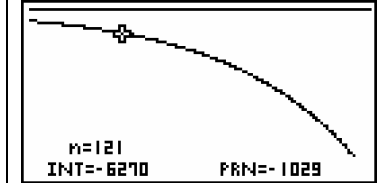


Fig27

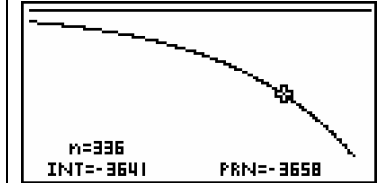


Fig28

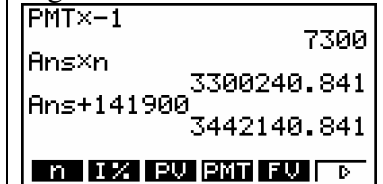
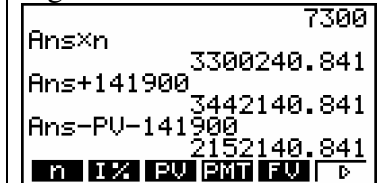


Fig29



NOTE: A simpler way to calculate this is to subtract the loan from the total amount of repayments (Fig29B)
 ANS = \$2 152 140.84 interest!!

Q14d) To find the interest as a percentage of the loan divide the last figure by PV (the loan) and multiply by 100 (Fig30)
 ANS = 187.45% !!

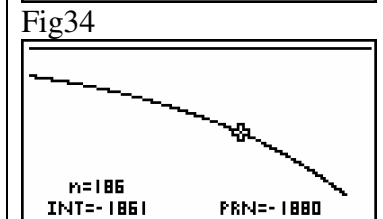
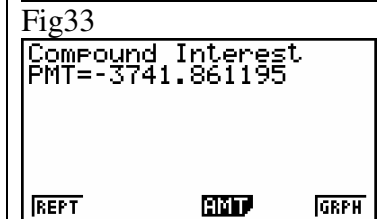
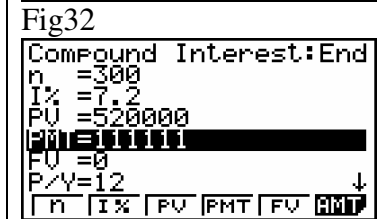
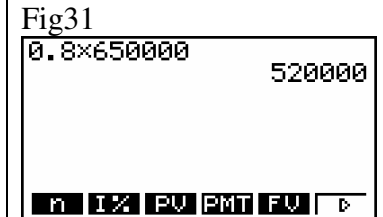
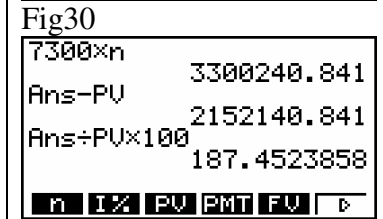
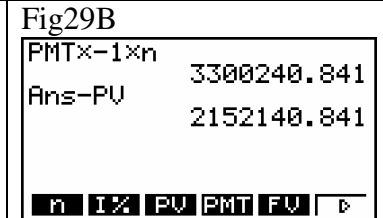
Q15) Various answers: Possibly a combined gross annual income of \$180 000 - \$220 000 will be required depending upon number of cars, number of children, lifestyle, etc.

Q16) a) **Press AC** to clear the screen.
 The size of the mortgage is 80% of the house value: ANS = \$520 000 (Fig31)

Q16b) The size of the repayments: **Go to TVM and enter the values as per Fig32, pressing EXE** after each entry. (PMT = 111111 means that the number here is irrelevant) Press PMT (F4)

ANS = \$3741.86pm (Fig33)

Q16c) **Press EXIT AMT (F6).**
Enter MP1=1, PM2=2.
Press BAL (F1) GRPH (F6).
Trace with SHIFT F1 and arrow right.
 ANS: in the 186th month (Fig34)



Q16d) (The deposit = $\$650\,000 \times 0.2 = \$130\,000$. Total cost of the house = $\$130\,000 + 300$ payments of $\$3741.86$)

Press MENU RUN 130000 + VARS [] (F6) TVM (F4) PMT (F4) x -1 x n (F1) EXE (Fig35)
 (The PMT needs to be multiplied by -1 so that it becomes a positive number)

Total cost of the house is $\$1\,252\,558.36$

Q16e) (Start with the total cost of the loan (ie not including deposit), then subtract the loan amount)

Press AC PMT (F4) x -1 x n (F1) - PV EXE

Interest paid = $\$602\,558.36$!! (Fig36)

NOTE: another route to this solution is to subtract the cost of the house from the total amount paid.

Q16f) (Divide the interest by the loan amount then multiply by 100)

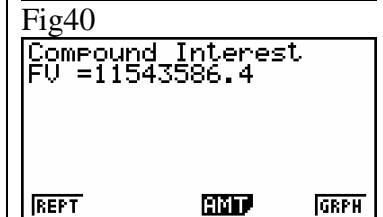
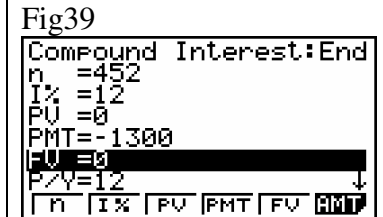
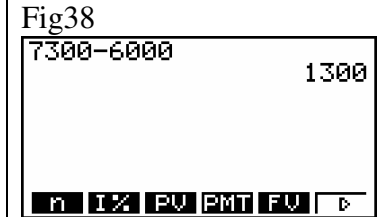
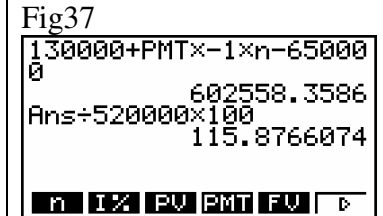
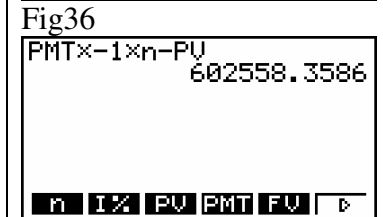
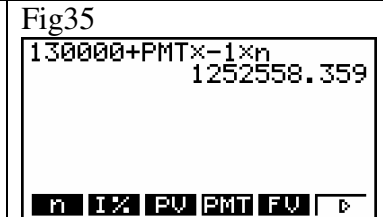
Interest as a percentage of the loan: **\div PV, x 100 EXE** (Fig37) ANS: 115% interest !!

Q17) $\$1300$ per month (Fig38)

Q18) **Return to TVM, enter the values as per Fig39.**

Press FV (Fig40)

ANS = $\$11\,543\,586.40$!!! (But this is the value of the investment in 37 years time)



(NOTE: It could be argued that 12% interest over 37 years is unlikely)

19) ANS: \$2 663 904.55 (Figs 41 and 42)

Q20) Monthly deposits are \$3300 (Fig43)

Value of investment in 453 months = \$29 302 950.10 (over \$29 million!!) (Figs 44 and 45)

Q21) Difficult to predict the increase in rental costs; no guarantee of staying for a long time in one property, cannot make improvements to the house, are subject to changing rental markets, a rental home is not yours, you do not own the house 'in the end', etc.

Q22) Don't have to pay for rates, repairs and maintenance, monthly rental costs are less than mortgage repayments, can be economically more sound if you invest as well as pay rent, you are not 'tied' to a mortgage, etc.

Fig41
Compound Interest:End
n =452
I% =12
PV =0
PMT=-300
FV =2663904.554
P/Y=12
| n | I% | PV | PMT | FV | AMT |

Fig42
Compound Interest
FV =2663904.554
| REPT | | AMT | | GRPH |

Fig43
7300-4000
3300
| AMT |

Fig44
Compound Interest:End
n =452
I% =12
PV =0
PMT=-3300
FV =29302950.1
P/Y=12
| n | I% | PV | PMT | FV | AMT |

Fig45
Compound Interest
FV =29302950.1
| REPT | | AMT | | GRPH |

NOTES: