Creative Tabling - Visualizing Loans on the TI-84CE

T[3] International Conference, Arlington, Texas, February 14, 2026, 4:00 pm – 4:55 pm, Level 4, Fan B
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An amortization table shows, in an easy-to-read format, how each payment on a loan is split between principal and interest. An amortization graph gives a visual picture of how those amounts change over time. In this example, we consider a 30-year mortgage for $400,000 at a 6% interest rate.

YOUR TASKS

A Determine how much your payments need to be, then set up an amortization table and graph.
B How much of your first payment goes towards principal, and how much towards interest?
C After 10 years, how much of your payment goes towards principal and interest?
D How much of the loan will you have paid off in the first 10 years? And what's the balance?
E How long will it take before your payments are more than 50% principal?
F There is talk about 50 year mortgages. Does it seem like a good idea financially?
G Explore the advantages and disadvantages of a 15 year mortgage for $400,000 at 6%.

A. Press [mode]. Fix the decimal display to 2 digits and choose "Simul" Graph setting. (figure 1)

Press [apps], then select **1:Finance** (figure 2).

Select the TVM (time-value-money) Solver by pressing [1] or [enter]. (figure 3) The variables stand for the following:

N	number of payment periods
I%	annual percentage rate
PV	Present value
PMT=	Payment amount
FV	Future value
P/Y	Payments per year
C/Y	Compounding periods per year
PMT:	Choose whether payments are made at the end or beginning of each period

For the given situation, since payments will be monthly, let N=30 × 12, I%=6, PV=-400000 (it is negative to represent it is a debt), PMT is skipped because it is what will be solved. FV=0, P/Y=12. Setting P/Y causes C/Y to be the same. It can be overridden, but is not necessary here. (figure 4)

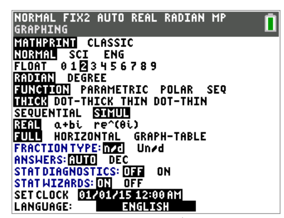


FIGURE 1

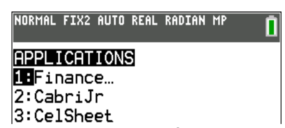


FIGURE 2

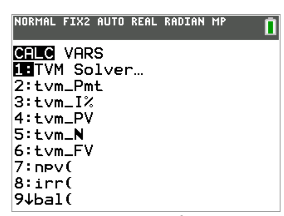


FIGURE 3

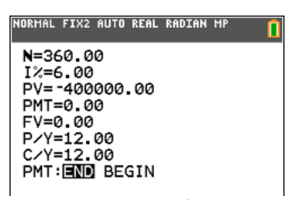


FIGURE 4

Move the cursor to PMT=. Press [alpha] [solve]. (figure 5)

Your payments will be $2398.20 per month.

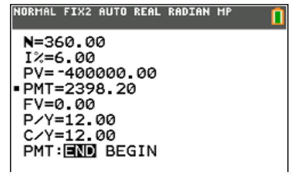


FIGURE 5

Press [2nd] [quit] to return to the HOME screen.

Answer questions **B**, **C**, & **D** using the sum of principal (**∑Prn**), sum of interest (**∑Int**), and balance (**bal**) functions. These are found in the Finance app in the menu shown in figure 6. Principal **∑Prn** and Interest **∑Int** are multiple argument functions. Balance **bal** requires only a single argument. The arguments are:

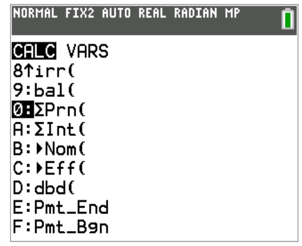


FIGURE 6

∑Prn(*j*, *k***)** = $Pmt_j + Pmt_{j+1} + \ldots + Pmt_{k-1} + Pmt_k$

∑Int(*j*, *k***)** = $Int_j + Int_{j+1} + \ldots + Int_{k-1} + Int_k$

bal(*number of payments made so far*)

When looking for the amount of principal or interest for just one payment, let the first payment &last payment be the same.

B. From the HOME screen, go to the Finance menu, highlight the command **∑Prn(**. For help with arguments, press [+] to go to the catalog (fig 7A), then press [trace] to select the "soft key" to paste (fig 7B). For the principal paid in just the first payment, define the first and last payments to both be 1. (See above definition.) Repeat with **∑Int(** (figure 7B)

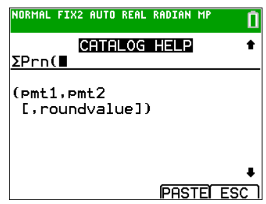


FIGURE 7A

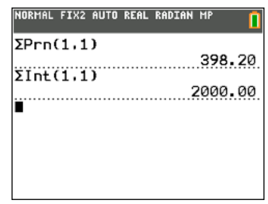


FIGURE 7B

$2000 of the first payment of $2398.20 *goes to pay interest, while only $398.20 goes towards the principal.*

C. The Payment after 10 years (the 120th payment of $2398.20): Repeat the above steps, use 120 for the payment. (figure 8)

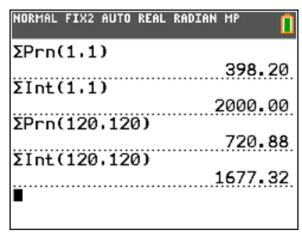


FIGURE 8

After 10 years, you still pay mostly interest.

D. How much has been paid off after 10 years? (How much is still owed?) This can be done in two ways: by summing the principal from the first 120 payments, or by calculating the remaining balance after 120 payments. (figure 9)

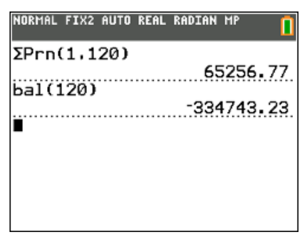


FIGURE 9

Less than $66000 of the loan has been paid off. More than $334000 is still owed. Note the balance is negative, it indicates this amount is still owed.

E. To find out when the loan payments are at least 50% principal, set up an amortization table or view a graph.

Press y=. Enter the principal, interest, and balance functions in Y1, Y2, and Y3 (fig 10). Let Y3 = −bal(x) so outputs are positive.

TIP: Save keystrokes. The "last entry" recall feature for the home screen works in the Y= menu, too. Put the cursor at Y1=, then press 2nd entry repeatedly until ∑**Prn(** appears. Then edit the arguments, replacing the digits with **X**'s.

Optional: Let Y4 = Y1+Y2 to clarify the meaning of Y1 and Y2.

Press 2nd tblset. Set TblStart = 0 and ΔTbl = 1. (figure 11)

Press 2nd table to view the table. Press the up or down arrow keys to scroll up or down. (figure 12)

Jump quickly to any part of the table by returning to the TBLSET editor and choosing a different TblStart and/or ΔTbl.

To use the table to find when principal equals interest, scroll and search Y1 and Y2 to find when they are equal.

Part **E** also can be answered graphically. Graph the principal and interest amounts, and explore where the graphs intersect. Be sure you are in Simultaneous graphing mode (MODE menu).

Press y=. Deselect the balance in Y3 by moving the cursor to the "=" sign and pressing enter.

Press window and set Xmin = 0 and Xmax = 360 with Xscl =100 (or whatever you prefer for tick marks) with Ymin = 0 and Ymax = 2500. Actually any Ymax ≥ 2398.20 would suffice (figure 13A). Press graph, then trace to explore. To uncover why the graph shows only a few points, check Figure 13. Despite so few points being plotted, we can still enter any value of X while trace is active to see the value of Y, even if the point on the graph does not display.

Now press window and enter 1 for TraceStep. Two things change.

1. ΔX, the horizontal distance between centers of adjacent pixels on the graph screen, changes to 0.5. TraceStep is always twice ΔX so the trace cursor moves horizontally in steps of 2 pixels with each press of an arrow key so tracing is less tedious.
2. Xmax changes to 132 (fig 14A). There are 265 pixels per row; so there are 264 steps between pixels per row. With ΔX now 0.5, the TI-84 Plus CE updates Xmax using the following formula: $\Delta X = \frac{(Xmax - Xmin)}{264}$. On the older TI-84, $\Delta X = \frac{(Xmax - Xmin)}{94}$.

Press graph & trace to see how the graph is changed (fig 14B).

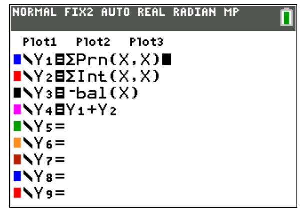


FIGURE 10

NOTE: Balance is entered with a (-) sign, so its table values are positive.

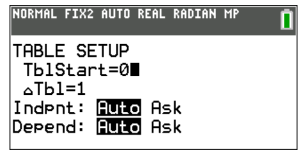
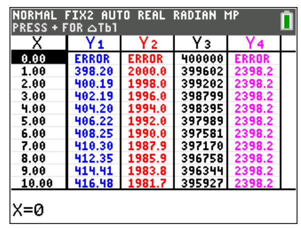


FIGURE 11



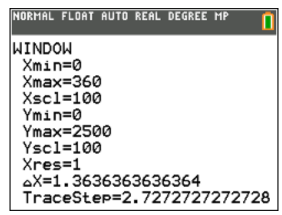
NORMAL FIX2 AUTO REAL RADIAN MP
PRESS + FOR ΔTbl

X	Y1	Y2	Y3	Y4
0.00	ERROR	ERROR	400000	ERROR
1.00	398.20	2000.0	399602	2398.2
2.00	400.19	1998.0	399202	2398.2
3.00	402.19	1996.0	398799	2398.2
4.00	404.20	1994.0	398395	2398.2
5.00	406.22	1992.0	397989	2398.2
6.00	408.25	1990.0	397581	2398.2
7.00	410.30	1987.9	397170	2398.2
8.00	412.35	1985.9	396758	2398.2
9.00	414.41	1983.8	396344	2398.2
10.00	416.48	1981.7	395927	2398.2

X=0

FIGURE 12

NOTE: Y1(0), Y2(0), and Y4(0) return ERROR messages because there was no "0th" payment. But Y3(0) does return the balance after 0 payments.



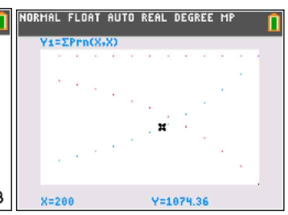
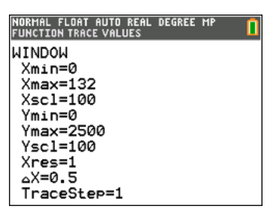


FIGURE 13A FIGURE 13B

Y1 (principal) is the set of points that are increasing. Y2 (interest) is the set of points that are decreasing. Y4 (sum of principal and interest) is the horizontal set of points near the top of the screen. All values of Y4 are 2398.20. Very few points are plotted because TraceStep is not an integer, and these functions are defined only at integers, but since Xmin=0 and Xmax=360, we see each graph from the first to the last payment



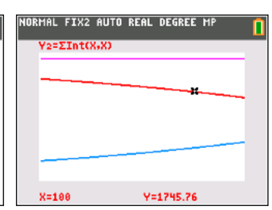


FIGURE 14A FIGURE 14B

Since Xmax =132, so we see only the first 132 payments in this graph screen.

Patience is helpful. Graphing is slow because there are so many calculations to perform.

TIP: Need to stop the graphing process? Press on.

TIP: To see the entire term of the loan, Xmax must be at least 360, but in order to keep all pixels as integers, Xmax must also be a multiple of 132 (so long as Xmin remains 0). Press window, change TraceStep to 4 (a factor of 12), and then press enter. Xmax changes to 528 = 132 x 4. Press graph and then use trace to see figures 15A and 15B.

NOTE: Unlike typical functions, where the calculator connects output values with line segments, **∑Prn** and **∑Int** are each sequences of partial sums defined only at positive integers, so the calculator does not connect their points. That is why it is helpful to have Xmax – Xmin be a multiple of 132. Using Xmin = 0 and Xmax = 528 with Xres = 1 will then make each press of the left or right arrow move the TRACE cursor (✖) by 528/132 = 4, i.e. the TraceStep. Similarly, it will move the free floating cursor (✚) by ΔX =2, i.e. the distance in the *x*-axis between adjacent pixel centers.

> TIP: If want to speed up the graph, press on to stop it, then press window and increase Xres from 1 to 4. Then press graph again. The graph is plotted 4 times as fast, but resolution is only ¼ what it was when Xres=1. (The highest value allowed for Xres is 8.)

To solve part **E** graphically, press trace and move the cursor as close as possible to the intersection of Y1 and Y2. The cursor does not stop at every payment number, so the intersection can only be approximated. See figures 15C and 15D.

> NOTE: Because of the limited domain (only positive integers) of these functions, the CALCULATE menu cannot be used. Instead, the intersection of the graphs can be approximated with the TRACE function. For more precision, "ZoomIn" on the intersection (using Xres = 1) or use the Table.

Let's use the Table to ZoomIn and find the first payment when principal finally is greater than the interest. Redefine Y4 to Y1−Y2 (figure 16A) to make it easier to use table scrolling to locate when Y1 > Y2. From the graph, we know the solution will be close to the 224th payment. In Figure 16B, we see the solution to part E, when principal finally is greater than interest, is the 223rd payment. So, for the first 18 years and 7 months, (this is over 60% of the 30 year loan) you're paying more interest than principal!

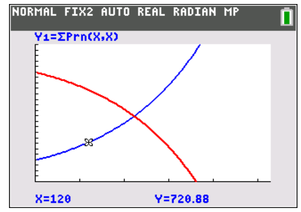


FIGURE 15A

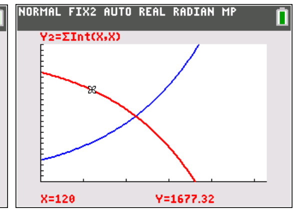


FIGURE 15B

Press trace. Then use the left and right arrow keys to move along each function. Alternatively, jump to any desired X value by typing that value (when TRACE is active). Use the up and down keys to move between the functions.
Compare the above to home screen calculations for the 120th payment in figure 8.

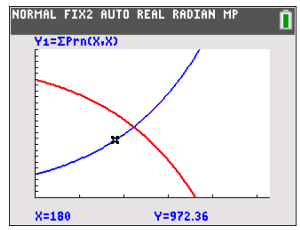


FIGURE 15C

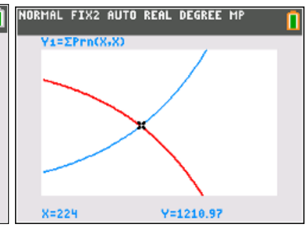


FIGURE 15D

In fig 15C we see that after 15 years (180 months) of making payments, the principal paid is only $972.36, and still significantly less than half of the total payment of $2398.20. In fig 15D, the cursor is very close to the intersection point. So we know principal and interest are very close at the 224th payment.

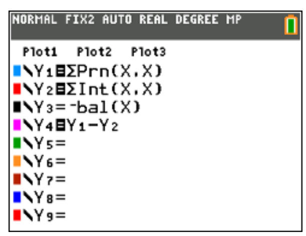
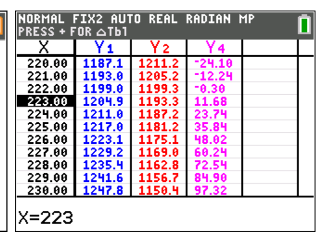


FIGURE 16A


NORMAL FIX2 AUTO REAL RADIAN MP
PRESS + FOR ΔTbl

X	Y1	Y2	Y4
220.00	1187.1	1211.2	-24.10
221.00	1193.0	1205.2	-12.24
222.00	1199.0	1199.3	-0.30
223.00	1204.9	1193.3	11.68
224.00	1211.0	1187.2	23.74
225.00	1217.0	1181.2	35.84
226.00	1223.1	1175.1	48.02
227.00	1229.2	1169.0	60.24
228.00	1235.4	1162.8	72.54
229.00	1241.6	1156.7	84.90
230.00	1247.8	1150.4	97.32

X=223

FIGURE 16B

Move quickly down the table by going to tblset and changing Tblstart. Precision in the graph in Figure 15 is limited by trace. We can enter values of X to evaluate them on the graph, but here in the table we can change ΔX to any value we choose and scroll. And we find it's actually the 223rd payment where the principal, Y1, first surpasses 50% of the total payment.

F. Are 50 year mortgages a good idea?

First, let's see how much a 30 year $400000 loan at 6% is going to cost. Fig 17 shows the total amount paid ($2398.20 per month for 360 months = $863352). $463000, more than half, of the amount goes to pay the interest.

The advantage of a 50 year mortgage is smaller payments. But the tradeoff is the lender will compensate by charging a higher rate. If the rate were raised to 7%, figure 18A shows that the monthly payments would be $2406.75 !! This is more per month than the 30 year loan. Not a good idea.

NOTE: Using Xres = 4 and TraceStep = 8 gives figure 18B. Compare the rates of change at the start and the end of the process.

If the lender splits the difference and charges 6.5%, we see in figures 19A and 19B that the payments do indeed reduce by $144 to $2254.87 per month. But after 600 payments, we have paid the lender a total of 1,352,922 ! That's about half a million dollars more to the lender than the 30 year loan! Not a good idea. Graphs of the principal and interest amounts would look similar to figure 18B.

If interest is raised 0.1% to 6.1%, the monthly rate is $2135.24, $263 less than at 6% for 30 years (figure 20A).

$263 less each month is nice, but the total after 50 years is $1,281,144 (figure 20B). We still pay an extra $400,000 than the 30 year loan. Is this a good idea? You decide.

Also, the extra 0.1% might not be enough for the lender, so they might not even offer this loan.

G. Suppose we take a 15 year mortgage for $400,000 at 6%.

Our payment is much larger at $3375.43 (figure 21A), but the total amount we pay after 15 years is $607,577.40 (figure 21B). We would then only pay $207,577 in interest, cutting the amount that we would have paid in interest on a 30 year loan by more than half.

If we use Ymax = 3500 with TraceStep = 8 as in figure 22A, we see in figure 22B the intersection point for the 15 year loan occurs much earlier, bending more sharply sooner.
When possible, some lenders may apply extra payments directly to the principal to accelerate progress.

These graphs and tables can help lenders shift the focus from the monthly payment to the total cost of the loan over time.

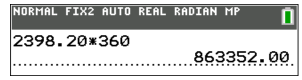


FIGURE 17

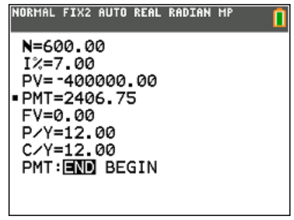


FIGURE 18A

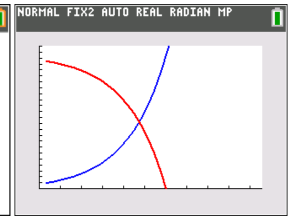


FIGURE 18B

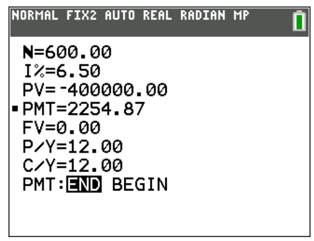


FIGURE 19A

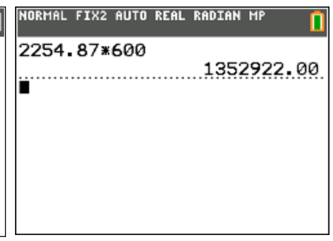


FIGURE 19B

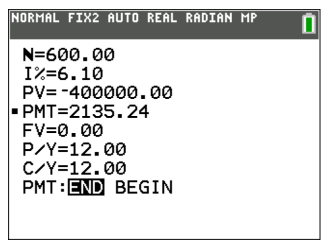


FIGURE 20A

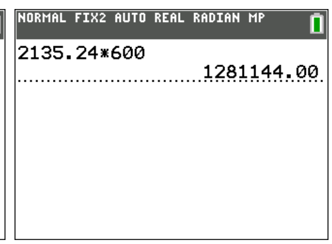


FIGURE 20B

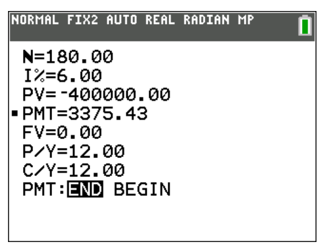


FIGURE 21A

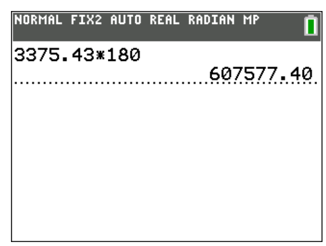


FIGURE 21B

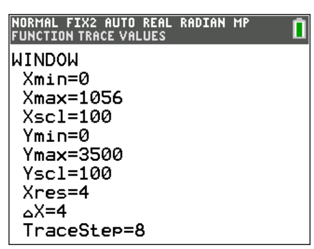


FIGURE 22A

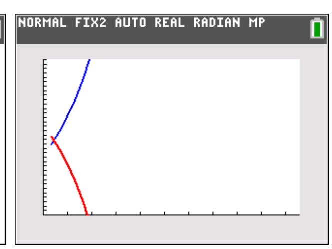


FIGURE 22B