Using the Finance Menu of the TI-83/84/Plus calculators KEY

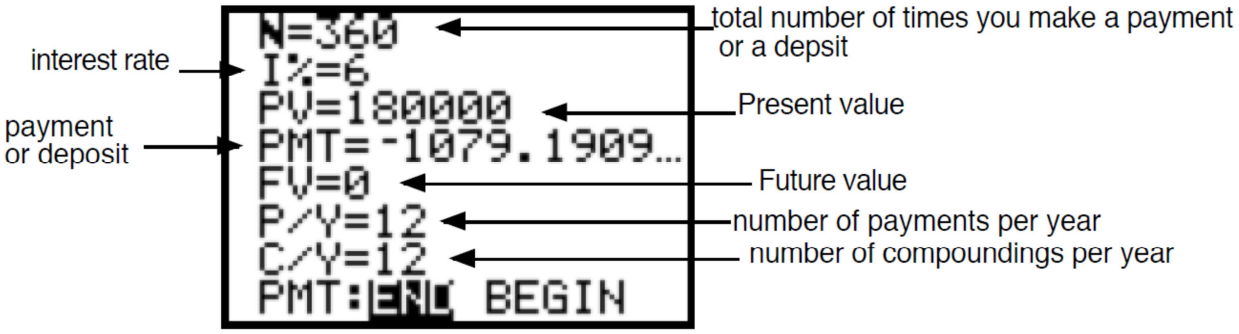
To get to the FINANCE menu

- On the TI-83 press [2nd] [x^{-1}]
- On the TI-83, TI-83 Plus, TI-84, or TI-84 Plus press [APPS] and then select 1:FINANCE…

The FINANCE menu looks like this:

"TVM" represents "Time, Value, Money"
We will use option 1:TVM Solver…

The TVM Solver menu looks like this:



You may not see these numbers above. If this is the first time that you have used this menu then all of the entries will be displayed as 0.

When solving an exercise, fill out all of the other entries first and then go back onto the entry you want to "Solve". Once you are on that entry, press [ALPHA] [Enter] (Solve).

For Systematic Savings	FV = total deposits + interest
For Systematic Loans	total payments = original loan amount + interest

What the variables mean:

N = the total number of deposits/payments made by you
I% = the annual interest rate
PV = Present Value or Principal
PMT = the amount of each deposit/payment made by you
FV = Future Value
P/Y = the number of deposits/payments per year made by you
C/Y = the number of compounding periods per year
PMT:END BEGIN is used to indicate if the payments are made at the beginning or end of each period.

NOTES:

- In formulas, the number of compounding periods per year was represented by the variable n. Therefore, we can think of C/Y as n.
    - Almost always, the deposits/payments made by you will match up with the compounding periods per year. In these cases,
        - P/Y = C/Y = n. For example, "…monthly deposits of $250, compounded monthly…" tells us that P/Y = C/Y = 12.
        - We can think of N as nt where t represents the total time in years.
- I% will be entered in percentage form. For example, 7% will be entered as I% = 7.
- PV
    - PV = 0 (for a systematic savings plan where you start the account with nothing).
    - PV = the loan amount (for a loan that has a systematic payment plan). This amount will be positive because the loan money is coming *into* your pocket at the beginning.
- PMT will always be a negative number for the calculator. We use negative numbers for money that is "coming out of our pocket." The "negative" [(-)] button is to the left of the [Enter] button. Do not use the "minus" [−] button .
- FV
    - FV = the total amount saved from deposits plus interest (for a systematic savings plan). For a savings plan this number will always be positive because the money is coming *into* your pocket at the end.
    - FV = 0 (for a systematic payment plan for a loan). In other words, the payment plan is designed so that at the end you should owe nothing.
        - In fact, for a loan with a set systematic payment plan, FV represents the "**Balance**" of the loan at any point in time: how much of the original loan amount you still owe at any point in time as you make your payments. The FV (Balance of the loan) will be negative until you have made your final loan payment. Note that the Balance of the loan does not include any interest that is taken out of each of your loan payments.
- PMT:END BEGIN For this option always have "END" highlighted for our exercises.

1. Suppose you deposit $200 at the end of each month into an account earning 5.4% interest compounded monthly. How much will be in the account after making deposits for 15 years?

N = 12*15 = 180 total monthly deposits
I% = 5.4
PV = 0
PMT = -200
FV = [ALPHA SOLVE] ⟶ 55281.20587
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

There will be $55,281.21 in the account after making deposits for 15 years.

2. The parents of a kindergarten student want to save $200,000 to pay for the estimated cost of her college education. They plan to invest in a mutual fund that earns about 8% compounded quarterly. How much should the parents deposit at the end of each quarter so the account will be worth $200,000 in 13 years?

N = 4*13 = 52 total quarterly deposits
I% = 8
PV = 0
PMT = [ALPHA SOLVE] ⟶ -2221.8171
FV = 200000
P/Y = 4
C/Y = 4
PMT: [END] BEGIN

The parents should deposit $2221.82 at the end of each quarter.

3. Suppose you want to have $3000 available for the down payment on a car. If you deposit $120 at the end of every month into an account earning 6% compounded monthly, how long will it take until you have the down payment?

N = [ALPHA SOLVE] ⟶ 23.6154497 total monthly deposits
I% = 6
PV = 0
PMT = -120
FV = 3000
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

23.6154497 = nt
23.6154497 = 12t
1.967954141 = t

It will take approximately 1.97 years to have the down payment.

4. On January 24, 2012, the United States average interest rate for money market accounts was 0.51%, whereas one of the best rates in the country, 0.90% , was being offered by First Internet Bank of Indiana. If $100 is invested at the end of each month into an account, how long will it take the account to grow to $10,000 if it is invested at 0.90% compounded monthly?

N = [ALPHA SOLVE] ⟶ 96.46370459 total monthly deposits
I% = 0.90
PV = 0
PMT = -100
FV = 10000
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

96.46370459 = nt
96.46370459 = 12t
8.038642049 = t

It will take approximately 8.04 years to grow to $10,000 if invested at 0.90% compounded monthly.

5. Suppose a 27-year-old man bought an annuity (a systematic savings plan) through the Jackson National Life Insurance Company in 1997. The plan calls for deposits of $100 at the end of each month and pays an interest rate of 6.25% compounded monthly.

   a. How much will the annuity be worth when the man is 65-years-old in 2035?

   t = 65 – 27 = 38 years
   Also, t = 2035 – 1997 = 38 years

   N = 12*38 = 456 total monthly deposits
   I% = 6.25
   PV = 0
   PMT = -100
   FV = [ALPHA SOLVE] ⟶ 185951.0988
   P/Y = 12
   C/Y = 12
   PMT: [END] BEGIN

   The annuity will be worth $185,951.10 when the man is 65-years-old in 2035.

   b. How much of the future value will be from deposits?

   456 total monthly deposits times $100 per deposit = 456*100 = 45,600

   $45,600 of the future value is from total deposits.

   c. How much of the future value will be from interest?

   For Systematic Savings we have: Future Value – total from deposits = interest
   $185,951.10 – $45,600 = interest

   $185,951.10
   – $ 45,600.00
   $140,351.10

   $140,351.10 of the future value is from interest.

6. After finishing your college degree you start a job that has a retirement plan. Suppose that $100 is deposited monthly into your retirement account which earns interest compounded monthly at a 6% annual rate.

   a. How much money will be in the retirement account after 30 years? How much would you have paid in total deposits?

N = 12*30 =360 total monthly deposits
I% = 6
PV = 0
PMT = -100
FV = [ALPHA SOLVE] ⟶ 100451.5042
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

$100,451.50 will be in the retirement account after 30 years.

360 total monthly deposits times $100 per deposit = 360*100 = 36,000

The total amount from deposits is $36,000.

   b. If instead of starting the retirement plan when you are hired, you wait until 10 years before retirement to start making the deposits. To help compensate for the delay, you make your monthly deposits $300. In this case, how much money will be in the account when you retire? (Assume the same interest rate). How much would you have paid in total deposits?

N = 12*10 = 120 total monthly deposits
I% = 6
PV = 0
PMT = -300
FV = [ALPHA SOLVE] ⟶ 49163.80404
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

$49,163.80 will be in the retirement account after 10 years.

120 total monthly deposits times $300 per deposit = 120*300 = 36,000

The total amount from deposits is $36,000.

7. Suppose you want to purchase a car and the added charges for taxes, title, license, and fees bring the total to $16,032.31. You must make a 10% down payment and pay for the remainder through a car loan at an interest rate of 7.9% compounded monthly. You are to repay the loan with monthly payments for 4 years.

   a. What are the monthly payments?

   The down payment will be
   $16,032.31*0.10 = $1,603.23

   So that
   $16,032.31
   – $ 1,603.23
   $14,429.08 is left to pay with a loan

   N = 12*4 = 48 total monthly payments
   I% = 7.9
   PV = 14429.08
   PMT = [ALPHA SOLVE] ⟶ -351.57909
   FV = 0
   P/Y = 12
   C/Y = 12
   PMT: [END] BEGIN

   The monthly payments will be $351.58.

   b. What is the total amount you make in payments over the life of the loan?

   48 total monthly payments times $351.58 per payment = 48*351.58 = $16,875.84

   The total amount made in payments is $16,875.84.

   c. How much interest will you pay over the life of the loan?

   For Systematic Loans we have: total amount in payments – original loan amount = interest
   $16,875.84 – $14,429.08 = interest

   $16,875.84
   – $14,429.08
   $ 2,446.76

   The total amount paid in interest is $2,446.76.

8. To pay for his home, Dr. Carrera has a mortgage (home loan) of $300,000 at 6.6% annual interest rate compounded monthly with a monthly payment plan over 30 years.

   a. How much would the scheduled payments on the loan be?

N = 12*30 =360 total monthly payments
I% = 6.6
PV = 300000
PMT = [ALPHA SOLVE] ⟶ -1915.976454
FV = 0
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

The monthly payments would be $1,915.98.

   b. If Dr. Carrera pays $100 extra each month, how long will it take him to pay off the loan?

N = [ALPHA SOLVE] ⟶ 311.0869017 total monthly payments
I% = 6.6
PV = 300000
PMT = -2015.976454
FV = 0
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

311.0869017 = nt
311.0869017 = 12t
25.92390848 = t

It will take approximately 25.92 years for Dr. Carrera to pay off the loan.

   c. How much does Dr. Carrera save in payments over the life of the loan by paying $100 extra each month?

The total amount Dr. Carrera pays in part (a) is

360*1,915.98 = $689,752.80

The total amount Dr. Carrera pays in part (b) is

311.0869017*2,015.98 = $627,144.97

$689,752.80
– $627,144.97
$ 62,607.83

The total amount Dr. Carrera saves by paying an extra $100 extra each month is $62,607.83.

9. Susan's friend Amber has fallen on hard times and needs to borrow some money. Looking at her weekly paycheck, Amber decides that she can afford to give Susan $20 a week to pay her back. Amber promises Susan that she will pay her back on a weekly basis, with interest, over a period of 6 months. They agree on a 10% annual interest rate compounded weekly. How much can Amber afford to borrow?

N = 52*(6/12) = 26 weekly payments
I% = 10
PV = [ALPHA SOLVE] ⟶ 506.738968
PMT = -20
FV = 0
P/Y = 52
C/Y = 52
PMT: [END] BEGIN

Under such a payment plan, Amber can afford to borrow $506.74.

10. Chad Porter takes out a $150,000 loan for a new house at an interest rate of 4.5% per year compounded monthly and the loan is to be paid back monthly for 30 years. Thirteen years and 4 months later Chad wins the lottery and wants to pay off the remaining balance on his loan. How much will Chad have to pay at that time?

First we must solve for the amount of the monthly payments.

N = 12*30= 360 monthly payments
I% = 4.5
PV = 150000
PMT = [ALPHA SOLVE] ⟶ -760.0279647
FV = 0
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

The monthly payments will be $760.03.

Now, given this payment plan, we must solve for the balance of the loan (FV) after thirteen years and 4 months of payments.

NOTE: There are two ways to figure out the value of N at this time.

Way #1 t is the total time in years so t = (13 + 4/12) years. Therefore
N= nt = 12(13 + 4/12) = 160

Way # 2 N is the total monthly payments, so we have
N = 12*13 monthly payments + 4 monthly payments = 160 monthly payments

N = 160 monthly payments
I% = 4.5
PV = 150000
PMT = -760.0279647 (This value is just left over from the previous solving)
FV = [ALPHA SOLVE] ⟶ -106803.2587
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

Of the original $150,000 borrowed, Chad would still owe $106,803.26 after thirteen years and 4 months of payments. ($106,802.81 also accepted if using PMT = -760.03)

By paying off the loan early, Chad does not have to make any future payments of $760.03 from the original payment plan, and therefore saves paying interest taken out from all of those future payments.

Additional Exercises

11. Suppose a couple takes out a 15-year mortgage for $130,000 at 2.75% interest rate compounded quarterly. After 10 years of quarterly payments, they inherit a small fortune from the passing of their rich uncle and decide to pay off the loan. How much will they have to pay?

First we must solve for the amount of the quarterly payments.

N = 4*15 = 60 quarterly payments
I% = 2.75
PV = 130000
PMT = [ALPHA SOLVE] ⟶ -2651.512716
FV = 0
P/Y = 4
C/Y = 4
PMT: [END] BEGIN

The quarterly payments will be $2,651.51.

Now, given this payment plan, we must solve for the balance of the loan (FV) after ten years of payments.

N = 4*10 = 40 quarterly payments
I% = 2.75
PV = 130000
PMT = -2651.512716 (This value is just left over from the previous solving)
FV = [ALPHA SOLVE] ⟶ -49387.74914
P/Y = 4
C/Y = 4
PMT: [END] BEGIN

Of the original $130,000 borrowed, the couple would still owe $49,387.75 after ten years of payments. ($49387.87 also accepted if using PMT = -2651.51)

By paying off the loan early, the couple does not have to make any future payments of $2,651.51 from the original payment plan, and therefore saves paying interest taken out from all of those future payments.

12. When Stephanie was born, her grandparents deposited $1500 in an account paying 5.75% interest compounded semi-annually. How much money was in the account when Stephanie turned 18 and was ready for college?

Here Stephanie's grandparents are making a one-time (lump sum) deposit so this situation is not "systematic" deposits. But it is compounded so we have

$$F = 1500\left(1 + \frac{0.0575}{2}\right)^{(2*18)}$$
$$F = 4161.460675$$

When Stephanie turned 18 and was ready for college, $4,161.46 was in the account.

13. Chris decides that he wants to save up money for a new canoe. After doing some online research he figures that the total amount the canoe would cost plus taxes, and other fees should be about $900 to $1000. He finds a savings account that will provide him a fixed 4% annual interest rate, compounded monthly. How much should he put into the account at the end of each month if he wants to have $1000 in 2 years?
N = 12*2 = 24 total monthly deposits
I% = 4
PV = 0
PMT = [ALPHA SOLVE] ⟶ -40.09158884
FV = 1000
P/Y = 12
C/Y = 12
PMT: [END] BEGIN

Chris should deposit $40.09 at the end of each month.

14. If a total of $1420 is due after 4 years on a simple interest loan for $1200, what interest rate is being charged?
For "simple" we have
$F = P(1 + rt)$
$1420 = 1200(1 + r4)$
$1.18333333 = (1 + r4)$
$1.18333333 + 4r$
$0.18333333 = 4r$
$0.04583 = r$

The simple interest rate that is being charged is 4.58%.

15. You need to purchase a vehicle to get back and forth to school and work. You find a 1-year old, pre-owned vehicle in terrific condition for $9845. The salesman offers you the vehicle for $800 down and $195 per month for 4 years.
    a. How much will you be borrowing?

    $9845 − $800 = $9045

    You will be borrowing $9045.

    b. What interest rate are you being charged if interest is compounded monthly?
    N = 12*4 = 48 total monthly payments
    I% = [ALPHA SOLVE] ⟶ 1.687189364
    PV = 9045
    PMT = -195
    FV = 0
    P/Y = 12
    C/Y = 12
    PMT: [END] BEGIN

    You will be charged an interest rate of about 1.69% if interest is compounded monthly.

    c. How much interest will you pay over the life of the loan?

    48 total monthly payments times $195 per payment = 48*195 = $9,360 total amount in payments.
    For Systematic Loans we have: total amount in payments – original loan amount = interest
    $9,360 – $9,045 = interest

    $9,360
    − $9,045
    $ 315

    The total amount paid in interest is $315.

16. Suppose that $1000 is put into an account with 8% annual interest compounded monthly for 15 years. What interest rate would give the same amount of money after 15 years if the simple interest method is used?

For "compounded" **without** systematic deposits we have

$$F = 1000\left(1 + \frac{0.08}{12}\right)^{(12*15)}$$
$$F = 3306.921477$$
$$F = \$3306.92$$

Then for "simple" we have

$$F = P(1 + rt)$$
$$3306.92 = 1000(1 + r15)$$
$$3.30692 = (1 + r15)$$
$$3.30692 = 1 + 15r$$
$$2.30692 = 15r$$
$$0.153795 = r$$

The simple interest rate that would give the same amount of money is about 15.38%.

Savings Activity:

Suppose you deposit $50 per month into an account earning 5% per year compounded monthly. You want to know how much you will have at age 60 if you start the savings plan at various ages. Also calculate how much of the final value is from the deposits and how much is interest earned.

Starting Age	Years until 60	Final Value	Total $ deposited	Interest earned
20	40	$76,301.01	$24,000	$52,301.01
30	30	$41,612.93	$18,000	$23,612.93
40	20	$20,551.68	$12,000	$8,551.68
50	10	$7,764.11	$6,000	$1,764.11