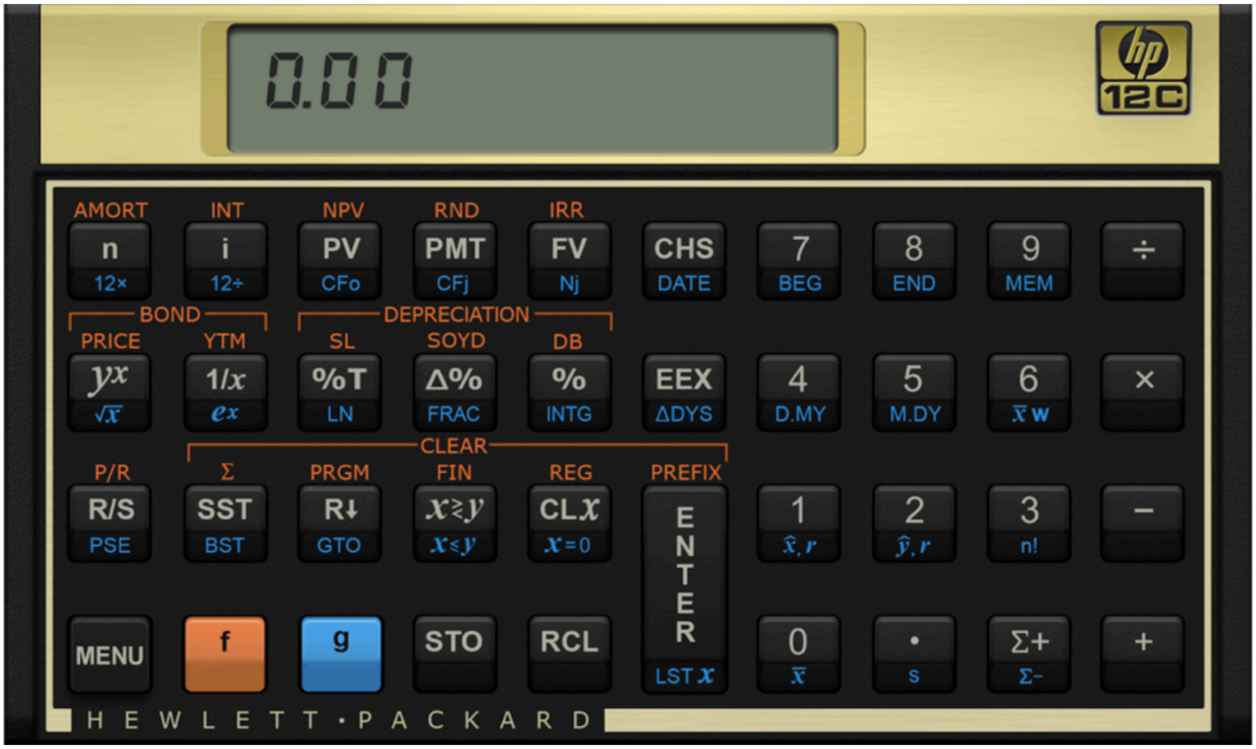
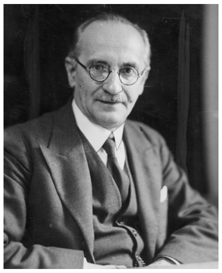
HP-12C Quick Guide



The Hewlett-Packard 12C (HP-12C) is HP's longest and best-selling product, in continuous production since its introduction in 1981. The HP-12C is one of only two calculators permitted on CFA Program exams (the Texas Instruments BA II Plus is the other). You may buy an HP-12C calculator for about $50 from Amazon or another retailer. Hewlett Packard also sells a smartphone app that mimics a full-functioning HP-12C for $14.99. Several versions of the HP-12C exist:

- The **Classic Gold HP-12C** uses only reverse Polish notation* (RPN).
- The **Platinum HP-12**C allows the user to choose either RPN or algebraic notation (AN) mode. (“Normal” calculators you’re familiar with are based on AN. So, the Platinum HP-12C in AN mode might be easiest for you.
- The **Limited Edition 25th Anniversary HP-12C Platinum** edition allows the user to choose either RPN or AN mode. HP claims it has a high-quality keyboard similar to the keyboard of the original 1980’s Classic Gold HP-12C.
- The **Limited Edition 30th Anniversary HP-12C** edition uses only RPN. HP again claims a high-quality keyboard.



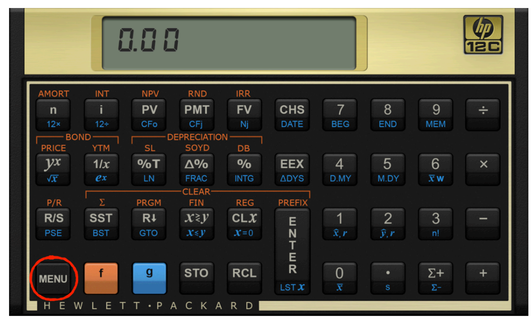
*The "Polish" in reverse Polish notation refers to the nationality of logician Jan Łukasiewicz, who invented Polish notation in the 1920s. Polish notation is parentheses-free and the inspiration for the idea of the recursive stack, a last-in, first-out computer memory store. Studies show that RPN calculators are superior to AN calculators in terms of speed and accuracy of operation. However, as noted above, you'll likely be up and running faster with Platinum HP-12C in the familiar AN mode.

What you will need to know for the purposes of this course is summarized in this quick guide. Keep it handy as a reference as you work through problems. The extensive instruction book included with your calculator is a valuable reference for the more sophisticated functions not covered in this guide. You can also find well-done tutorials on a number of financial calculators, including the HP-12C, at:

http://www.tvmcalcs.com/calculator_index.

Basic Functions

- **Turning on your calculator**



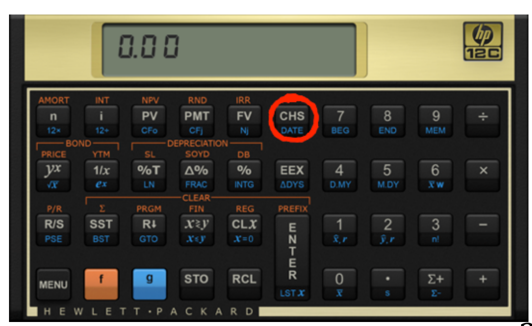
The [ON] key–or [MENU] key on some HP-12C versions–in the bottom left corner turns the calculator on or off. If you do not use the calculator for several minutes, it will turn itself off.

- **Changing the display**

To change the number of decimal places displayed, key [f] then the desired number of digits. For example, [f] [2] sets the display to two decimal places past the decimal point.

The default values in the calculator are '.' for the decimal point and ',' as the separator between groups of three digits to the left, as in 30,000.00. To reverse these, turn off the calculator, then turn it back on while holding down the [.] key.

- **Changing sign**



To change the sign of the displayed value, key [CHS].

Cash inflows (i.e., money going into your wallet) are entered as positive numbers. Cash outflows (i.e., money coming out of your wallet) are entered as negative numbers.

- **Mathematical calculations**

The primary difference between the HP-12C's operation in RPN mode and AN calculators is the way operations are entered. On an AN calculator, you enter the operator between two numbers:

[2] [+] [3] [=]

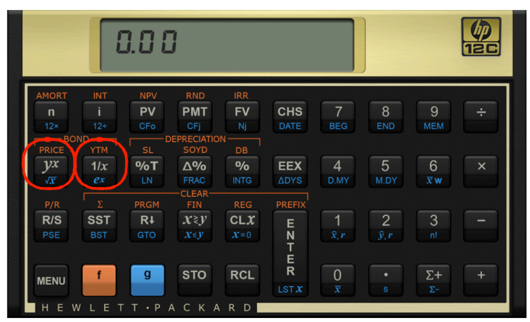
On the HP-12C, you key:

[2] [ENTER] [3] [+]

The first number is entered into the "stack" memory by using [ENTER]. The second number is followed by the operator desired. Another example:

Desired Calculation:	What you key:	What you see:
(12 + 13) x 5	[1] [2] [ENTER]	12.00
	[1] [3] [+]	25.00
	[5] [x]	125.00

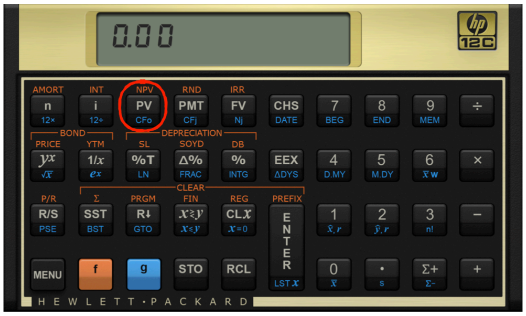
A bit of HP-12C terminology: The displayed value showing in the window is referred to as "*x*", i.e., the number in the "*x*" register. When you key [ENTER] it moves "*x*" into the "*y*" register. You'll see several keys that perform operations on "*x*" and "*y*." For example, the [y^x] key raises "*y*" to the "*x*" power. The [1/*x*] key takes the inverse of "*x*." Here are examples that use the [y^x] and [1/*x*] keys:



Desired Calculation:	What you key:	What you see:
$\frac{1}{(1.06)^5}$	[1] [.] [0] [6] [ENTER]	1.06
	[5] [y^x]	1.34
	[1/*x*]	0.75
$\frac{1200}{(1.06)^5}$	[1] [.] [0] [6] [ENTER]	1.06
	[5] [y^x]	1.34
	[1/*x*]	0.75
	[1] [2] [0] [0] [*x*]	896.71

In the examples that follow in this guide, keystrokes for numbers will be consolidated for ease of reading.

- **Accessing alternate functions:**



Many of the keys on the HP-12C perform more than one function. For example, take a closer look at the [PV] key. The [NPV] function above is accessed by first keying the gold [f] key. The [CF_0] function below is accessed by first keying the blue [g] key. For example, the sequence:

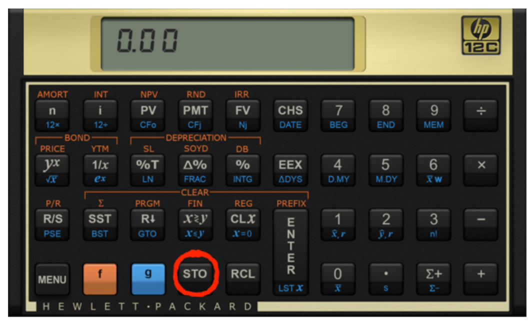
[25] [g] [CF_0]

enters 25 as the cash flow at time 0. The use of the [NPV] and [CF_0] keys is covered in this guide's "Irregular Cash Flows".

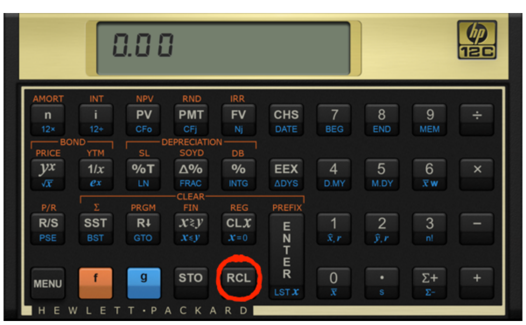
- **Storing numbers in memory**

Up to twenty numbers may be placed into memory. The first ten 'registers' are accessed using the number keys [0] to [9], and the second ten using [.0] to [.9]. The [STO] key is for storage. Example: to enter 1.12^5 into the first memory slot, key

[1.12] [ENTER] [5] [y^x] [STO] [0]



If the display is set to two decimal places, 1.76 is displayed and also stored without rounding in R_0, register 0, and is available for use until the memory is cleared or another number is entered into R_0.

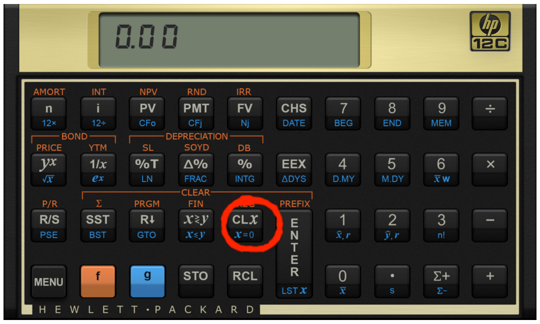


To use the stored number in R_0, key [RCL] [0]. Example: to multiply 1000 by the 1.76 already stored in register 0, key

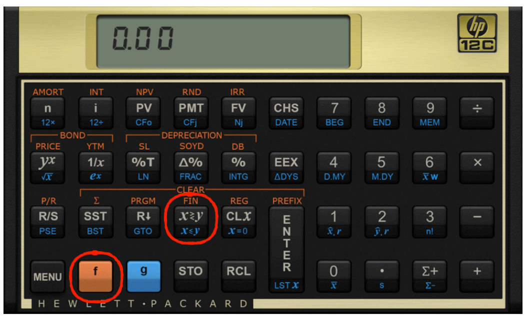
[1000] [ENTER] [RCL] [0] [x]

If the display is set to two decimal places, 1,762.34 is displayed.

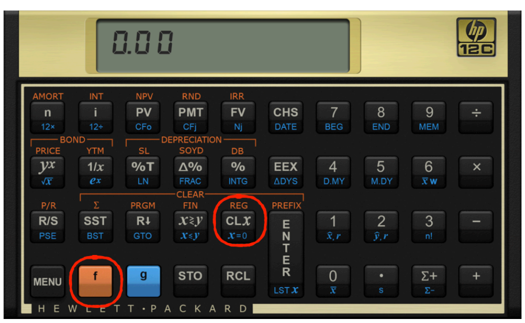
- **Clearing registers/memory**



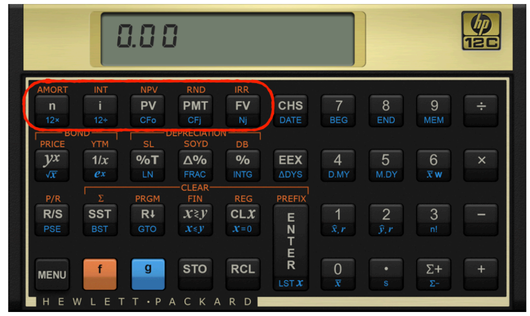
Clear just the *x* register (i.e., the number that appears in the display window) by keying [CL*X*]. This is useful when you make an error keying in a number.



Clear the financial registers by keying [f] [FIN]. This sets all financial registers, including [n], [i], [PV], [PMT], and [FV], equal to zero. This is good form before you start any time value of money calculation.



Keying [f] [REG] clears all registers, including any values stored in the *x* register, financial registers, and memory.



Time Value of Money

Five keys in the upper left corner are used for many of the time value of money (TVM) calculations you'll be introduced to in this course.

[n] number of payments or time periods.
[i] interest rate expressed as percent, e.g., 12% entered as [12] [i], not as [.12] [i].
[PV] present value, or value at time 0
[PMT] payment, a constant amount paid or received each period.
[FV] future value, specifically the value at time n

Given four of the above values, the fifth can be calculated.

Example: You deposit $1,000 today into an account paying 4.00% per year. Compute the amount you will be able to withdraw in 5 years.

Reminder: First, clear the financial registers by keying [f] [FIN].

Data:	What you key:	What you see:
n = 5	[5] [n]	5.00
i = 4%	[4] [i]	4.00
PV = $1000	[1000] [CHS] [PV]	-1,000.00
PMT = 0*	[0] [PMT]	0.00
compute FV	[FV]	1,216.65

*If [f] [FIN] is keyed to start, then the payment register would already be set to zero, so no need to key [0] [PMT].

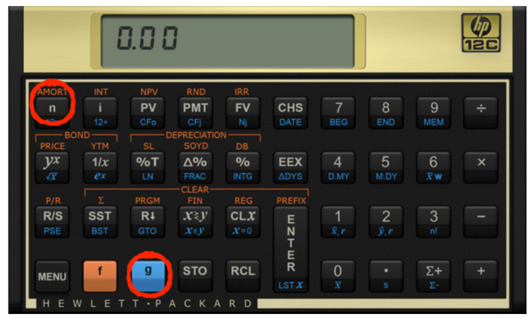
The HP-12C keeps track of cash flows moving in different directions by the using opposite signs. The $1,000 we deposit today (i.e., the present value) is entered as a negative number, and the $1,216.65 we withdraw in 5 years (i.e., the future value) is shown as a positive number. A good way to visualize how the flows are signed: If you're taking money out of your wallet and depositing, then it's a negative sign. If you're withdrawing money and putting it into your wallet, then it's a positive sign.

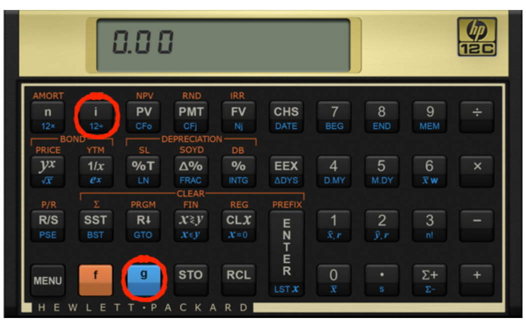
Example: You invest $5,000 today and $1,000 at the end of each of the next 10 years. Compute the amount you will have after 10 years if the investment earns 8% per year.

Data:	What you key:	What you see:
n = 10	[10] [n]	10.00
i = 8	[8] [i]	8.00
PV = $5000	[5000] [CHS] [PV]	-5,000.00
PMT = $1000	[1000] [CHS] [PMT]	-1,000.00
calculate FV	[FV]	25,281.19

- **Monthly cash flows**

Car loans, home mortgages, student loans, and other loans typically have monthly payments. To input the number of monthly payments when you know the number of years, key [g] [n]. For example, the number of payments for a 30-year mortgage can be entered as [30] [g] [n]. 360 is displayed and entered into the n register.





To input the monthly interest rate when you know the annual percentage rate (APR), key [g] [i]. For example, the monthly interest rate for a mortgage with 6.00% APR, compounded monthly, can be entered as [6] [g] [i]. 0.50 is displayed and entered into the i register.

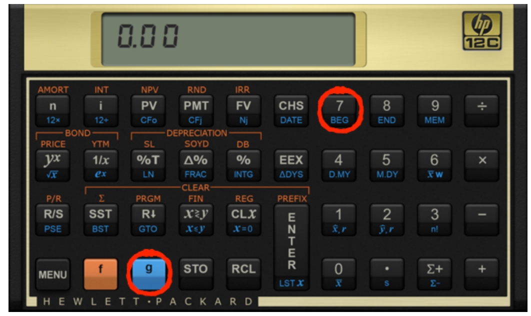
Example: Compute the monthly payment on a 30-year $200,000 mortgage with a 7.5% APR, compounded monthly?

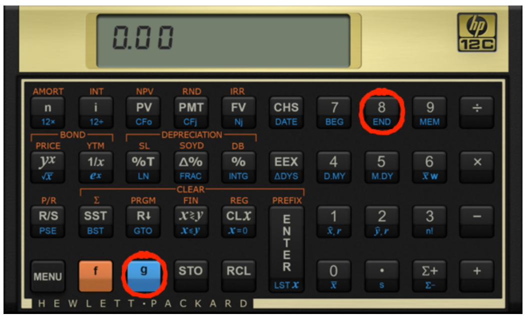
Data:	What you key:	What you see:
n = 30 x 12	[30] [g] [12x]	360.00
i = 7.5% ÷ 12	[7.5] [g] [12÷]	0.63
PV = $200,000	[200000] [PV]	200,000.00
FV = 0*	[0] [FV]	0.00
calculate PMT	[PMT]	-1,398.43

*If [f] [FIN] is keyed to start, then the payment register would already be set to zero, so no need to key [0] [FV].

- **Payments at the end of the period versus the beginning of the period**

For payments that occur at the beginning of the period, key [g] [BEG]. To confirm that the HP-12C will now make calculations presuming payments occur at the beginning of each period, "BEGIN" appears at the bottom of the display.

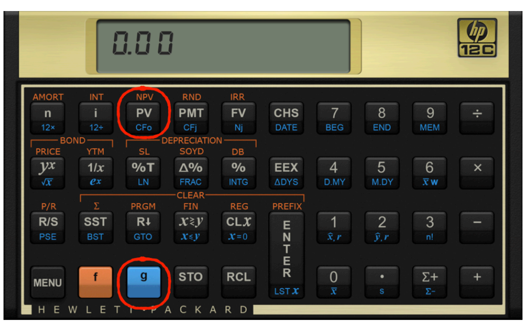




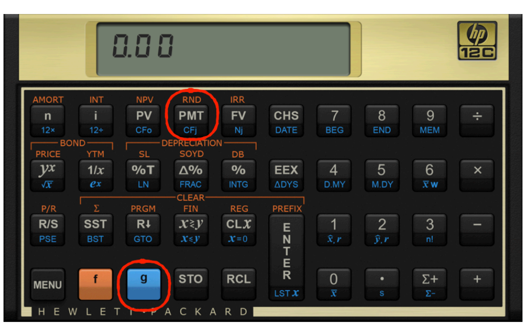
Most of the time, though, such as when we are dealing with car loans, home mortgages, or student loans, payments occur at the end of the period. To return to the HP-12C's default mode of presuming payments occur at the end of the period, key [g] [END]. "BEGIN" will no longer appear at the bottom of the display.

- **Irregular cash flows**

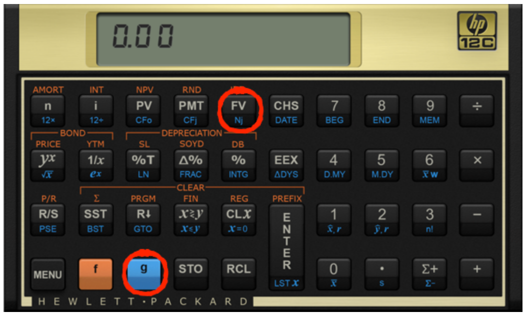
For calculations that involve cash flows occurring at regular intervals but with differing amounts, we enter values using [g] functions [CF_0], [CFj], and [Nj]. We can then calculate the net present value or internal rate of return by using [f] functions [NPV] and [IRR].



Enter the cash flow at time 0 by keying the value followed by [g] [CF_0]. If there is no time 0 cash flow, key [0] [g] [CF_0]. For example, if the first cash flow is -1000, key [1000] [CHS] [g] [CF_0].



Enter subsequent cash flows in order using [g] [CFj]. If subsequent cash flows are different, each must be entered separately. For example, if the next two cash flows are 400 and then 500, key [400] [g] [CFj] then [500] [g] [CFj].



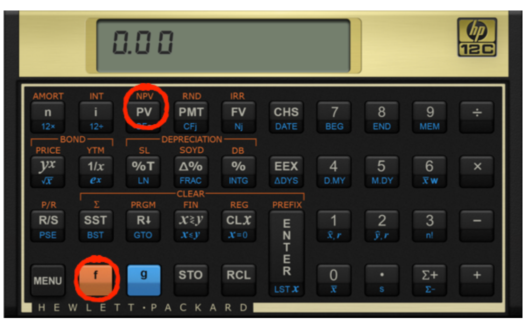
If equal cash flows repeat, then the number of equal cash flows can be keyed using [g] [Nj]. For example, if the next five cash flows equal 300 each, key [300] [g] [CFj] [5] [g] [Nj].

Up to 20 cash flows can be stored in CF_0 to CF_{19}. Note that these cash flow registers are shared with the 20 memory registers. If you key [1000] [CHS] [g] [CF_0], -1000 is entered into CF_0 and will overwrite the value in the R_0 register. If you then key [400] [g] [CFj], 400 is entered into CF_1 will overwrite the value in the R_1 register.

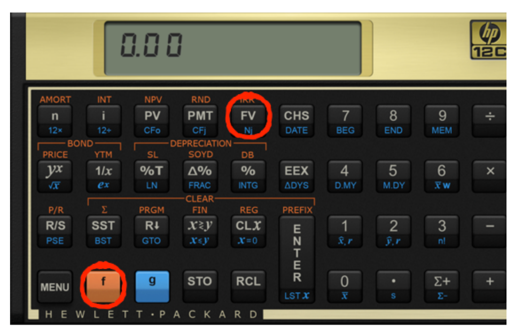
Example: Following an initial investment of $1,000, you expect cash flows of $400 in one year, $500 in two years, and $600 in three years.

Data:	What you key:	What you see:
clear all registers	[f] [REG]	0.00
enter CF_0	[1000] [CHS] [g] [CF_0]	-1,000.00
enter CF_1	[400] [g] [CFj]	400.00
enter CF_2	[500] [g] [CFj]	500.00
enter CF_3	[600] [g[[CFj]	600.00

You can now perform NPV and IRR calculations using these stored values.



To calculate the NPV of the investment, you first need to enter an interest rate using the [i] key. Then key [f] [NPV].



Calculation of internal rate of return requires no additional information. Key [f] [IRR].

Example: Continuing the example from above, if the cost of capital is 14.5% per year, what is the NPV and IRR?

Data:	What you key:	What you see:
enter interest rate	[14.5] [i]	14.50
calculate NPV	[f] [NPV]	130.43
calculate IRR	[f] [IRR]	21.65