



Retirement Planning

You will likely spend 1/4 to 1/3 of your life in retirement - collecting money while *not* working. Where does your income come from in retirement? This activity investigates a special type of retirement planning scenario: pay yourself first!

Objectives:

- Determine the amount of money you will accrue in a retirement account by controlling various parameters.
- Examine the impact of management fees on your retirement savings.

This might sound like a strange topic for high school students, but it is *never* too soon to plan for retirement!

Retirement income can come from many different sources: a pension plan, a 401K or similar plan, IRAs (Individual Retirement Accounts), USA's Social Security or the Canada Pension Plan (other countries have similar government-managed plans). But company-sponsored pension plans can be risky (see Enron), and government plans are usually not sufficient to live on comfortably.

Your personal planning and saving can assure you a secure and rewarding retirement. It's never too soon (or too late) to start saving for retirement. But sooner is better because you will tap 'the power of compounding' as you will see in this activity.



Beyond the Time Value of Money

TI-84 PLUS CE PYTHON TECHNOLOGY

1. Run the Python program named **RETPLAN** on your TI-84 Plus CE Python. (Be sure you have installed the RETPLAN.8xv program file to your calculator using [TI Connect CE](#).)

The result of the program is the screen shown here. You will change some of the values that the program uses to calculate these results by editing the code.

Press **<Editor>** to edit the program.

2. The data that the program uses is stored in a Python dictionary named **data** which conveniently labels each of the input values. This variable is defined near the top of the code. *Edit the program and change only the numbers in the variable **data**, not the text, punctuation, or indentation!*

The values represent:

Start age: the age at which you open a retirement account.

Retire age: the age when you plan to retire.

Final age: the age when you expect the plan to run out of money. Your death?

Current Savings: the opening deposit in the account.

Current Salary: your total annual salary for the first year of saving.

Percents are entered in 'percent form,' not their decimal equivalents. For 12% enter 12, not 0.12. For 2½% enter 2.5, not 0.025.

% to save each year: percent of annual salary to save. 12% of annual salary is the default.

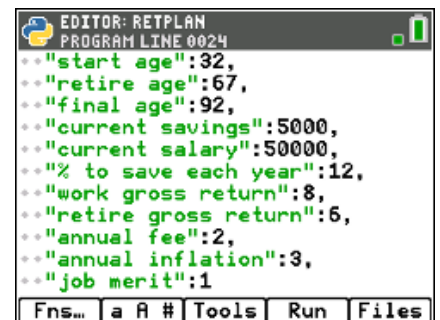
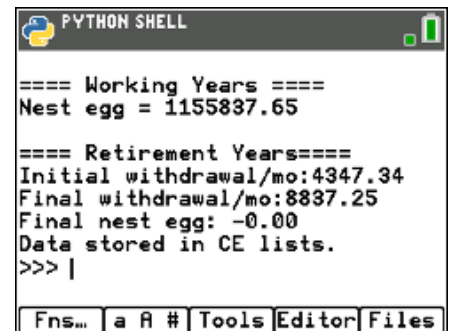
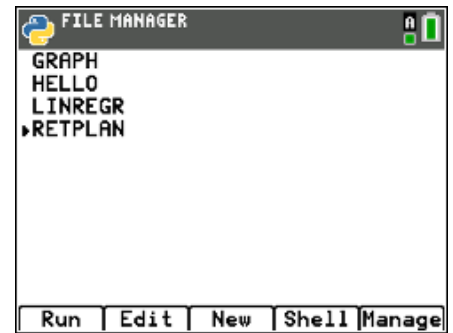
Work gross return %: estimated rate of return on investment during working years. Default is 8%.

Retire gross return %: estimated rate of return on investment during retirement years. Default is 6%.

Annual fee %: percent of the investment company's annual fees. Default is 2%.

Retirement Planning

TEACHER NOTES





Annual inflation %: estimate of annual inflation rate. Default is 3%.

Job merit %: average increase in salary/year. Default is 1%.

Note: (inflation+merit) are combined to account for annual increases in salary and your retirement contribution.

Scenario 1: You graduate from college at age 22. Your first job pays \$40,000 a year. You immediately (smart!) open a retirement account starting with \$1,000. You will deposit only \$100 the first year and plan to increase that deposit thanks to your (predicted) increases in salary to cover inflation at 3% plus merit raises of 2%. Your retirement plan charges 3% fees annually. Assume the gross returns on the investment are 8% while working and 6% when retired. You plan to retire at age 70 and expect your retirement plan to last to age 100 (with annual increases to cover inflation).

- a) What percent of your salary are you depositing each year? Use this value as the **% to save each year**.

Enter the **data** into the dictionary and run the Python program.

- b) How large is your **nest egg** at retirement?
c) What is your first monthly retirement payment?

Are you happy with this result?

Scenario 2: Suppose you find a retirement plan that charges a very small fee for administration: 0.1% (one tenth of one percent). Change only this value in your input sheet from Scenario 1 and re-run the program. Report your new

- a) Nest egg value
b) First month retirement payment
c) By what percent does your nest egg increase?

Your answers:

a) _____

b) _____

c) _____

Your answers:

a) _____

b) _____

c) _____



Scenario 3: What will it take to retire with one million dollars?

At age 25 you open a retirement account with \$2,000. Your salary is currently \$50,000 a year, and you confidently expect 2% merit increases each year on top of inflation increases. What *minimum yearly* deposit should you start with to acquire a nest egg of \$1,000,000 at age 70?

Assume the following additional parameters:

Final age: 100

Work Gross Return: 8%

Retire Gross Return: 6%

Annual Fees: 2%

Annual Inflation: 2%

- a) Work with the “% to save each year” value to get the nest egg just above \$1,000,000. Calculate that % of \$50,000 to arrive at the first year’s deposit.
- b) Suppose you can get an annual fee of only 1%. How does this impact the nest egg?

\$1,000,000.00

Answer a) _____

Answer b) _____

Stat Plots

After each run of the program several lists are stored into the calculator. Quit the Python App and look at the **[list]** menu (press **[2nd]** **[stat]**). The seven *named* lists (below **L₁** ... **L₆**) are:

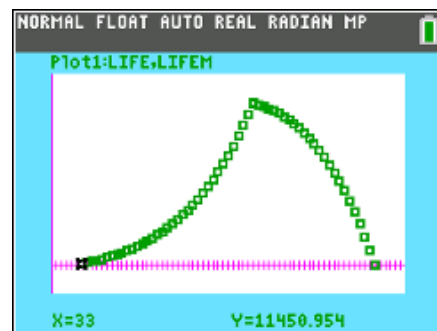
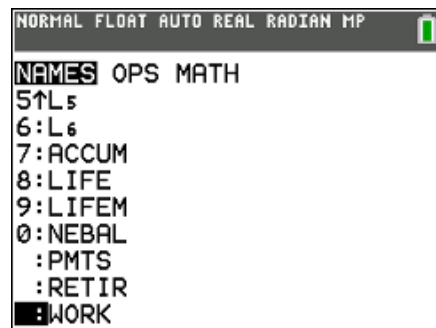
- ACCUM**: the amounts in the account during the working years
- LIFE**: ages from “start age” to “final age”: $LIFE = WORK + RETIR$
- LIFEM**: lifetime money - amounts in the account
- NEBAL**: the nest egg balance during retirement
- PMTS**: the monthly payments during retirement
- RETIR**: the retirement ages
- WORK**: the working ages

There are several **stat plots** possible:

1. Growth of the nest egg while working:
x-list: **WORK**
y-list: **ACCUM**
2. Decline in the nest egg balance during retirement:
x-list: **RETIR**
y-list: **NEBAL**
3. Growth of monthly retirement payments:
x-list: **RETIR**
y-list: **PMTS**
4. The whole lifetime values in the account (*image to the right*):
x-list: **LIFE**
y-list: **LIFEM**

What types of graphs are displayed?

Use the TI-84 Plus CE **[stat]** > **CALC** tools to determine an appropriate mathematical model for each graph.





Beyond the Time Value of Money

TI-84 PLUS CE PYTHON TECHNOLOGY

Summary:

Some things are out of your control when it comes to retirement planning, but the factors that you *can* control greatly influence the final outcome: the age you start saving, the percent of your income you can put away each year, and the fees that the company charges you to invest your money all have an impact on nest egg values.

Regardless of the actual numbers you use, your retirement plan *with increasing monthly payments* will look like the screen to the right. The final question is: how high can it go? It's up to you: forewarned is forearmed.

Retirement Planning

TEACHER NOTES

