Our Process

The following five steps are required to calculate what it's going to take to retire financially independent.

Step 1

Determine how much is needed to live comfortably.

This number is chosen by the user and may be based on several things. Some financial analysts say you should retire on 65% of your income. The retiree may end up having to do that but that would certainly not be ideal. Some people retire so they don't have to go to work anymore. Others want to retire so they can travel, join a country club, or just play golf. Either way, your health and life insurance are going up and there may be other things you want to do in retirement.

For our purposes, choose a number between 40,000 and 100,000. For my test data I use 70,000. It's just a number for testing and it's the average of the range 40k and 100k.

Step 2

Select the number of years until you would like to retire. This number may change as information is returned from the calculations in this program.

Most of us would like to retire today (so we don't have to work this calculation) but don't have enough money. One of the things we hope to learn from doing these calculations is how long we have to work until we can retire but we'll learn that from 'running the numbers'. We are not trying to calculate time to retirement so don't try to work that into the formulae listed below.

Try starting with 10 years. If you can't afford the monthly investment, which is what we are trying to calculate, then try 20 or 30 years. For my test data I use 20 years. Again it's arbitrary… it's just for testing purposes.

Step 3

Determine how much money it will take in the year you want to retire to be equal to the amount of money you said you needed to live in Step1. The difference or the change is called the time value of money. The amount you need to live on today is woefully short of what you will need if you retire 20 years from now. The value of money goes down over time.

For this calculation, we can use the simple interest formula to determine how much the value of money will change (the interest is the difference):

$I = P \times R \times T$

Where:

- I = The interest earned or the change in value
- P = The amount invested
- R = The annual interest rate (or inflation rate in this case)
- T = Time: the number of years to save

You should now have the Principal, which in this case is the amount you want to live on in today's value, maybe $70,000, and you have calculated how much that will change in let's say 20 years. At what rare will it change in 20 years? The change is based on the average inflation rate; somewhere between 2.5 and 4%. For this calculation think of the Interest as the effect of Inflation. Add the Inflation to the Principal to calculate how much money you will need 20 years from now that's equal to $70,000 today. That is called the Future Value or F_v in the calculations that follow.

Step 4

Calculate how much money you need to have invested so you can live on half of the interest you receive from your investment. Why half the interest? The other half continues to grow enough to cover inflation and investment fees. If you earn $130,000 a year in interest you want to live on $65,000 or you deplete your Principal. The goal is to never touch the Principal.

The question here is, how much do we need to have invested to earn the Future Value of the original $70,000 in as many years away as we've chosen to retire?

Once we know how much we need to earn in interest, we can again use the simple interest formula but this time, solve for the Principal on which the interest is paid:

If: $I = P \times R \times T$

Then: $P = \frac{I}{R \times T}$

NOTE: P, or Principal, in this calculation is the Future Value of the total amount invested. It is the value Fv in the calculation in Step 5.

Step 5

Calculate how much money you will have to invest each month at a fixed interest rate compounded monthly and having no initial investment.

This will require the use of the Future Value of an Ordinary Annuity formula:

$$F_v = PMT\left[\frac{((1 + i)^n - 1)}{i}\right]$$

Note: To a mathematician PMT means P x M x T. That is not the meaning in this calculation. Here PMT is simply the abbreviation for a single variable: Payment (PayMenT).

The Calculations

Step 1

Get the user's targeted annual income. Since it is a simple annual amount consider it the Principal.

Step 2

Get the user's targeted retirement date in years or Time until retirement.

Step 3

Apply the simple interest formula to calculate how much the user will need in T (years) to equal the current P(rincipal) considering the average Inflation rate. There will be investment fees which I would estimate at about 1%. For easy figuring let's round it off to 4%.

$I = P \times R \times T$

Where:
I = Interest or in this case total inflation or increase in cost of living
P = The Principal or the annul amount need to live now
R = The interest Rate or in this case the inflation rate; 4%
T = The years to retirement

Keep in mind that 'I' is the difference or the change in the Principal from now to retirement so it has to be added to the Principal to get the future value or:

$P_{future} = P_{current} + I_{change\ due\ to\ time}$

Therefore Future Value or $F_v = P_{future}$

Future value is what the Principal is equal to in T years.

Example:

$I = PRT$

Let
I = the unknown difference in value over time
P = $1,000 = the amount of interest we desire in today's value.
R = 4% or 0.04 (our rounded inflation plus investment fees)
T = 10 years

$I = \$1,000 \times 0.04 \times 10$
$I = \$400$

This means that in 10 years it will take $400 more to have the same buying power as $1,000 today or $1,400 in 10 years equals $1,000 today.

From our equation that is:
$P_{(\text{in 10 years})} = P_{(\text{today})} + I_{(\text{Inflation over 10 years})}$
$P_{10} = \$1{,}000 + \$400$
$P_{10} = \$1{,}400$

Step 4

Calculate how much money you need to have invested so you can live on half of the interest you receive from your investment. Why half the interest? The other half continues to grow enough to cover inflation and investment fees. If you earn $130,000 a year in interest you want to live on $65,000 or you deplete your Principal. The goal is to never touch the Principal.

The question here is, how much do we need to have invested to earn the Future Value of the original $1,000 (in our example) in as many years away as we've chosen to retire?

Once we know how much we need to earn in interest, we can again use the simple interest formula but this time, solve for the Principal on which the interest is paid:

If: $I = P \times R \times T$

Then: $P = \frac{I}{R \times T}$

NOTE: P, or Principal, in this calculation is the Future Value of the total amount Invested. It becomes the value Fv in the calculation in Step 5.

Let's continue with our previous example where:

I = Interest of $1,400 to receive from an unknown Principal
R = The annual interest Rate we will use to live. If our total return on our investment is 8% then half of our annual interest rate would be 4%.
T = 1; we are using the interest returned for one year to live on for one year.
P = the amount we need to have invested to return $1,400 per year.

Therefore:
$P = \$1{,}400 / (0.04 \times 1)$
$P = \$35{,}000$

This tells us that we need to have $35,000 invested to get back $1,400 when we get a 4% (half) return.

P or the Principal is how much we need invested in 10 years to reach our income goal. It is referred to as the Future Value or F_v.

Step 5

Calculate how much money you will have to save each month at a fixed interest rate compounded monthly and having no initial investment.

This will require the use of the Future Value of an Ordinary Annuity formula:

$$F_v = PMT\left[\frac{((1 + i)^n - 1)}{i}\right]$$

Note: To a mathematician PMT means P x M x T. That is not the meaning in this calculation. Here PMT is simply the abbreviation for a single variable: Payment (PayMenT).

What do we know about this formula at this point?

PMT = the unknown monthly investment or payment

F_v = $35,000 or the total amount invested

n = the number of compounding periods. Investments are typically compounded or calculated every month. How many months are there? 10 years = 120 months

i = Interest rate: If we typically get an 8% return on our investments, what is our compounding interest rate? 8% or 0.08 / $12_{(months)}$ = 0.0067 ('i' is used here instead of 'I' because it represents interest calculated monthly instead of annually.)

Our formula now looks like this:

$$\$35{,}000 = PMT\left[\frac{((1 + 0.0067)^{120} - 1)}{0.0067}\right]$$

$$PMT = \$35{,}000 / \left[\frac{((1 + 0.0067)^{120} - 1)}{0.0067}\right]$$

$$PMT = \$35{,}000 / (((1.0067)^{120} - 1) / 0.0067)$$

$$PMT = \$35{,}000 / ((2.2196 - 1) / 0.0067)$$

$$PMT = \$35{,}000 / 182.94$$

$$PMT = \$191.31$$

PMT = $191.31 = The amount we must invest monthly to receive $1,400 per year 10 years from now.

Designing the Interface

The user will want to see a summary of how much they need to invest each month and the total investment is required.

The advisor, or the person using the program, will need a place to enter the annual income goal from Step 1, the number of years the client or user wants to work, the anticipated interest rate, and a button to invoke the calculator and another to end the program.

For this project we will have one form for data entry and another form for a report.

The user should be able to view the forms on the screen and print them to a printer from the program.