

SeeWhy Financial Learning recommends the **Hewlett Packard (HP) 10B** or **HP 10B II**. This calculator is easy to find, reasonably priced and very user friendly. However, you are free to use any financial calculator permitted by CSI<sup>®</sup>. Pages 4 – 14 of this tutorial will help you regardless of your choice of calculator as the focus is really on learning to pull the required information out of the questions!

If you are already working with a bank or investment firm, you are probably doing financial math everyday -- well, perhaps your computer is doing the actual "math" part for you, but you are likely entering the known variables in order to determine the answer to a given financial question. Things like:

- How much does your client need to retire?
- How much does your client have saved already?
- How much can your client afford to invest each year?
- What return is expected on the client's investments?
- Etc.

For example: Your client is 35 years old and plans to retire at age 60. He has already saved \$250,000. His investments have averaged 7% per year, and you feel that a return of 7% is a reasonable expectation going forward. Your client wonders how much he will need to invest each year to have \$1,000,000 in his investment account on the day he retires.

By gathering all of this information, you have just gone through the same process as you would when doing a financial math question on the WME<sup>®</sup> exam. First, you gathered all of the information you know (current savings, annual return, years to retirement and amount required at retirement). Then, you take all of this information, plug it into your computer (or calculator) and it will calculate what you are looking for (required savings per year).

Let's get your calculator set-up properly first, and then we can come back and actually figure out the answer to the above example.

### Description of Time Value of Money (Financial Math) Buttons

<p><b>N</b> =</p> <p><b>I/YR</b> =</p> <p><b>PV</b> =</p> <p><b>PMT</b> =</p> <p><b>FV</b> =</p>	<p>Number of payment periods</p> <p>Interest rate per year</p> <p>Present Value</p> <p>Payments</p> <p>Future Value</p>	}	<p>You will notice that these are all on the top row of your HP 10B / 10BII calculator!</p>
<p><b>P/Y</b> =</p> <p><b>2<sup>nd</sup> function key</b> =</p> <p><b>DISP</b> =</p>	<p>Number of Payments per year. Keep this set at 1-payment per year.</p> <p>This key allows you to shift between the two functions for each key.</p> <p>Number of decimal places. We suggest setting the calculator to 4 decimal places.</p>		

## 1. Number of Decimal Points on your Calculator

You should adjust your calculator to show 4 decimal places.

To adjust your calculator to 4 decimal places:

- Press the 2<sup>nd</sup> function key
- Press the DISP key located on the = key
- Press 4
- Your calculator should now display: 0.0000
- To make sure it has worked, enter  $1 \div 3$ . The display should read: 0.3333

## 2. Number of Payments per Year

The majority of the questions that you will encounter on the exam will involve annual payments. You could see something like: *Michael needs to withdrawal \$1,000 per year, or How much must Terry invest each year?*

These questions require that your calculator be set at 1 payment per year (1 P\_Yr). You will also do questions that with more than one payment period per year; however, you should still keep your calculator set at 1 payment per year, and adjust the other variables. Why we are having you do this will become clear as we work through some examples on the following pages.

To set your calculator at 1 payment period per year

- Press 1
- Press the 2<sup>nd</sup> function key
- Press the P/YR key located on the PMT key

Leave your calculator set at 1 P\_Yr for all questions. You will adjust your calculator for more frequent payments as the question warrants.

You can check to see how many payments per year your calculator is set at:

- Press the 2<sup>nd</sup> function key
- Press the C ALL key located on the C Key
- Your calculator should now display: 1 P\_Yr

### 3. Payments at the Beginning or End of the Period

Regular payments (cash flows) can be made into or out of an investment account either at the end of the period (this is the norm) or at the beginning of the period. Depending on which it is, you will get a slightly different answer, and you can bet that both will be potential answers on your multiple choice exam. *Assume payments are made at the end of the period*, unless you are specifically told otherwise in the question.

If your calculator is set to payments at the beginning of the period, **BEGIN** will be displayed on your calculator. If you do not see BEGIN, then the calculator is set to payments at the end of the period (this is the default).

To change when the payments are made (beginning vs. end):

- Press the 2<sup>nd</sup> function key
- Press the BEG/END key *located on the MAR Key*

### 4. Cash In-flows Vs. Out-flows

You may have noticed that when you are doing financial math questions, sometimes the answer is negative; you have probably wondered, "Why is my calculator saying that I have to save a *negative* amount of money?"

When your calculator gives you a negative number, it just means that the money is coming *out* of the investor's pocket to be invested.

For example: Mary has no current retirement savings. She is 30 years old and plans to retire at age 65. On the day she retires, she would like to have accumulated \$1,000,000. If she can earn 7% on her investments, how much must she save each year to reach her retirement goal?

If you enter these variables into your calculator (and don't worry, we are going to teach you how do that in a moment) you will get an answer of -\$7,233.96. That would be one heck of an investment if she could save negative money and end up with \$1,000,000 wouldn't it? What the negative means is Mary must take \$7,233.96 OUT of her pocket each year to be able to put \$1,000,000 in her pocket in 35 years. The \$7,233.96 is a cash OUT-flow.

You need to let your calculator know whether a number you are entering is a cash in-flow or a cash out-flow, otherwise it will get confused and either give you a wrong answer or "no solution". The button you use to indicate a cash out-flow is the (+/-) button. You do not need to enter anything for cash in-flows (you **do not** enter a (+) symbol), only out flows.

**NOTE:** A Present Value entry will ALWAYS be an out-flow, so you must use the (+/-) button.

## How to do Financial Math

You should always go through these same 3 steps when tackling a financial math question.

1. What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**
2. Is your calculator set up properly? I.e. 1 payment per year and BEGIN vs. End.
3. Enter the information into the calculator and solve.

Let's practice these 3 steps by taking another look at the example from the Cash In-flows Vs. Cash Out-flows section:

*Mary has no current retirement savings. She is 30 years old and plans to retire at age 65. On the day she retires, she would like to have accumulated \$1,000,000. If she can earn 7% on her investments, how much must she save each year to reach her retirement goal?*

**Step #1:** What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**

Before you go and start punching numbers in to your calculator, write down the Time Value of Money (Financial Math) variables. They are right there on your calculator, so you don't need to memorize them.

**N** = Number of payment periods  
**I/YR** = Interest rate per year  
**PV** = Present Value  
**PMT** = Payments  
**FV** = Future Value

**Note:**

These keys may be slightly different depending on the calculator that you have chosen to use, but they will be very close. For example, on the Texas Instruments BA II Plus (another popular financial calculator) the only one that is different is the I/Yr. On the Texas Instruments, it is I/Y – see, it is very close!

Now, determine what information you been given in the question? You know that:

- She wants to retire in 35 years.
- She can earn 7% on her investments.
- She has no current savings
- She wants to have \$1,000,000 at retirement.
- This is N = Number of payment periods
- This is I/YR = Investment return per year
- This is PV = Present value
- This is FV = Future value

Now, write in your information:

**N** = 35 (years)  
**I/YR** = 7 (rate of return per year)  
**PV** = \$0 (present value of retirement savings)  
**FV** = \$1,000,000 (annual contributions)

What you are being asked to calculate?

**PMT** = *How much must she save each year to reach her retirement goal?*

### Step #2: Is your calculator set up properly?

Does this question specifically state that she wants to invest the money at the beginning of each year? NO. So you assume that it is to be done at the end of the year.

Make sure that you do not see BEGIN on your calculator, and that it set to 1 P\_Yr. To do so, press the 2<sup>nd</sup> function button and then CALL (clear all). If you see 1 P\_Yr on the display, then your calculator is set properly. It is a good idea to do this before every question.

### Step #3 Enter the information into the calculator and solve!

Enter      Press

35	<b>N</b>
7	<b>I/YR</b>
0	<b>PV</b>
1,000,000	<b>FV</b>

**PMT**      **\$-7,233.96** Remember, this is negative because Mary must take \$7,233.96 OUT of her pocket each year to be able to put \$1,000,000 in her pocket in 35 years.

**Examples for N, I/YR, PV, and FV****Solve for N: Number of Payment Periods**

Janice has \$100,000 in her retirement account and she feels that she needs to have \$1,250,000 to comfortably retire. If she can afford to invest \$1,000 at the beginning of each month and can earn an investment return of 8%, how many years will it take to reach her retirement goal?

Remember the 3 steps:

1. What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**
2. Is your calculator set up properly? I.e. 1 payment per year and BEGIN vs. End.
3. Enter the information into the calculator and solve.

**Step #1:** What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**

Write down the variables.

**I/YR =**  
**PV =**  
**PMT =**  
**FV =**  
**N =**

Now, write in the information that you know:

**I/YR =** 0.6667      8% per year on a monthly basis (8% / 12)  
**PV =** \$100,000      Present values are ALWAYS a cash OUT-flow  
**PMT =** \$1,000      Remember, this is a cash OUT-flow  
**FV =** \$1,250,000  
  
**N =** ???

**Step #2: Is your calculator set up properly?**

Janice is investing at the beginning of each month, so set your calculator to BEGIN. Make sure that you see BEGIN on your screen. DO NOT change your calculator to 12 payments per year. You have already adjusted for this by dividing your investment return by 12.

**Step #3 Enter the information into the calculator and solve!****Enter**0.6667  
100,000 (+/-)  
1,000 (+/-)  
1,250,000**Press**I/YR  
PV  
PMT  
FV

**N** **258.77 periods.** Remember that we are talking about months here, so 258.77 months equals **21.56 years**. If you got 259.27 months, your calculator is not set on BEGIN.

**Solve for I/YR: Investment Return per Year**

Jamie just finished university and wants to start investing. If he were to invest \$3,000 each year for then next 35 years, what rate of return will he have to earn to save \$500,000?

Remember the 3 steps:

1. What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**
2. Is your calculator set up properly? I.e. 1 payment per year and BEGIN vs. End.
3. Enter the information into the calculator and solve.

**Step #1:** What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**

**N** = =  
**PV** =  
**PMT** =  
**FV** =  
**I/YR** =

Now, write in the information that you know:

<b>N</b> =	35	Number of periods (years)
<b>PV</b> =	\$0	He is just getting starting investing, so he has nothing saved yet.
<b>PMT</b> =	\$3,000	Remember, this is a cash OUT-flow. Also, it does not say that it is at the beginning of the period, so we assume that it's at the end.
<b>FV</b> =	\$500,000	This is how much he wants to have at the end of 35 years.
<b>I/YR</b> =	???	

**Step #2: Is your calculator set up properly?**

Jamie is investing annually, and we assume that it's at the end of the year. Your calculator should still be set at 1 payment per year, but our last question was done with payments at the beginning of the period. Be sure that you set your calculator back to the end of the period (the default setting).



**Step #3 Enter the information into the calculator and solve!****Enter**35  
0 (+/-)  
3,000 (+/-)  
500,000**Press****N**  
**PV**  
**PMT**  
**FV****I/YR 7.85%.** So Jamie must be able to earn a return of 7.85% on his investments to meet his goal of saving \$500,000 in 35 years.

**Solve for PV: Present Value**

Jeremy just had a new baby girl. He would like to save \$100,000 by her 18<sup>th</sup> birthday so she can attend a good university. If Jeremy can afford to save \$2,500 annually and can earn 7% on that money, how much will he have to deposit today in order to reach his goal?

Remember the 3 steps:

1. What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**
2. Is your calculator set up properly? I.e. 1 payment per year and BEGIN vs. End.
3. Enter the information into the calculator and solve.

**Step #1:** What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**

Write down the variables.

**N** = =  
**PMT** =  
**FV** =  
**I/YR** =  
**PV** =

Now, write in the information that you know:

**N** = 18      Number of years until her birthday  
**I/YR** = 7%  
**PMT** = \$2,500      Remember, this is a cash OUT-flow. Also, it does not say that it is at the beginning of the period, so we assume that it's at the end.  
**FV** = \$100,000      This is how much he wants to save.  
**PV** = ???

**Step #2: Is your calculator set up properly?**

Jeremy is investing annually, and we assume that it's at the end of the year. Your calculator should still be set at 1 payment per year and for payments at the end of the period from the last questions. Always remember to set your calculator back to payments at the end of the period unless the question specifically states that payments are to be made at the beginning.

**Step #3 Enter the information into the calculator and solve!****Enter**18  
7  
2,500 (+/-)  
1500,000**Press**N  
I/YR  
PMT  
FV**PV** **\$-4,438.68**. Remember, this is negative because Jeremy must take \$4,438.68 OUT of his to get the account started (PV) to be able to have \$1,000,000 saved in 18 years.

**Solve for FV: Future Value**

Jonie just purchased \$10,000 worth of a Canadian Balanced Mutual Fund on which she expects a return of 6% per year. She also set up a Pre-Authorized Contribution (PAC) plan that will direct \$100 each month into the fund. If Jonie has 25 years until retirement, how much will she have saved in the fund on the day she retires?

Remember the 3 steps:

1. What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**
2. Is your calculator set up properly? I.e. 1 payment per year and BEGIN vs. End.
3. Enter the information into the calculator and solve.

**Step #1:** What information (variables) are you are given, and what you are being asked to calculate? **Write them down!**

Write down the variables.

**N =**  
**PMT =**  
**I/YR =**  
**PV =**  
**FV =**

Now, write in the information that you know:

<b>N =</b>	300	Monthly payments for 25 years is 300 payment periods. (12 x 25)
<b>I/YR =</b>	0.50%	6% on a monthly basis is 0.50% (6% / 12)
<b>PV =</b>	\$10,000	This is the amount that she put in as one-time contribution. Remember, this is a cash OUT-flow.
<b>PMT =</b>	\$100	This is also a monthly cash OUT-flow. It does not say that it is at the beginning of the period, so we assume that it's at the end.
<b>FV =</b>	???	

**Step #2: Is your calculator set up properly?**

DO NOT change your calculator to 12 payments per year. You have already adjusted for this by dividing your investment return by 12 and multiplying your payment periods by 12. This question does not specifically state that the contributions will be at the end of the month so you assume that they are done at the end of each month.

**Step #3 Enter the information into the calculator and solve!****Enter**300  
0.50  
10,000 (+/-)  
100 (+/-)**Press****N**  
**I/YR**  
**PV**  
**PMT****FV** **\$113,949.09.** Jonie's fund will be worth \$113,949.09  
in 25 years.

## Summary

1. You don't do financial math...your calculator does! Learn to pull the variables you know out of the question, figure out what you are looking for and let your calculator do the work.
2. Before entering anything into your calculator, always jot down the 5 financial math variables (N, I/Yr, PV, PMT and FV). Look for the information you have been given in the question, and write it down. This will help you think through the question and also save you time if you make a mistake because you can look back to see exactly what it was you entered.
3. Be sure that you have your calculator set up properly before doing any question.
4. Remember that money coming out of a client's pocket will be cash out-flows, and you must enter a minus in front of the value using the (+/-) key. Present Values (PVs) are ALWAYS negative!

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