The Truth About Money

"This is money—get ready to worry about it for the rest of your life."

Saving and Borrowing:

Fun With Real-World Consumer Finance

Time Value of Money Made Easy

Presented by
Dean Harris, CPA (ret.)
and
SavingandBorrowing.org

Thank you to the following for their assistance…

Melissa Thomas, CTE Specialist, Round Rock ISD

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Why I am here today?

Mainly because I enjoy sharing this skill, and watching y'all "get it" before my very eyes.

High School students will be turning 18 before too long, and people will start beating down their doors to sell credit cards, car loans, and other financial contracts, all with the theme of "buy now, pay later." A tool is needed to equip students with the life skill to help them make more informed decisions.

Personally, this skill has directly helped me as an accountant, commercial real estate appraiser, real estate investor, and college finance instructor. So I know it will help you, too.

You are here today to learn things like…

How much to save monthly to reach a financial goal

How much of a nest egg is needed upon retirement to make monthly withdrawals for a given period of time

What interest rate are you paying on a purchase if it’s not otherwise disclosed

And you can relax, because…

Very little math is involved (other than to be able to multiply by 12 on the calculator) in order to learn this Life Skill.

And also, very little memorization is needed. You will understand the concepts rather than memorize them.

Everyone can learn this, I promise!

The Time Value Of Money

Time Value of Money (TVM) is kind of related to the phrase “A bird in the hand is worth 2 in the bush.”

TVM means that money is worth more now than in the future. The sooner you get it, the more valuable it is to you.

Why Does Money have Value over Time?

The common sense reason is because of INTEREST.

1) You Receive interest on your money invested somewhere, and

2) You Pay Interest on money you have borrowed.

So, yes, Interest Is Interesting!

General note: Our problems today do not take into account any effects of income taxes or inflation.

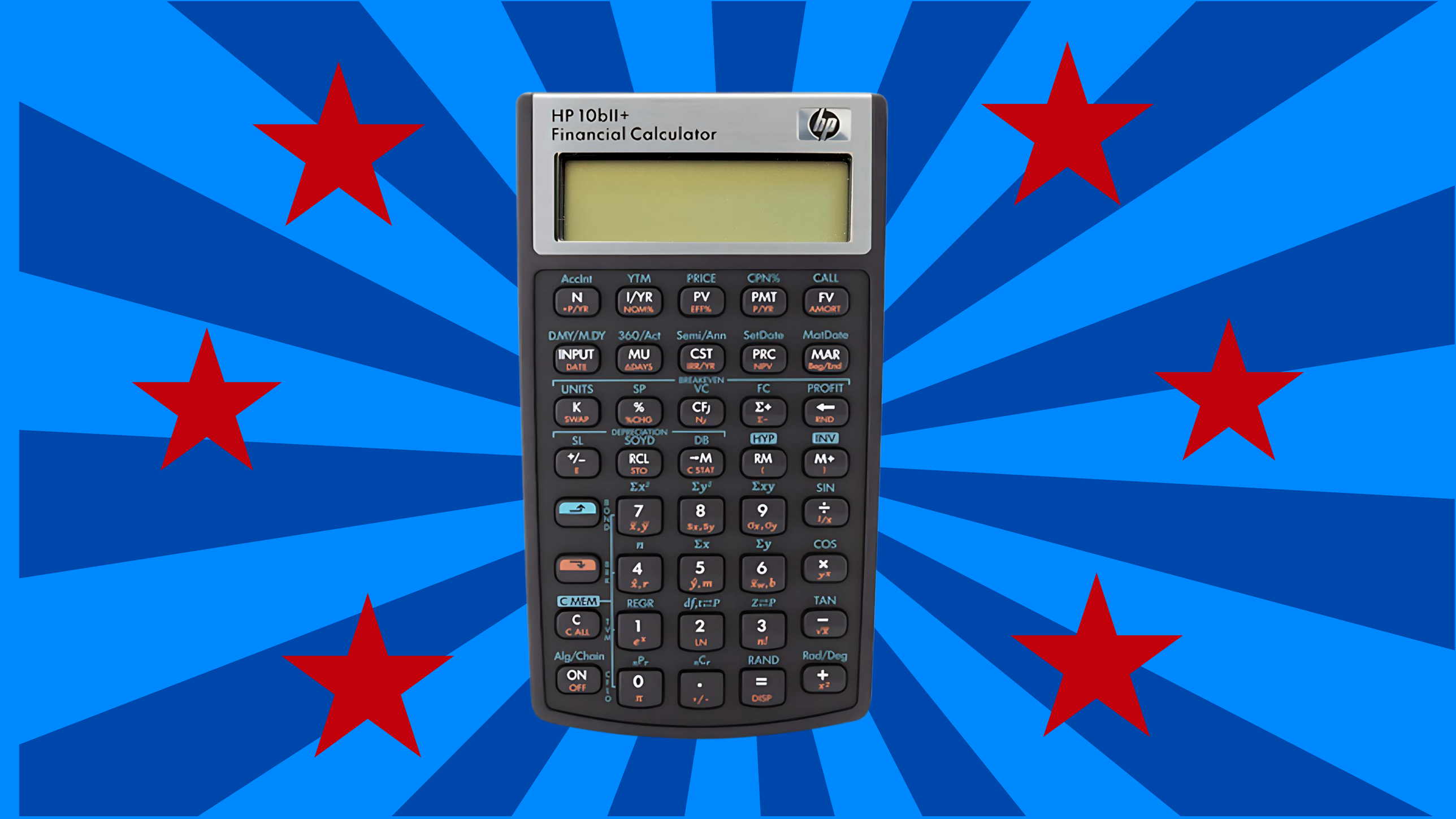
Common Sense Time Value of Money

Question- If you were going to be given $100, would you care if you received it now, or 10 years from now?

Of course you would! Why? Because there is no incentive to wait for the money.

You could put the money in the bank and be earning a little interest. Plus, it would be available in case of an emergency.

Get Ready to Meet the star of today’s show, the HP 10bII+ Financial Calculator…


HP 10bII+
Financial Calculator
Accint
YTM
PRICE
CPN%
CALL
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PV
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FV
DMY/MDY
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Semi/Ann
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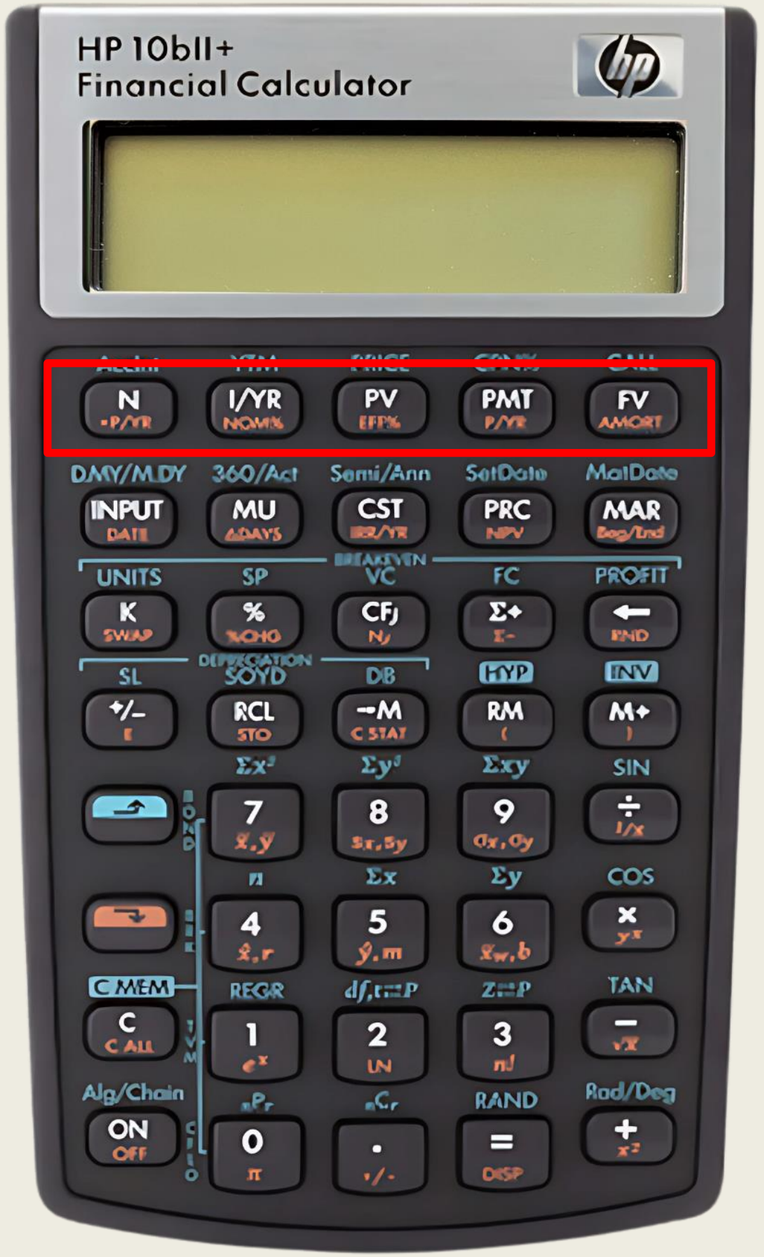
Here is the 10bii App:

Time Value of Money Keys:

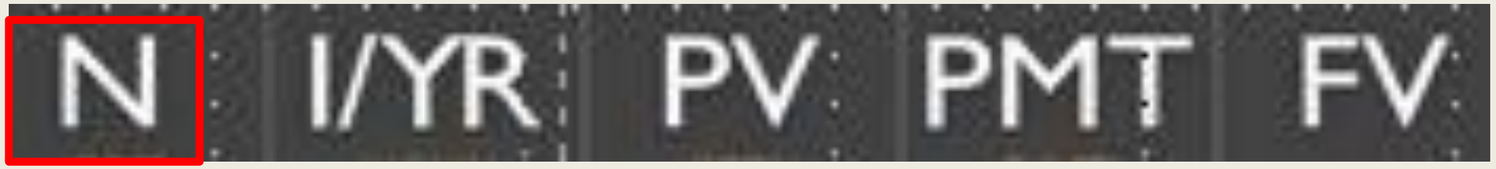


Good News! No real note taking for definitions is needed today.

As we work the problems, you will practice enough to soon understand the concepts. Very little memorization is involved.

Just as an intro, below are the Time Value of Money (TVM) Keys:

Next, we will go over what each TVM Key means……



N = Number of Months, in Total (Multiply Number of Years x 12)

Example: 4 year loan is 4 x 12 = 48 N

I/YR = Percent Interest Per Year. (For 6%, enter simply as 6)

PV = Present Value (Today's Loan Amount or Today's Lump Sum Deposit)

For example, if you got a $15,000 car loan, the PV would be $15,000.

PMT = Payment (the same amount over and over, often monthly)

These could be payments you make on a loan, payments you make to a savings account, payments from your retirement account, etc.

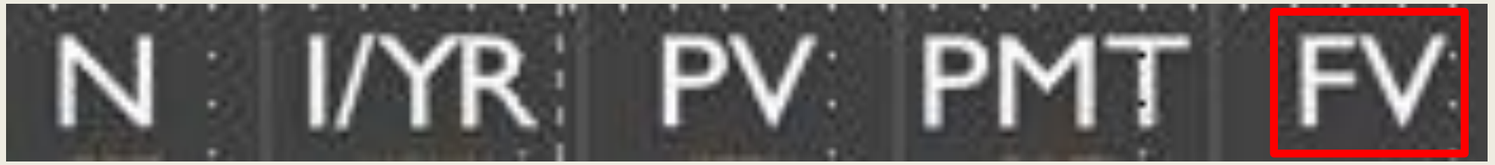
Note: If entering a loan PMT, make the PMT a negative number by pressing +/- after entering the number on the display. This is because the money is going out of your pocket to the bank.

For those of you with an Inner Nerd, this should make you happy…

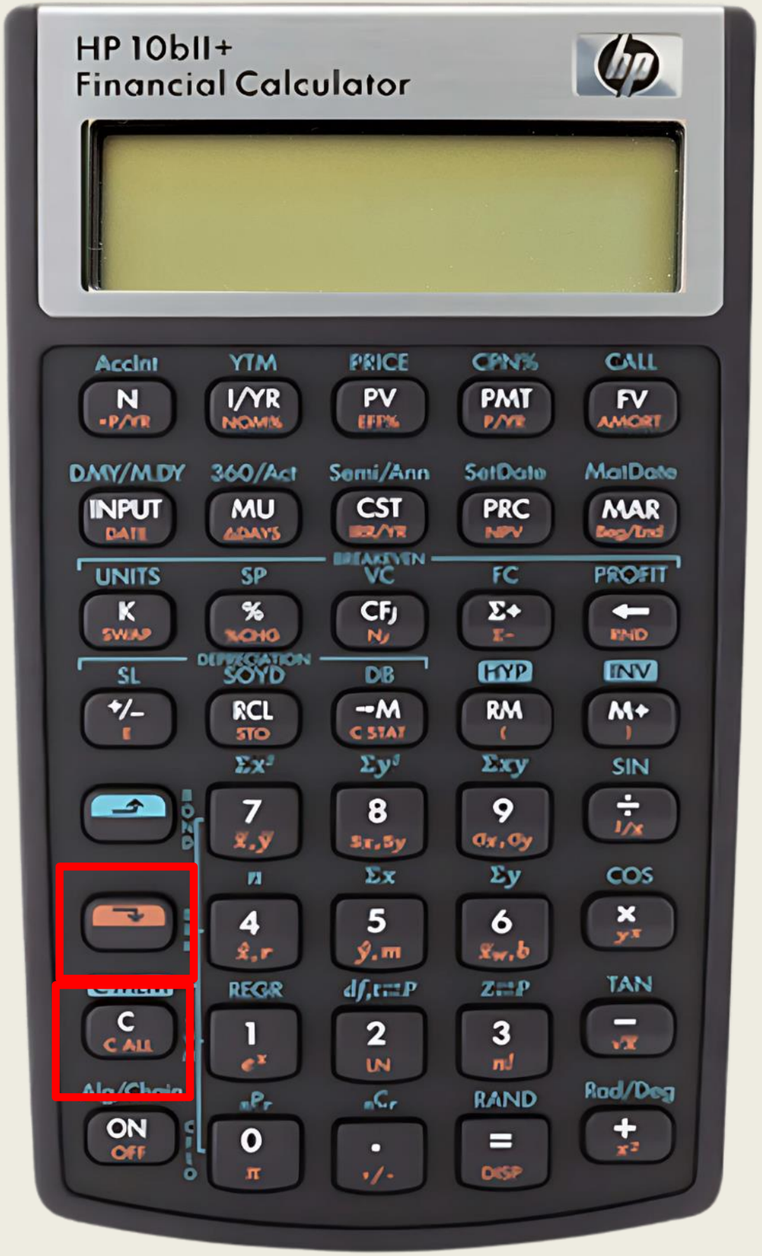
All payments we work with today will be assumed to be made at the end of the month. This is referred to as an “ordinary annuity.”

But a payment can also occur at the beginning of the month. This is referred to as an “annuity due.“

No need to memorize this for today, just FYI.



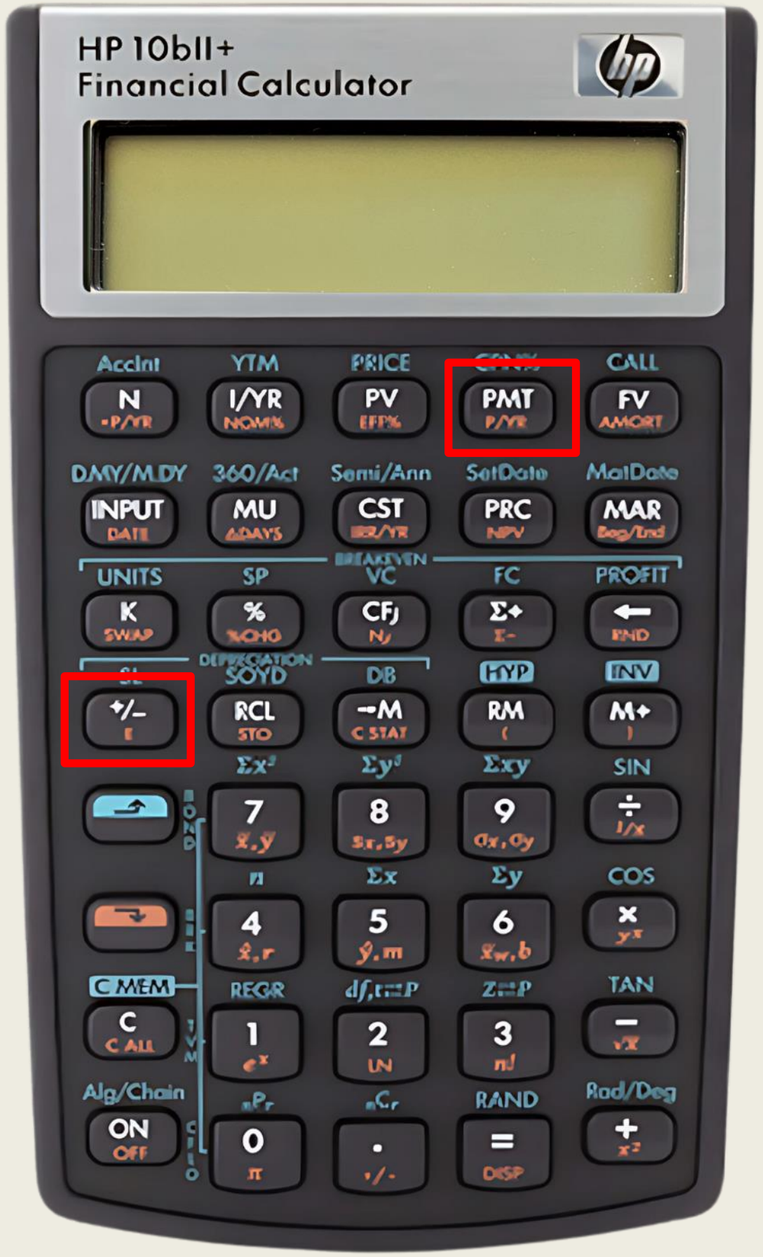
FV = Future Value (How much a series of Savings Account Deposits, or a single Lump Sum Savings Account Deposit will grow to in the future)



Three Operating Tips

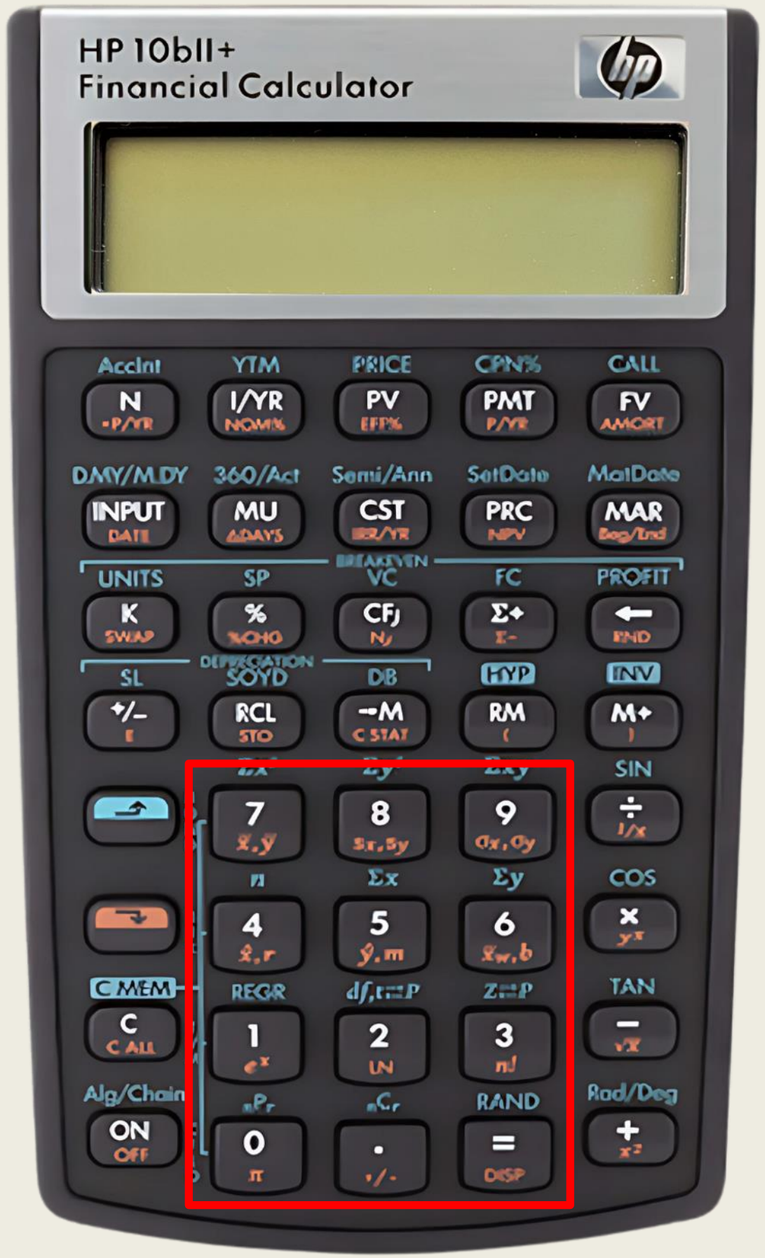
1. Note the Orange Bar key on the lower left side.

Before we work a new problem, we will clear any previous time value of money (TVM) entries. To do so, press the Orange Bar key, then move your finger down and press the C ALL key which is on the bottom of the C key. <u>Don't press them both at the same time.</u>



2. Payments are entered as Negative Numbers. Think of Payments as money paid out of your pocket to someone, so they are entered as negative numbers.

Note the “+/-” key (+/−) on the left side about midway down. If entering a Payment, <u>first</u> enter the Payment amount on the display, <u>then press the +/- key</u> to make the Payment number negative. Next, you would just press the PMT key.

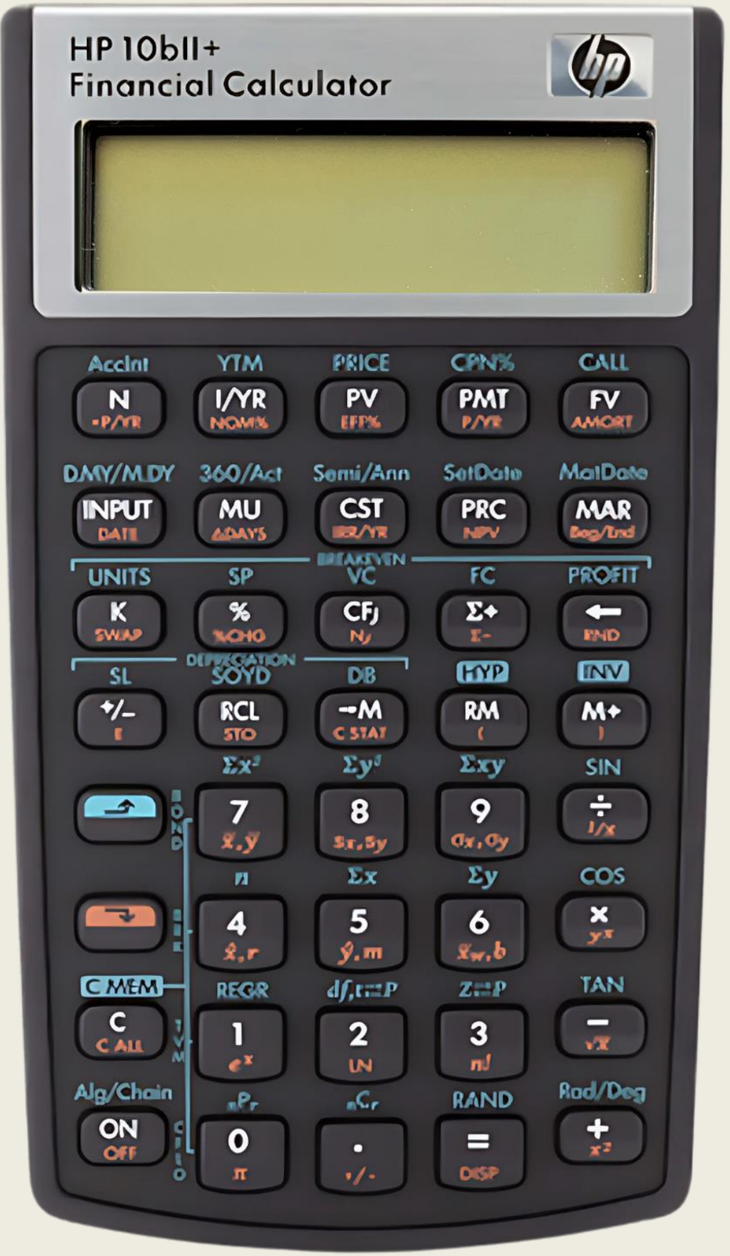


3. When entering numbers, use the keypad as outlined in red below. Once you have the number you want on the display, press the TVM key on the top row that is linked to that number.

Let’s get started learning a new skill today!

We’re now going to pass out the calculators and Problem Sets.

You will also need something to write with.



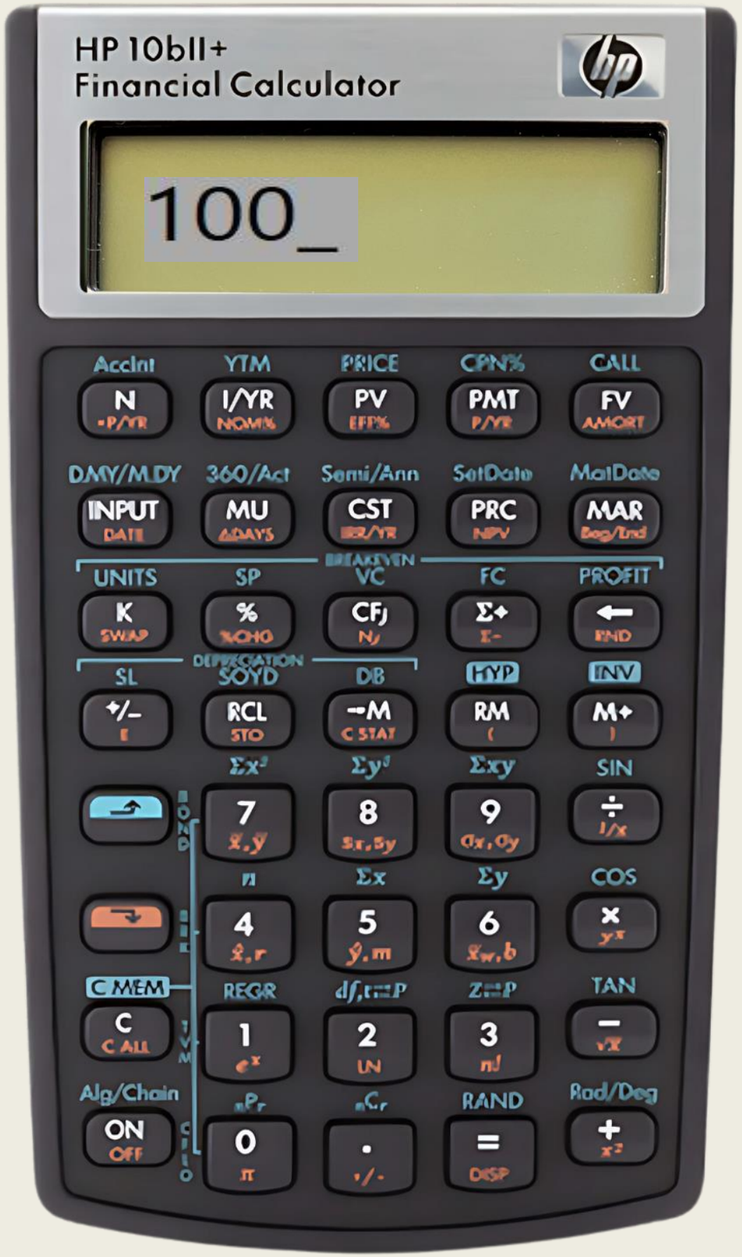
#1) FV of Savings: Monthly Savings Deposits for Car Down Payment

First, press the Orange Bar key, then move your finger down and press the C ALL key.

Let's say you put $100 monthly in a savings account for 36 months that earns 4.17% APR to save for a down payment on a car.

Question: How much will your savings grow to in the future, as in the Future Value?

Now, please follow along and write down on your Problem Set exactly what is shown on each of the following PowerPoint (PPT) slides.



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Let's say you put $100 monthly in a savings account for 36 months that earns 4.17% annual percentage rate (a local institution offers this) to save for a down payment on a car.

Question: How much will your savings grow to in the future, as in the Future Value?

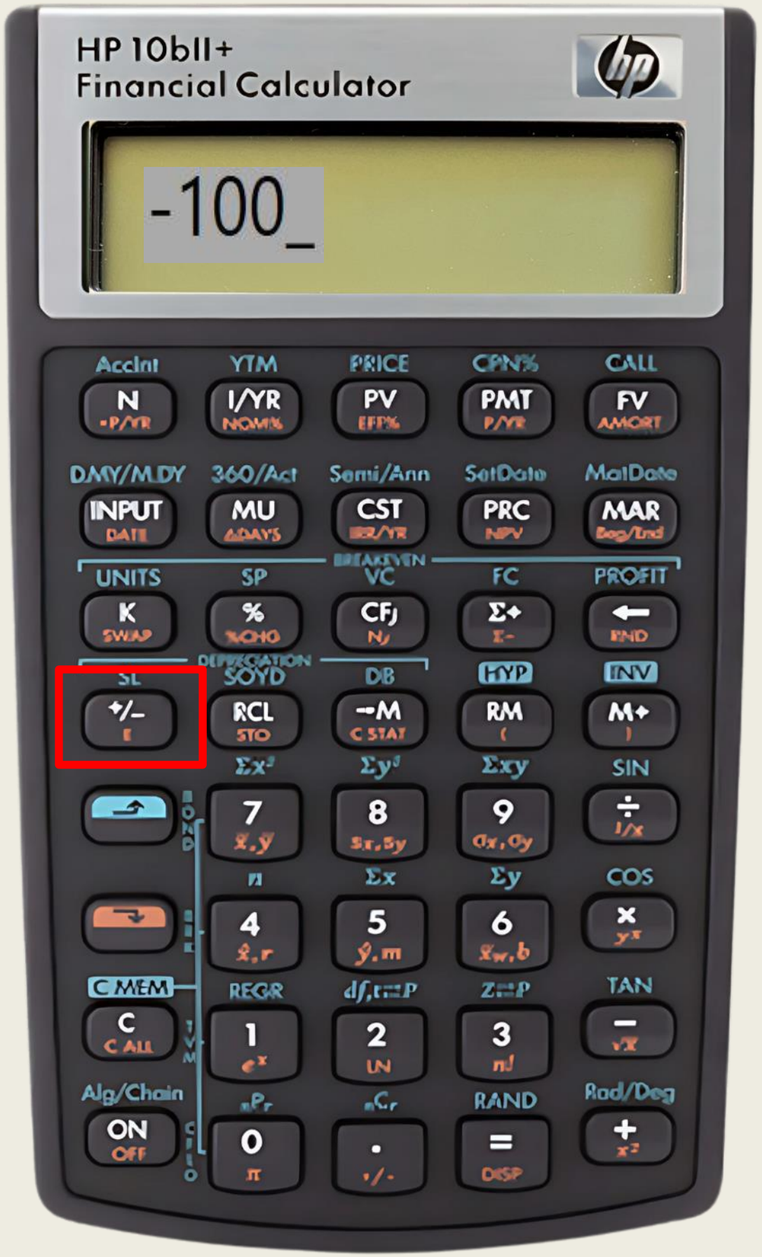
First, press "100" on the keypad to enter it on the display. (I have left off the ".00" digits)

100 _____ ☐

_____ ☐

_____ ☐

☐ _____



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Question: How much will your savings grow to in the future, as in the Future Value?

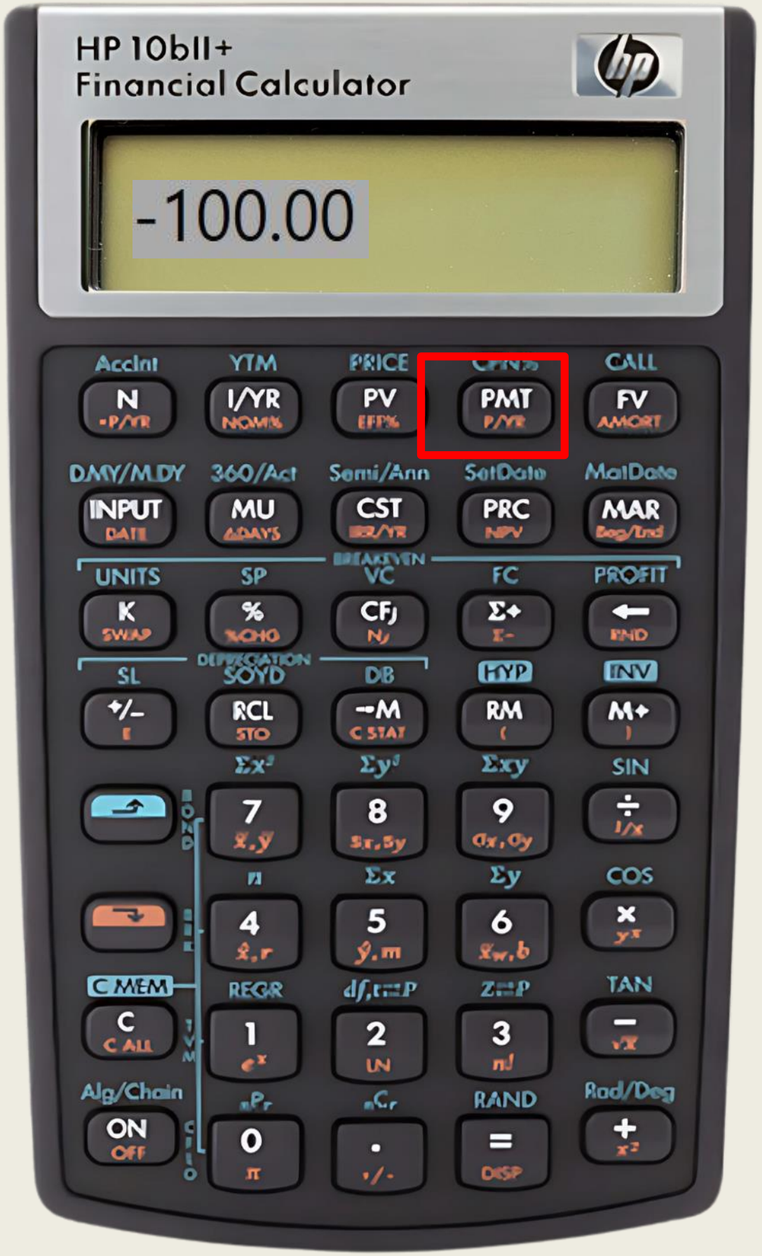
Next, press the "+/-" key to change the sign to a negative, which indicates something paid out of your pocket and put in the bank.

-100 _____ ☐

_____ ☐

_____ ☐

☐ _____



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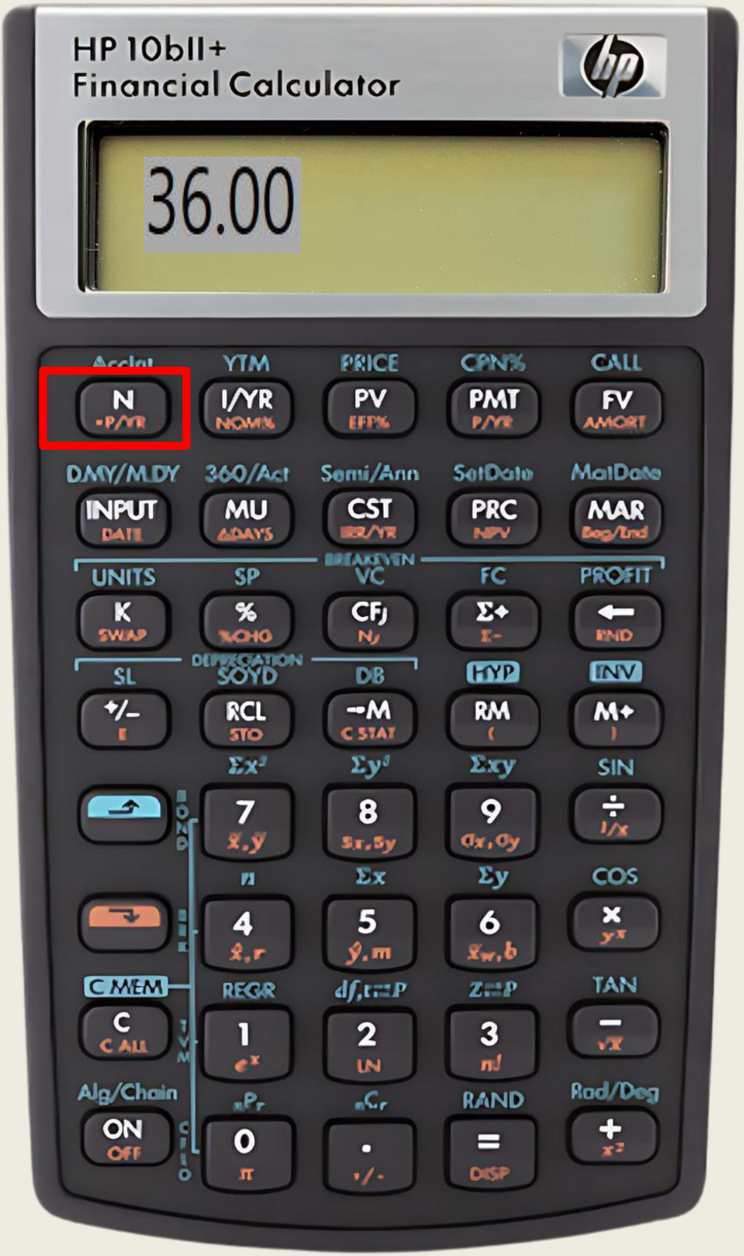
Now, press the "PMT" key to tell the calculator that is the key associated with the number shown on the display.

-100 _____ PMT

_____ ☐

_____ ☐

☐ _____



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Question: How much will your savings grow to in the future, as in the Future Value?

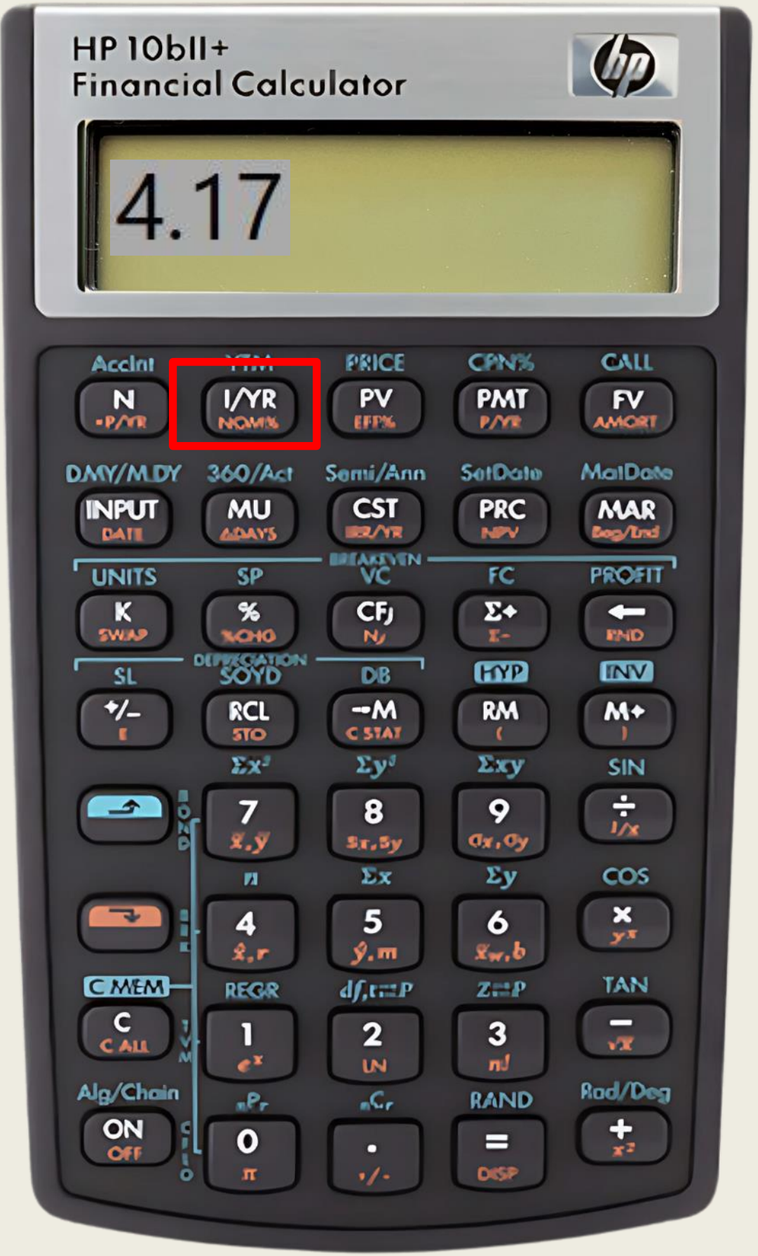
From here on, these answer pages will show both the numerical entry to write on the horizontal line, and then the associated TVM key to write inside the square box.

-100 _____ PMT

36 _____ N

_____ ☐

☐ _____



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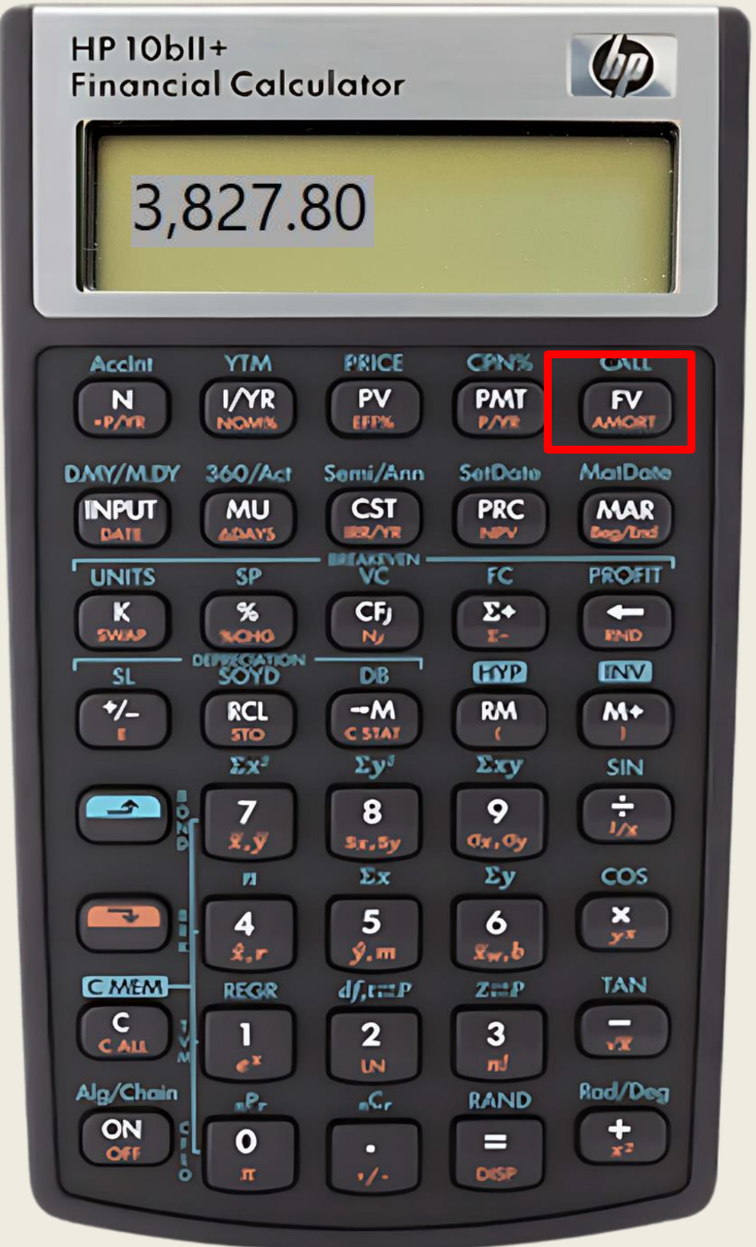
-100	PMT	4.17	I/YR
36	N		



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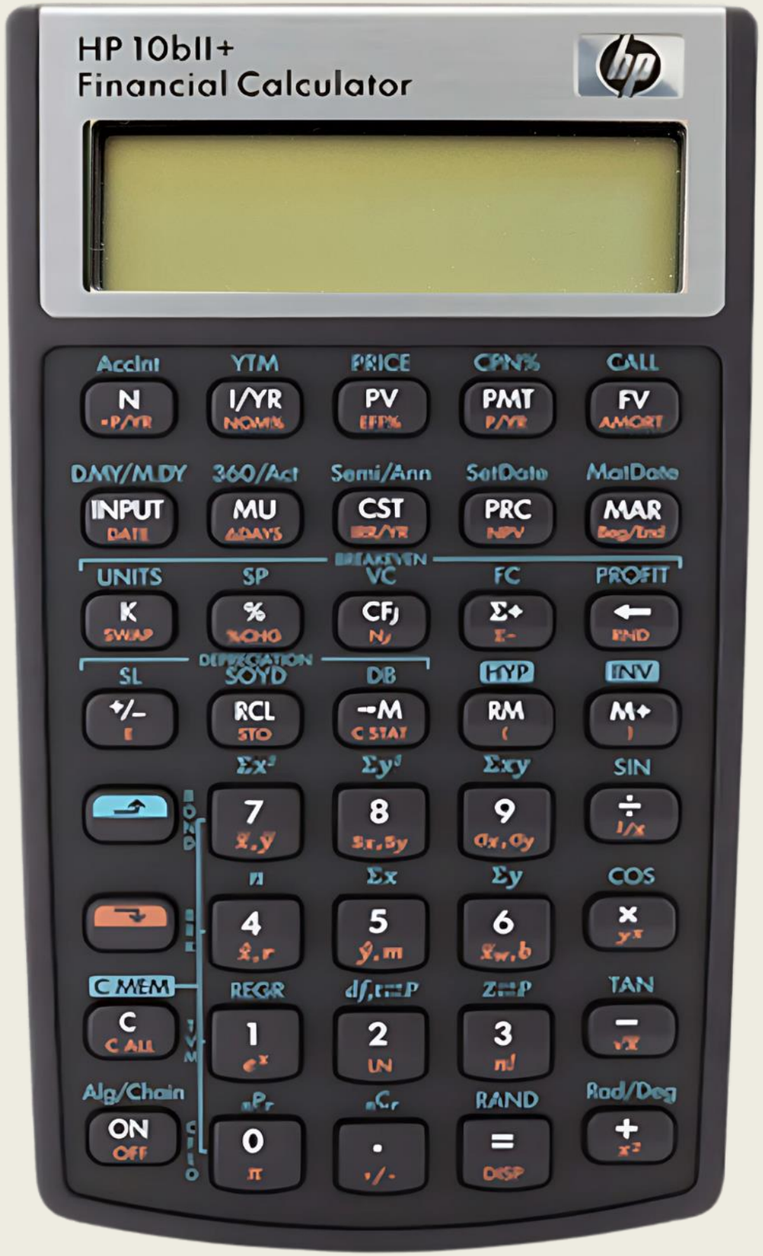
Question: How much will your savings grow to in the future, as in the Future Value?

-100	PMT	4.17	I/YR
36	N	FV	3,827.80


HP 10bII+
Financial Calculator
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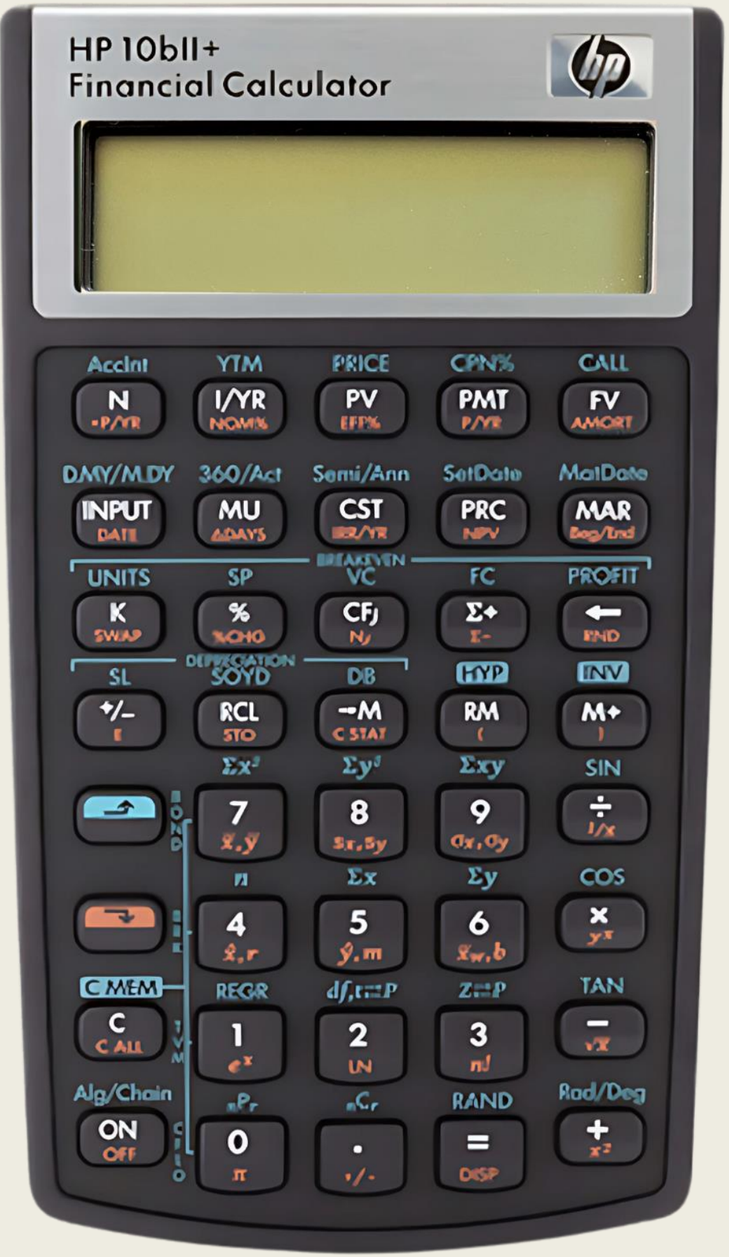
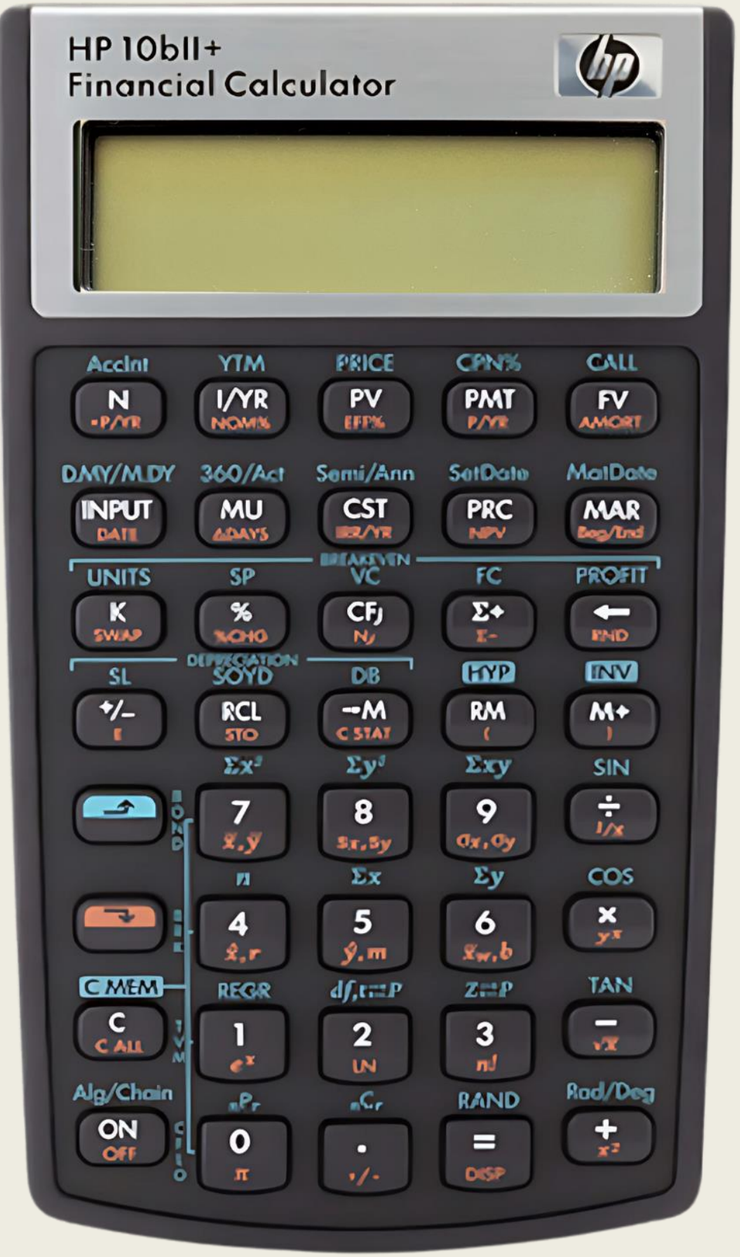


#2) Savings PMT: Saving to become a millionaire

First, press the Orange Bar key, then move your finger down and press the C ALL key.

How much of a payment do you have to save per month if you want to have $1,000,000 in the future if you start saving at age 18 and save until you are 60, while investing in a stock index fund that averages a 10% annual return?



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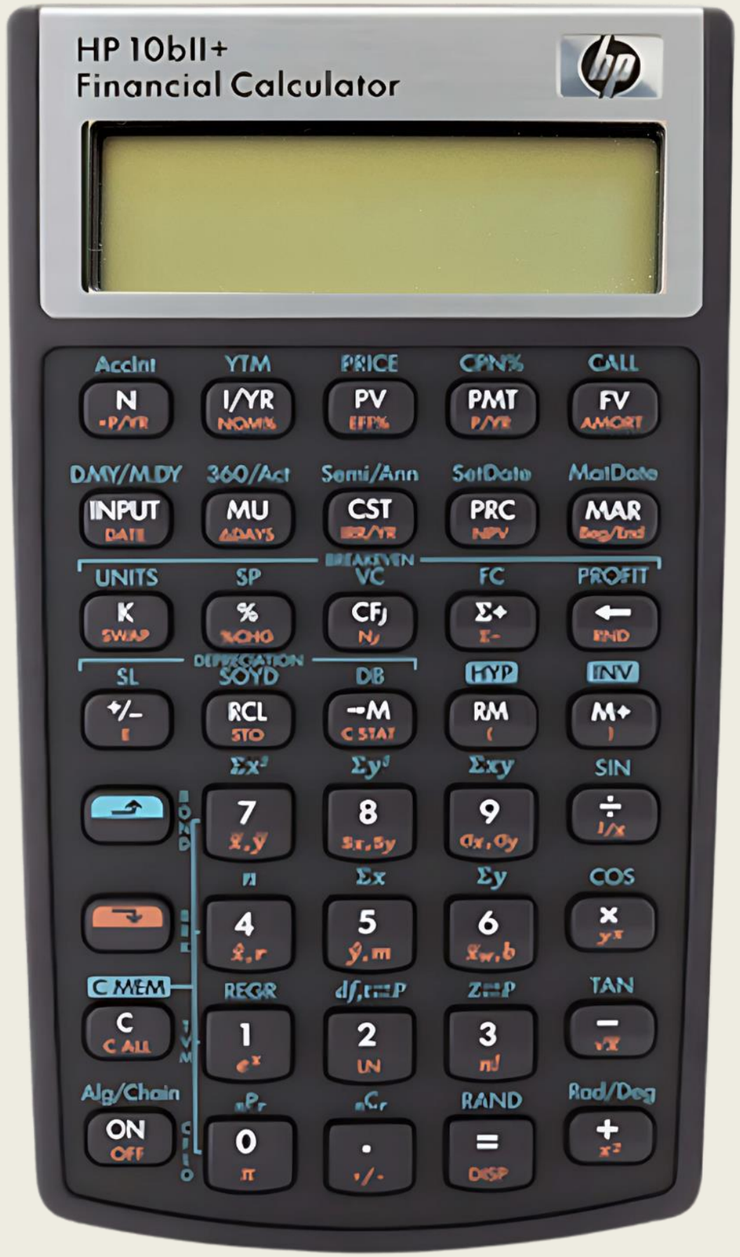
1,000,000 FV



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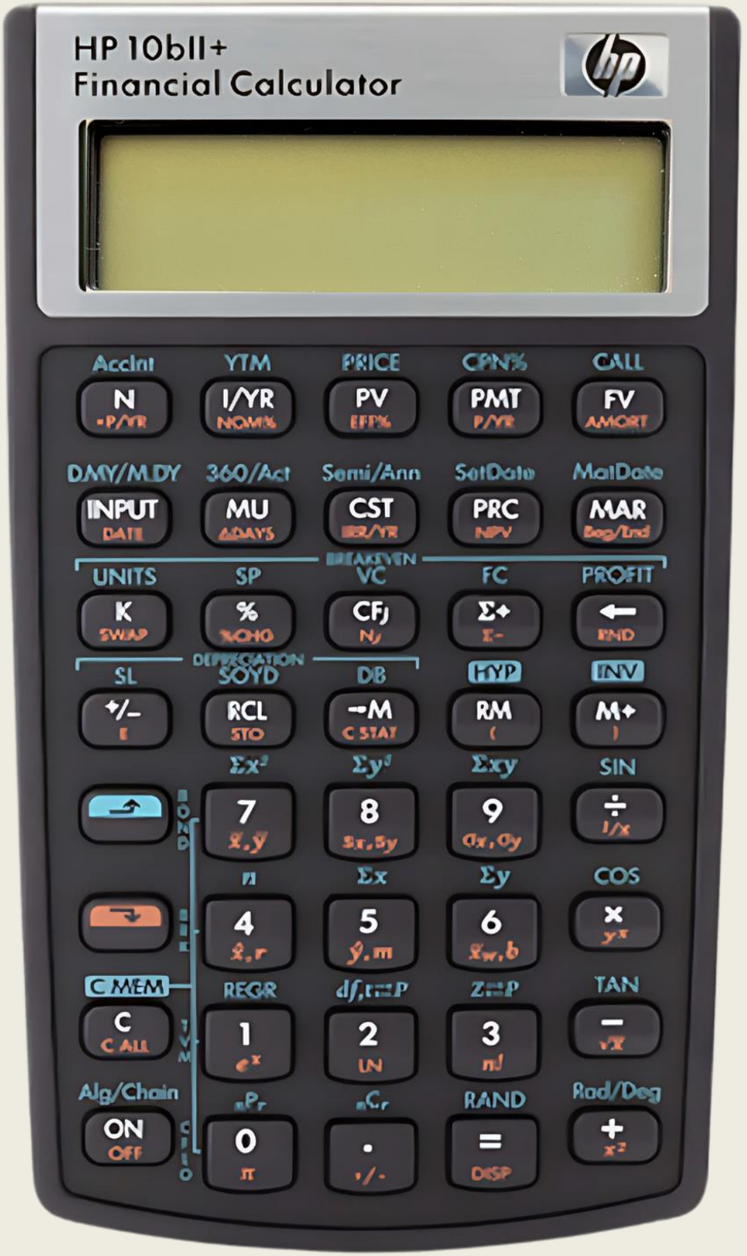
1,000,000 **FV**

60-18= 42
42x12=504 **N**



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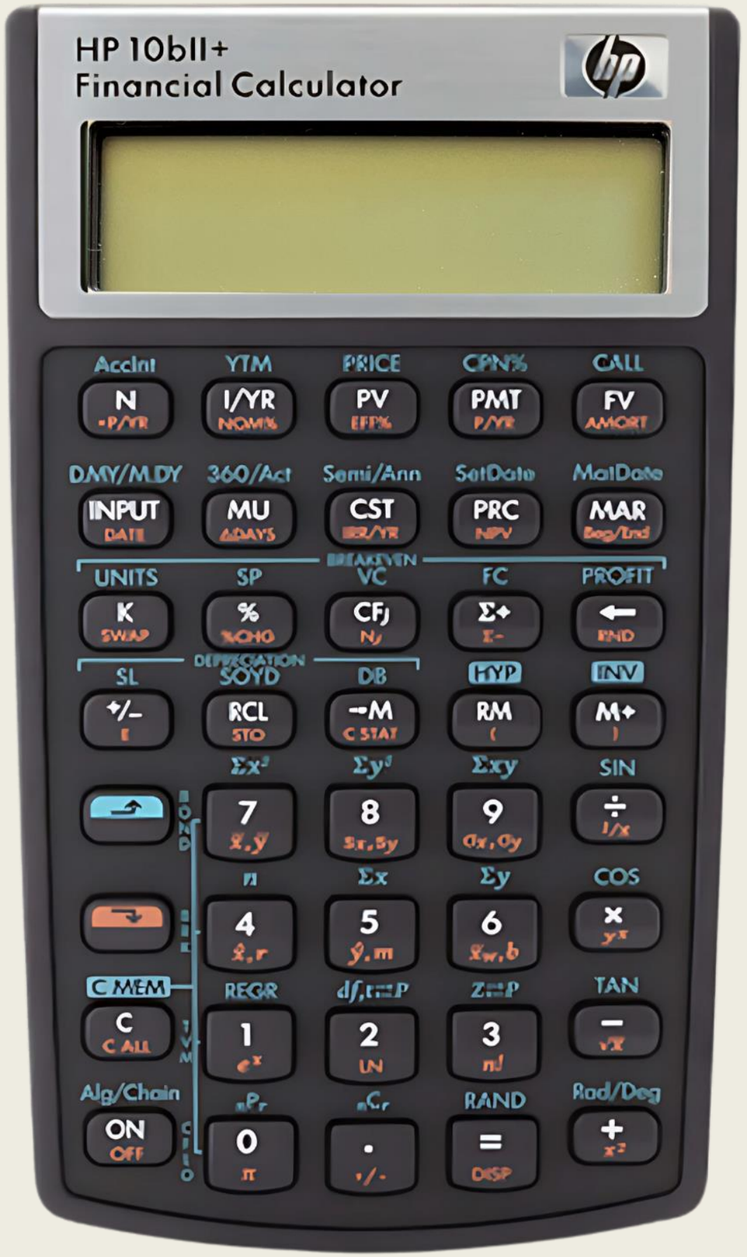
1,000,000 **FV**

60-18= 42
42x12=504 **N**

10 **I/YR**

PMT



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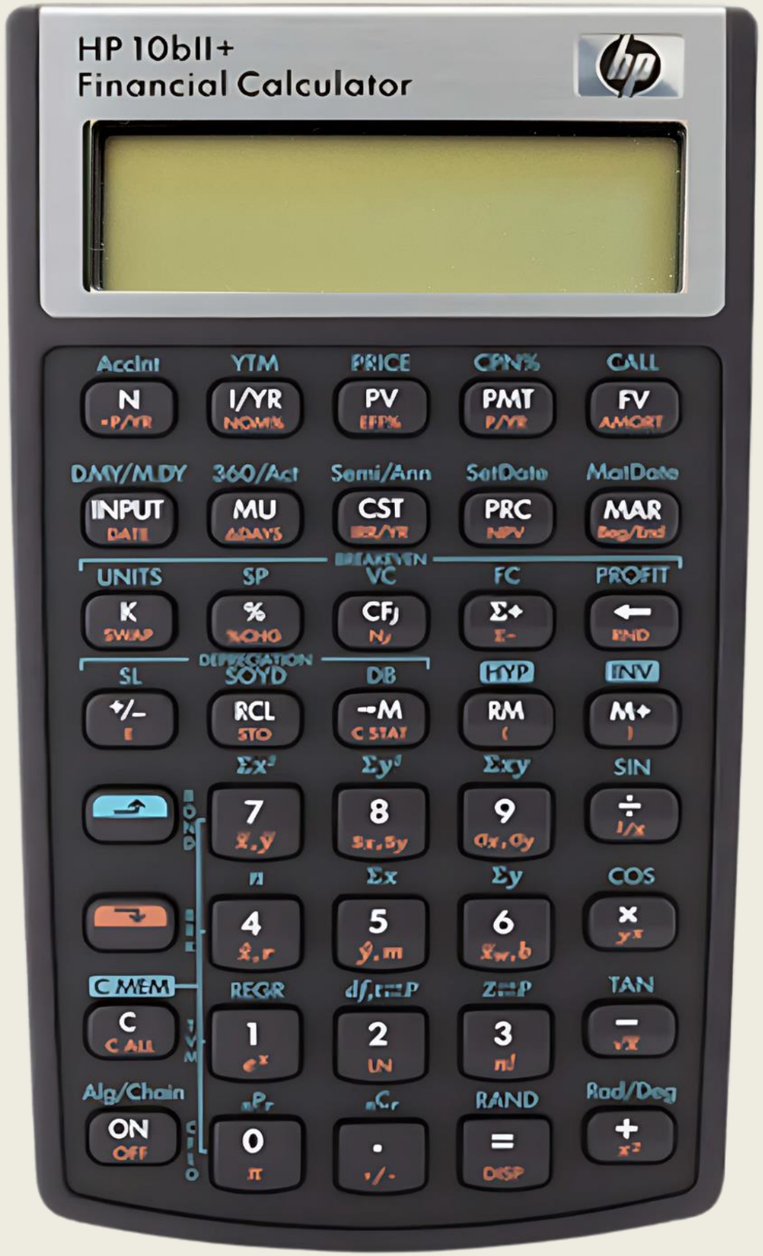
1,000,000 **FV**

60-18= 42
42x12=504 **N**

10 **I/YR**

PMT -129.13


HP 10bII+
Financial Calculator
Accint
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CPN%
CALL
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PMT
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MatDate
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MU
CST
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UNITS
SP
VC
FC
PROFIT
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Σ+
SL
SOYD
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#3) Compute I/YR: What Annual Interest Rate is being charged by a Rent-to-Own store?

First, press the Orange Bar key, then move your finger down and press the C ALL key.

Suppose you walk into Yuddy's Rent-to-Own store in Round Rock and see an HP refurbished laptop you want. Today's cash price is $1,299.99. If you don't have the cash today, they do advertise a financing plan. The Number of payments you will make is 18, in the amount of $107.99 per Payment.

Question: What annual interest rate are you paying on the monthly payment plan?

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1299.99	PV

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1299.99	PV
18	N

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Question: What annual interest rate are you paying on the monthly payment plan?

1299.99	PV
18	N
-107.99	PMT

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1299.99	PV
18	N
-107.99	PMT
55.52%	I/YR

Discussion: How does this interest rate compare to bank loans, credit cards, and pawn shops?

The next slide shows a truly outrageous interest rate based on a Payday Loan company flyer I picked up there.

National CSO Loan Corp

Payday Loan

$500, One Payment

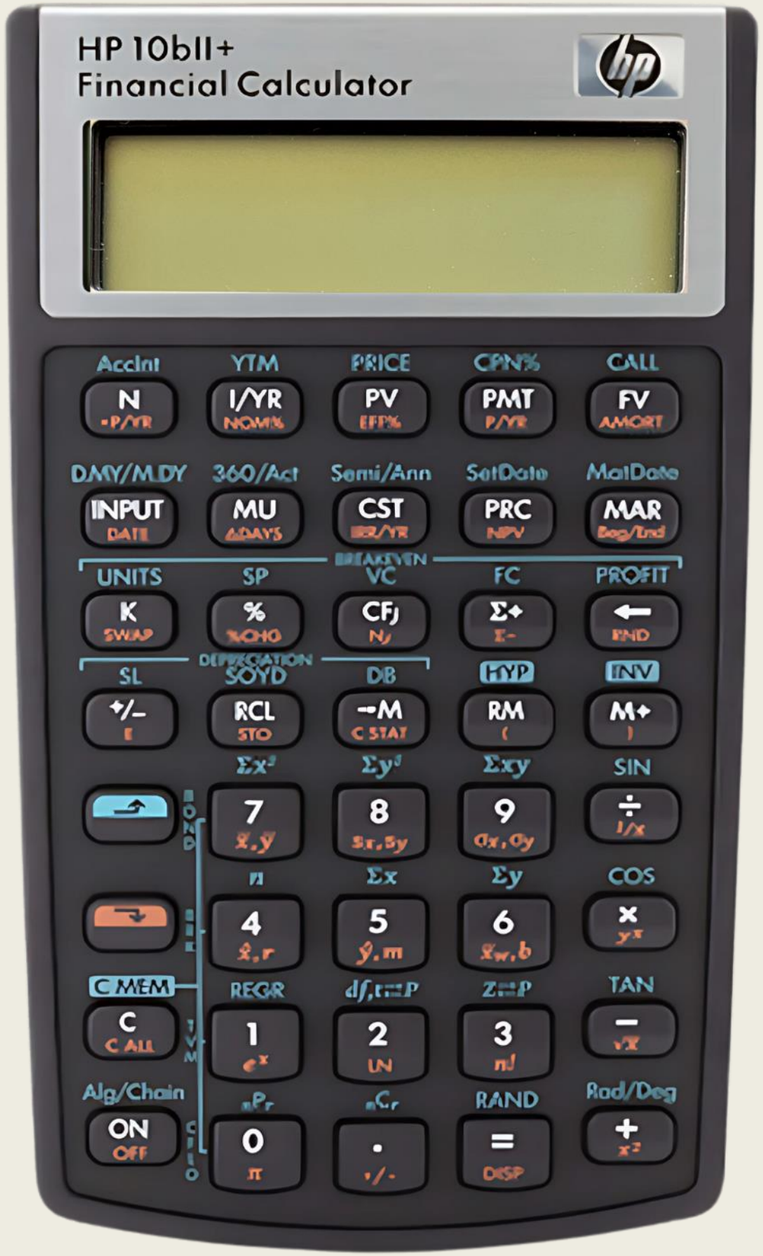
Cost Disclosure

Cost of this loan:

Borrowed amount (cash advance)	$ 500.00
Interest paid to lender (interest rate: 9.95 %)	$ 1.91
Fees paid to National CSO Loan Corp	$ 125.00
Total of payments (if I pay on time)	$ 626.91

APR	661.75 %
Term of loan	14 days

If I pay off the loan in:	I will have to pay interest and fees of approximately:	I will have to pay a total of approximately:
2 Weeks	$ 126.91	$ 626.91
1 Month	$ 254.09	$ 754.09
2 Months	$ 508.19	$ 1,008.19
3 Months	$ 762.27	$ 1,262.27


HP 10bII+
Financial Calculator
Accint
YTM
PRICE
CPN%
CALL
N
I/YR
PV
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FV
DMY/M.DY
360/Act
Semi/Ann
SetDate
MatDate
INPUT
MU
CST
PRC
MAR
UNITS
SP
VC
FC
PROFIT
K
%
CFj
Σ+
SL
SOYD
DB
INV
+/−
RCL
−M
RM
M+
Σx²
Σy²
Σxy
SIN
7
8
9
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COS
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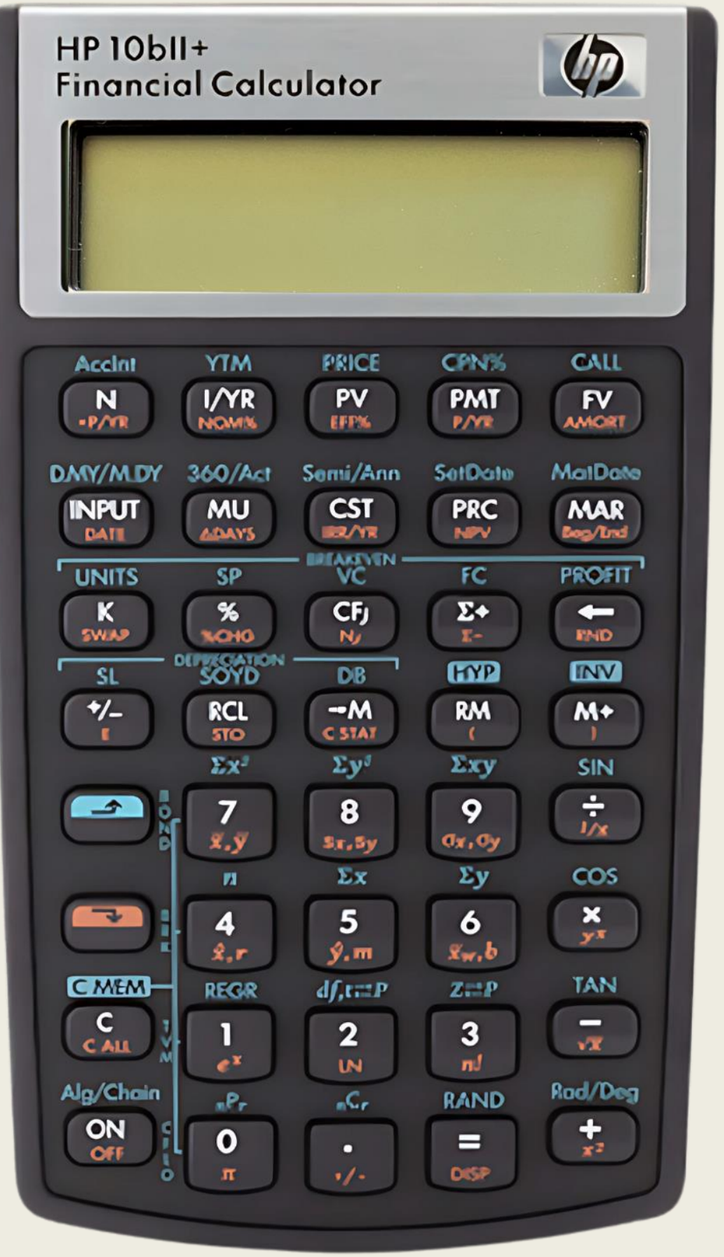
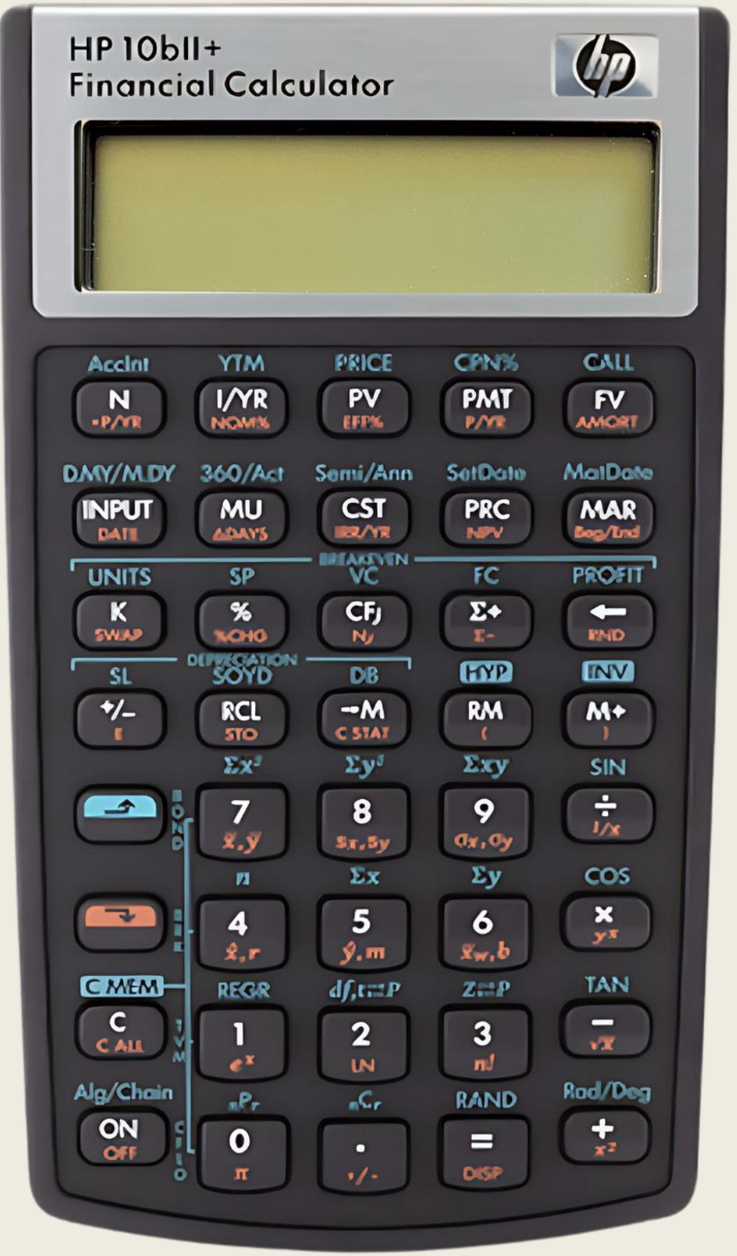


#4) PV of a Series of Payments: What is the Retirement Nest Egg Amount?
First, press the Orange Bar key, then move your finger down and press the C ALL key.

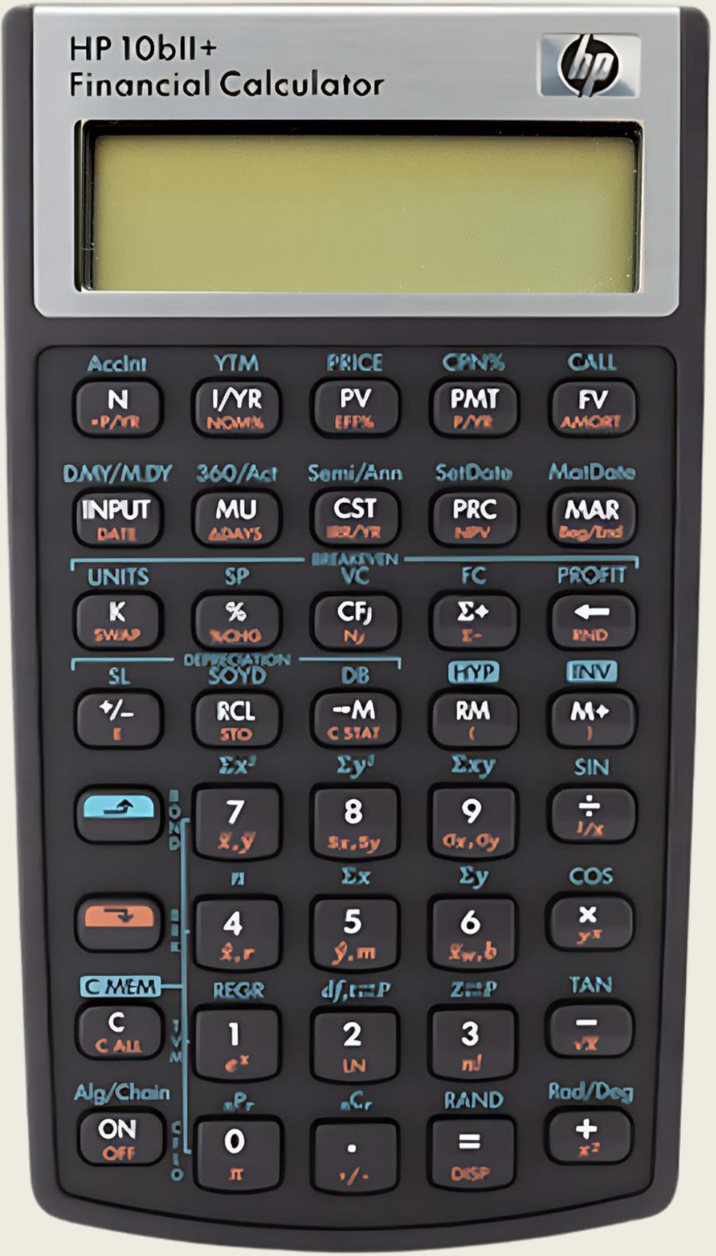
What amount will you need in the bank when you retire in order to make withdrawals of $2,000 monthly (hint: payments) for 20 years if interest rates are 4% APR?



#4) PV of a Series of Payments: What is the Retirement Nest Egg Amount?

What amount will you need in the bank when you retire in order to make withdrawals of $2,000 monthly (hint: payments) for 20 years if interest rates are 4% APR?
(don't forget to enter the negative sign)

-2000	PMT		

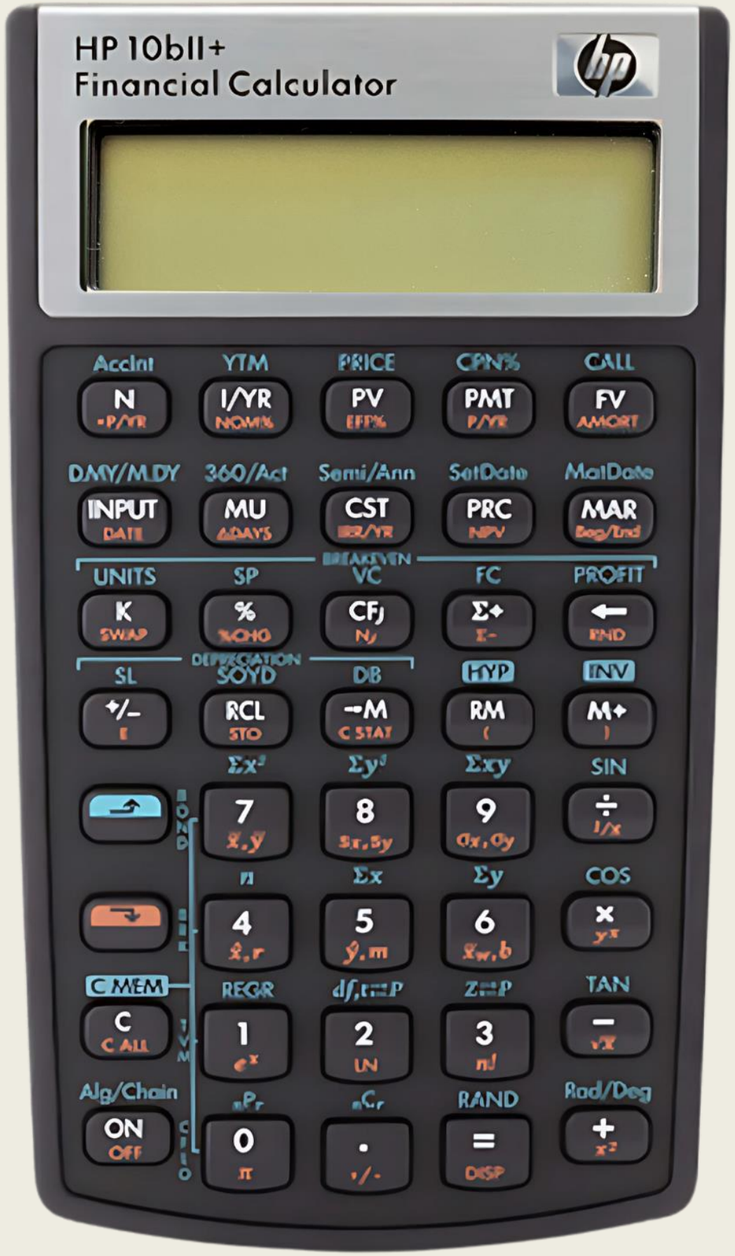


#4) PV of a Series of Payments: What is the Retirement Nest Egg Amount?

What amount will you need in the bank when you retire in order to make withdrawals of $2,000 monthly for 20 years if interest rates are 4% APR?

-2000 PMT

20X12=240 N



#4) PV of a Series of Payments: What is the Retirement Nest Egg Amount?

What amount will you need in the bank when you retire in order to make withdrawals of $2,000 monthly for 20 years if interest rates are 4% APR?

-2000	PMT	4	I/YR
20X12=240	N		

#4) PV of a Series of Payments: What is the Retirement Nest Egg Amount?

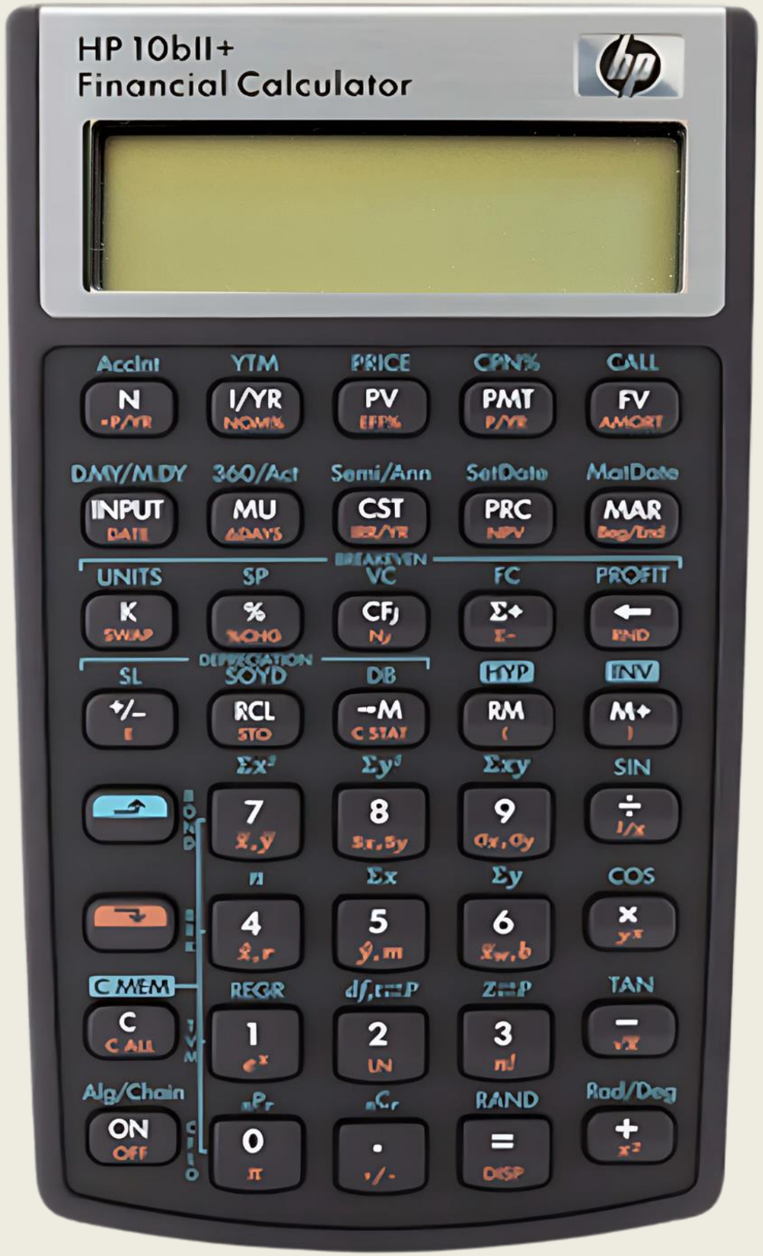
What amount will you need in the bank when you retire in order to make withdrawals of $2,000 monthly for 20 years if interest rates are 4% APR?

-2000 **PMT**

20X12=240 **N**

4 **I/YR**

PV 330,043.72


HP 10bII+
Financial Calculator
Acclnt
YTM
PRICE
CPN%
CALL
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FV
DMY/M.DY
360/Act
Semi/Ann
SetDate
MatDate
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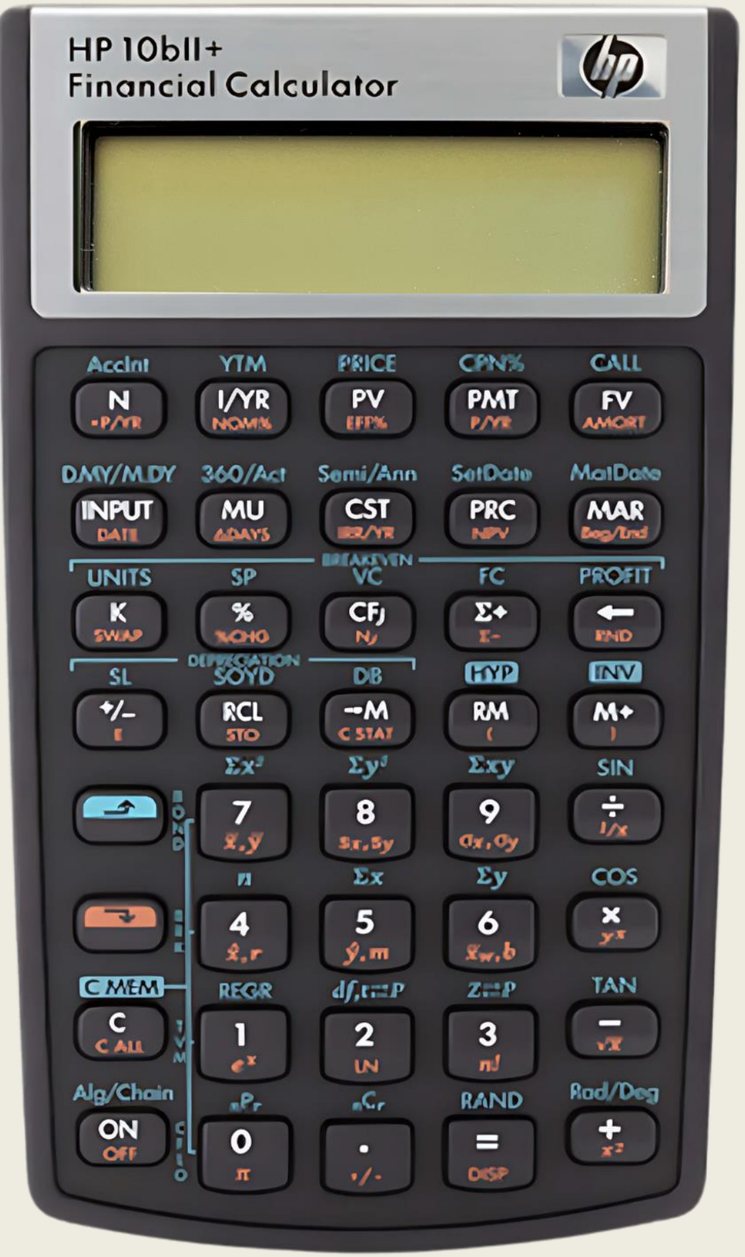
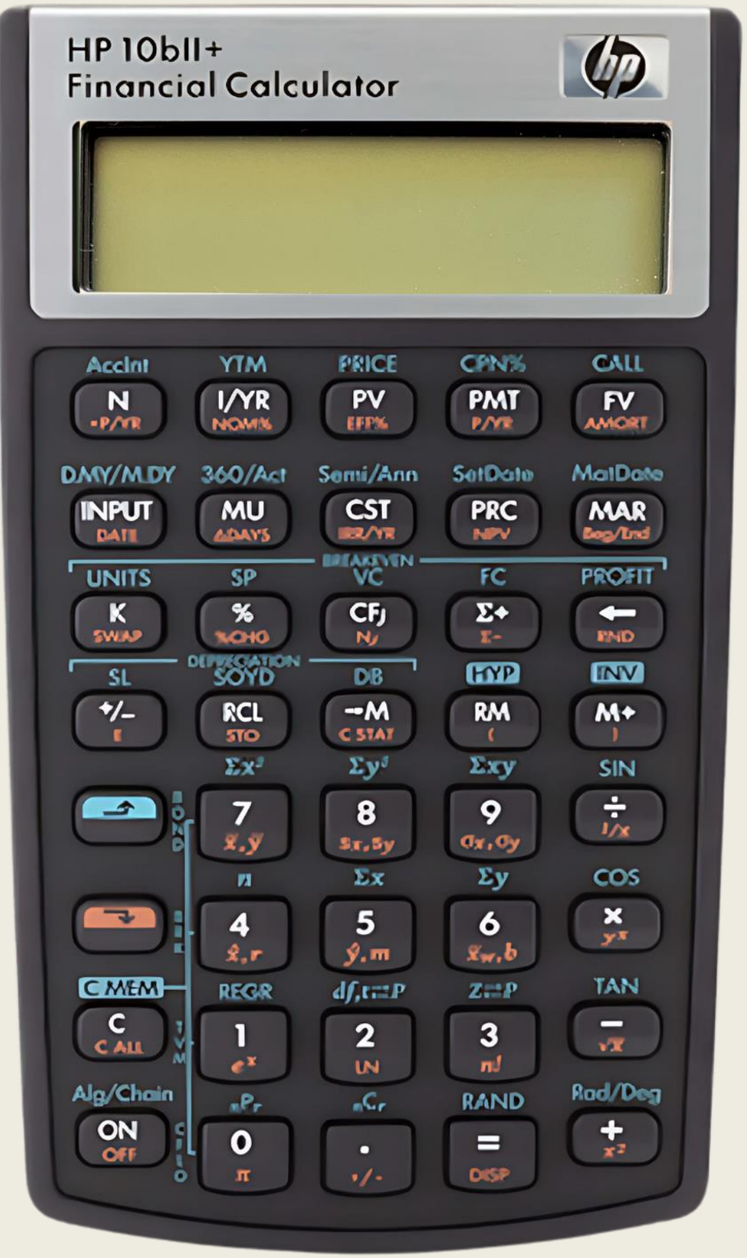


#5) PV of a Series of Equal Payments: How much is your Lump Sum Offer Today?

First, press the Orange Bar key, then move your finger down and press the C ALL.

Your doorbell rings, and your Ring App shows the famous Steve Harvey standing there. Oh my word, The Publishers Clearinghouse Sweepstakes has just knocked on your door, and you've won the $10,800,000 Sweepstakes! They give you the choice of $30,000 per month (hint: payment) for 30 years, or a lump sum cash payout today.

If annual interest rates are 4.3871134%, how much will they offer you today (PV) as a lump sum payout?



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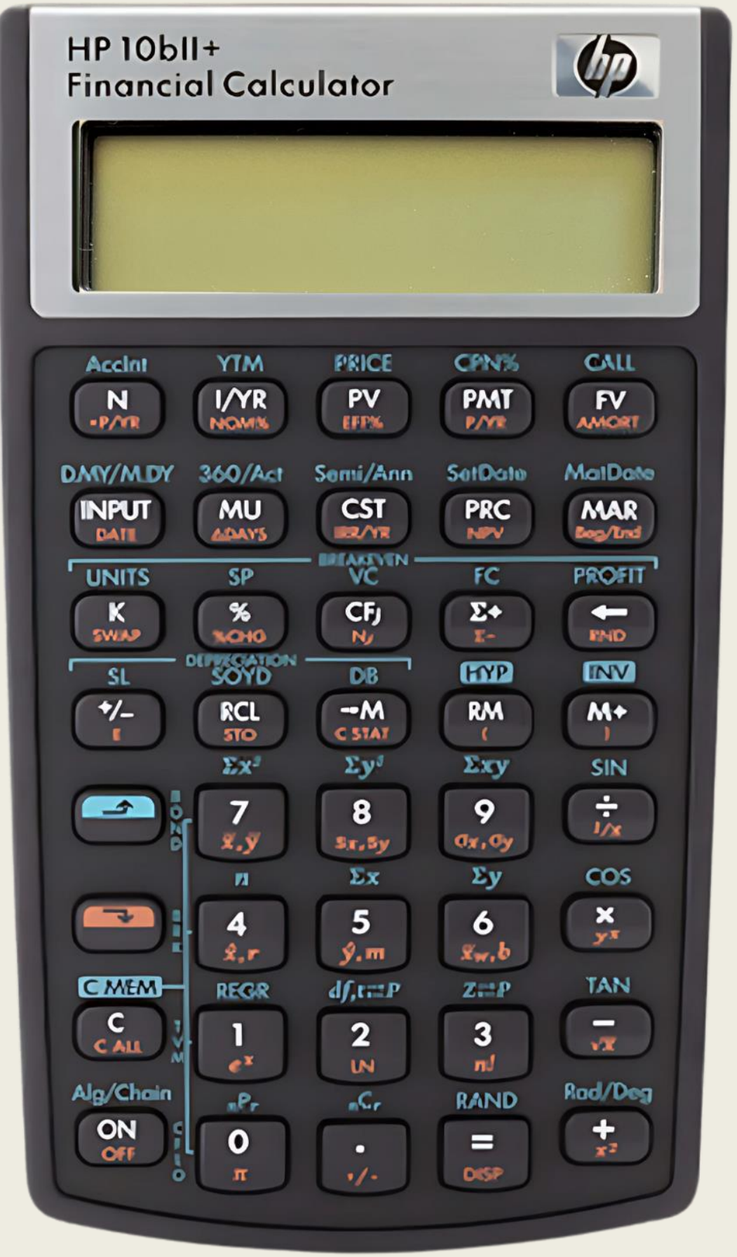
If annual interest rates are 4.3871134%, how much will they offer you today (PV) as a lump sum payout?

-30,000 PMT

_____ ☐

_____ ☐

☐ _____



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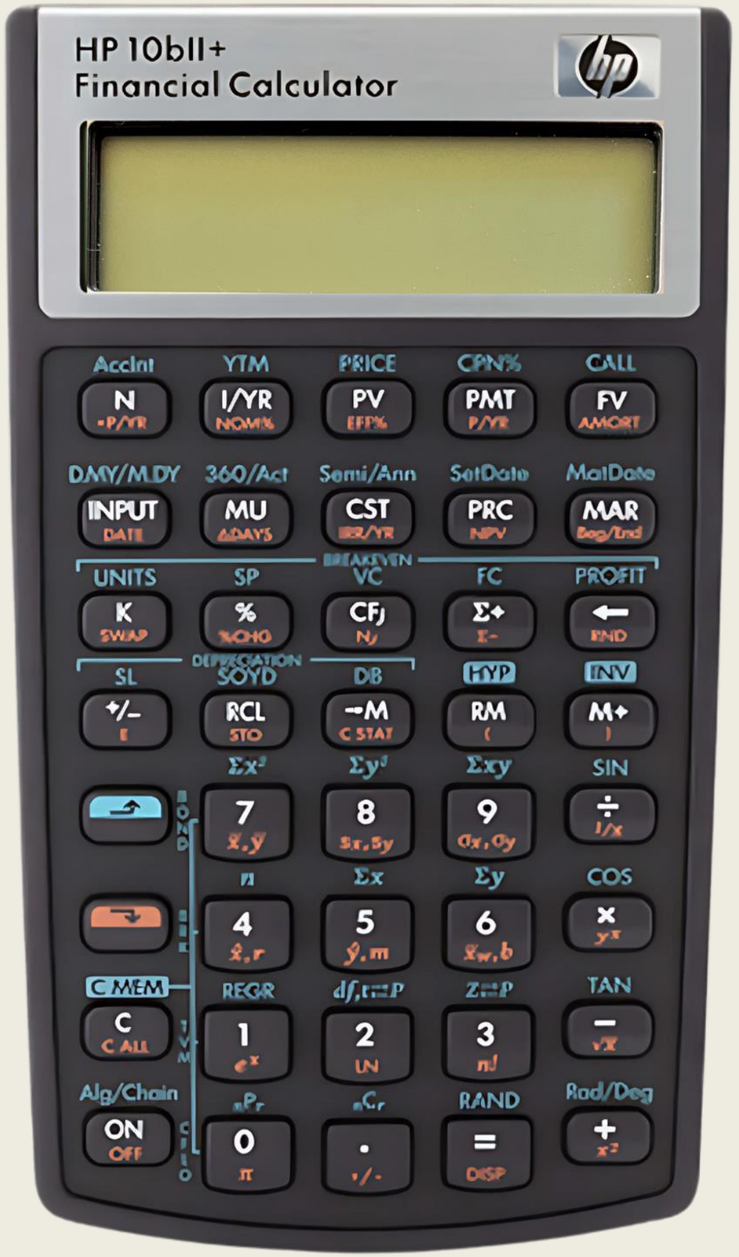
If annual interest rates are 4.3871134%, how much will they offer you today (PV) as a lump sum payout?

-30,000 PMT

30X12=360 N

_____ ☐

☐ _____



#5) PV of a Series of Equal Payments: How much is your Lump Sum Offer Today?

Your doorbell rings, and your Ring App shows the famous Steve Harvey standing there. Oh my word, The Publishers Clearinghouse Sweepstakes has just knocked on your door, and you've won the $10,800,000 Sweepstakes! They give you the choice of $30,000 per month for 30 years, or a lump sum cash payout today.

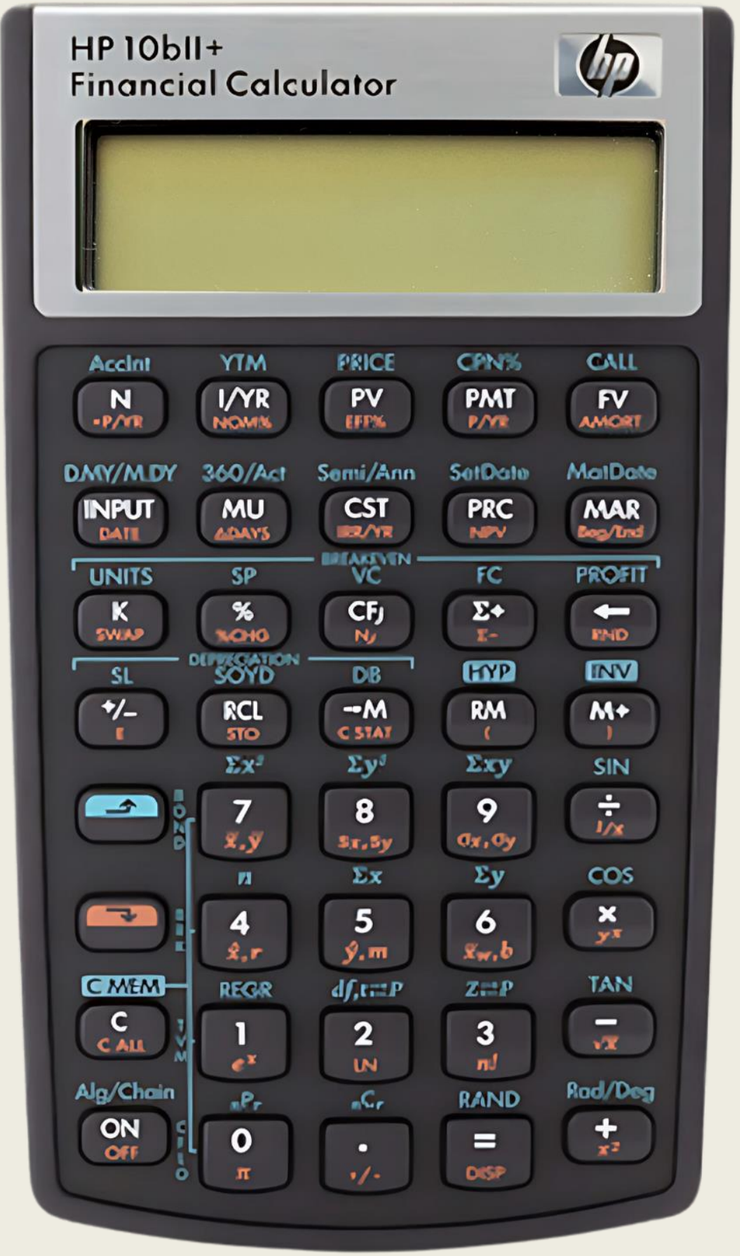
If annual interest rates are 4.3871134%, how much will they offer you today (PV) as a lump sum payout?

-30,000 PMT

30X12=360 N

4.3871134 I/YR

[ ] _____



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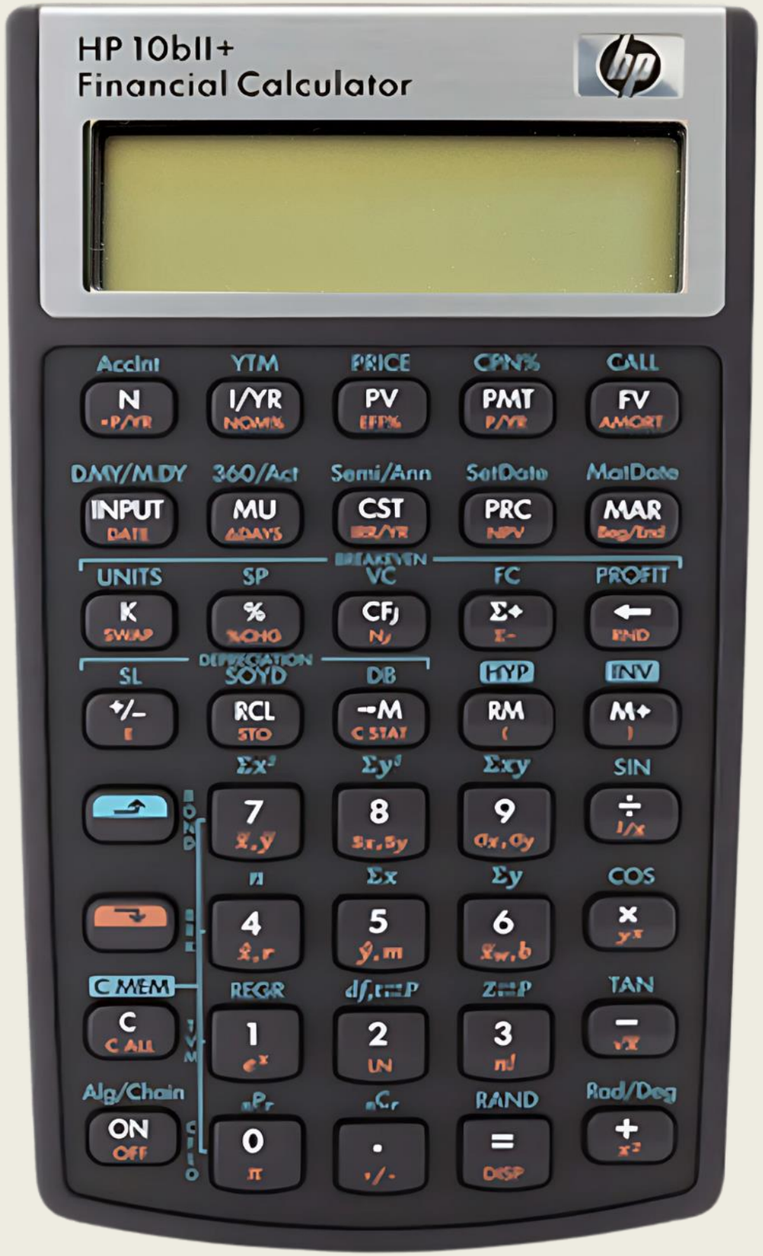
If annual interest rates are 4.3871134%, how much will they offer you today (PV) as a lump sum payout?

-30,000 **PMT**

30X12=360 **N**

4.3871134 **I/YR**

PV 6,000,000.10


HP 10bII+
Financial Calculator

#6) Savings PMT: Start Saving at Different Ages

First, press the Orange Bar key, then move your finger down and press the C ALL key.

But don't press these keys again before you start working on b)

How much would your monthly savings payments be to reach $1,000,000 in the future at age 65, with a mutual fund earning an average of 10% annual return, if you begin saving at the following ages?

	a) Age 21	b) Age 51 (don't press the Orange Bar key, and C ALL key.)
a)	65-21=44 44x12=_____ 	_____ 	_____ 	 _____
b)	_____ 	_____ 	_____ 	 _____

#6) Savings PMT: Start Saving at Different Ages

How much would your monthly savings payments be to reach $1,000,000 in the future at age 65, with a mutual fund earning an average of 10% annual return, if you begin saving at the following ages?

		a) Age 21		b) Age 51			
a)	65-21=44 44x12=528	N					
b)	65-51=14 14x12=						

#6) Savings PMT: Start Saving at Different Ages

How much would your monthly savings payments be to reach $1,000,000 in the future at age 65, with a mutual fund earning an average of 10% annual return, if you begin saving at the following ages?

	a) Age 21				b) Age 51			
a)	65-21=44 44x12=528	N	1,000,000	FV				
b)	65-51=14 14x12=							

#6) Savings PMT: Start Saving at Different Ages

How much would your monthly savings payments be to reach $1,000,000 in the future at age 65, with a mutual fund earning an average of 10% annual return, if you begin saving at the following ages?

		a) Age 21			b) Age 51			
a)	65-21=44 44x12=528	N	1,000,000	FV	10	I/YR		
b)	65-51=14 14x12=							

#6) Savings PMT: Start Saving at Different Ages

How much would your monthly savings payments be to reach $1,000,000 in the future at age 65, with a mutual fund earning an average of 10% annual return, if you begin saving at the following ages?

a) Age 21

b) Age 51 (don't press the Orange Bar key, and C ALL key.)

a) 65-21=44
44x12=528

N = _____ 1,000,000 FV = _____ 10 I/YR = _____ PMT = -$105.51

---

b) 65-51=14
14x12=_____

N = _____ FV = _____ I/YR = _____ PMT = _____

#6) Savings PMT: Start Saving at Different Ages

How much would your monthly savings payments be to reach $1,000,000 in the future at age 65, with a mutual fund earning an average of 10% annual return, if you begin saving at the following ages?

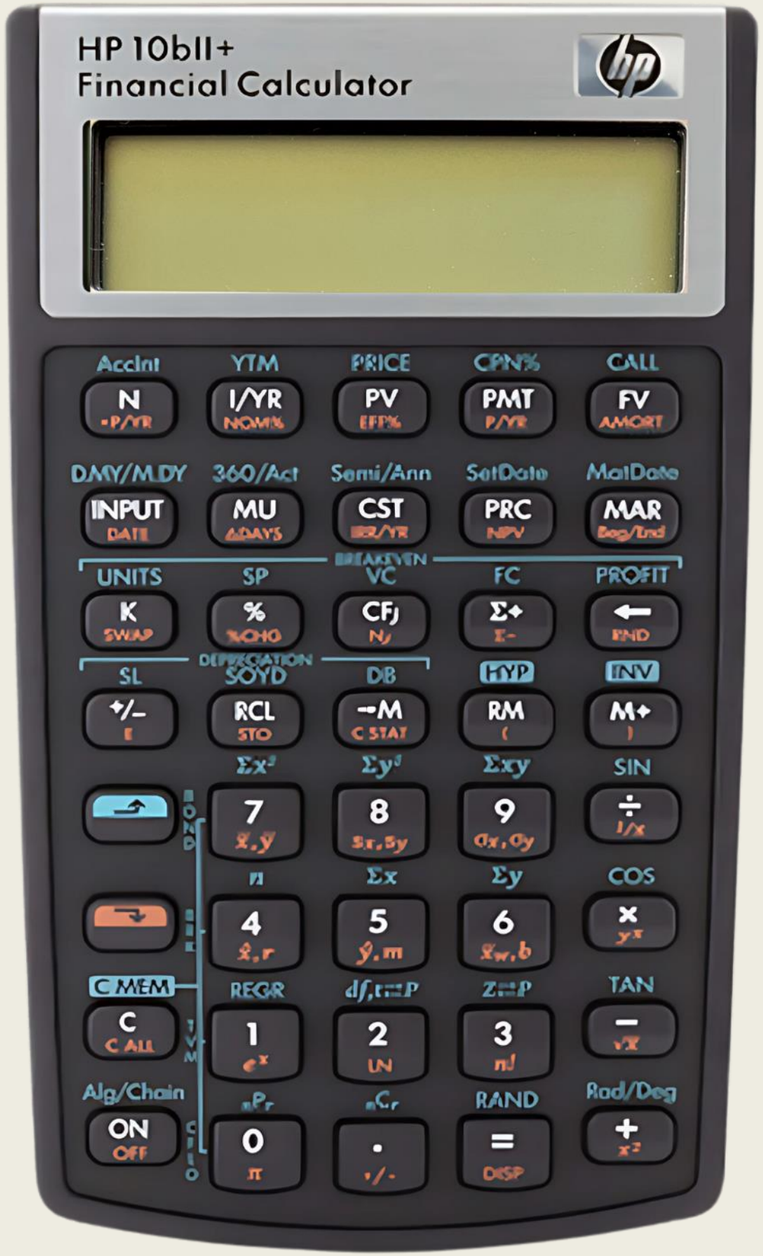
a) Age 21 b) Age 51 (don't press the Orange Bar key, and C ALL key.)

a)	65-21=44 44x12=528	N	1,000,000	FV	10	I/YR		PMT	-105.51
b)	65-51=14 14x12=168	N							

#6) Savings PMT: Start Saving at Different Ages

How much would your monthly savings payments be to reach $1,000,000 in the future at age 65, with a mutual fund earning an average of 10% annual return, if you begin saving at the following ages?

		a) Age 21		b) Age 51		
a)	65-21=44 44x12=528	N	1,000,000	FV	10	I/YR	PMT	-105.51
b)	65-51=14 14x12=168	N					PMT	-2,748.69


HP 10bII+
Financial Calculator
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CPN%
CALL
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I/YR
PV
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FV
DMY/M.DY
360/Act
Semi/Ann
SetDate
MatDate
INPUT
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PRC
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SOYD
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HYP
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Σy²
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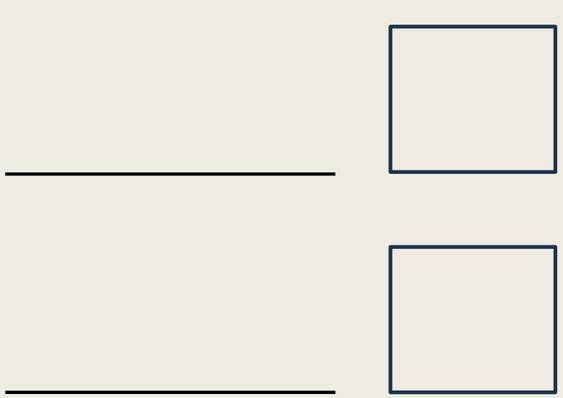
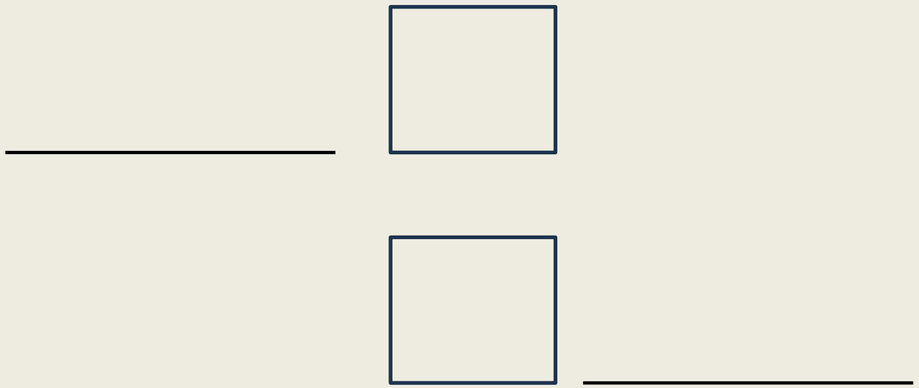
#7) Savings PMT: Dustin's Retirement Observation

First, press the Orange Bar key, then move your finger down and press the C ALL key.

a) Recorded history reports individuals living to age 950. Let's use that age in this example. Suppose that a person from this era wants to have $10,000,000 in the bank when they retire in the future. They are going to start saving monthly for retirement at age 100, and retire at age 700. Interest rates are 2.42% APR. How much of a payment do they have to save per month?





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10,000,000 FV

700-100= 600
600x12= 7200 N

#7) Savings PMT: Dustin's Retirement Observation

a) Recorded history reports individuals living to age 950. Let's use that age in this example. Suppose that a person from this era wants to have $10,000,000 in the bank when they retire in the future. They are going to start saving monthly for retirement at age 100, and retire at age 700. Interest rates are 2.42% APR. How much of a payment do they have to save per month?

10,000,000 FV

700-100= 600
600x12= 7200 N

2.42 I/YR

[ ] _____

#7) Savings PMT: Dustin's Retirement Observation

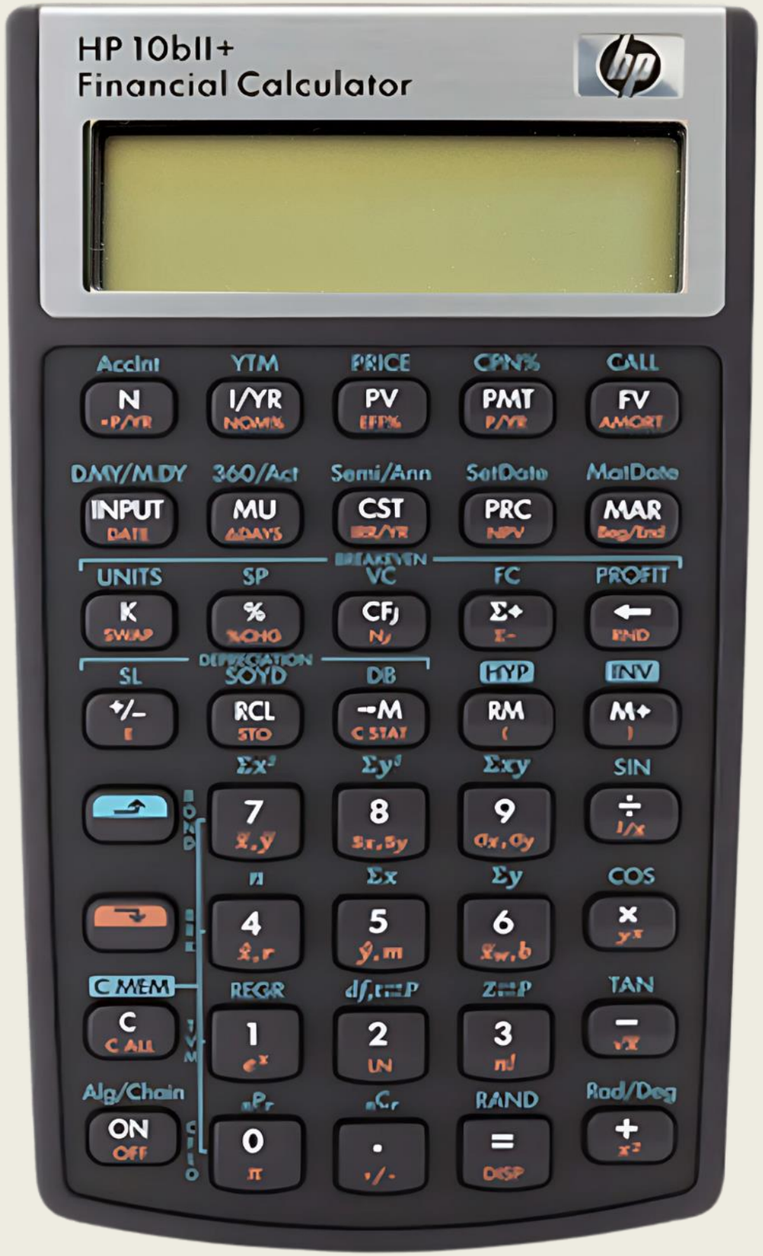
a) Recorded history reports individuals living to age 950. Let's use that age in this example. Suppose that a person from this era wants to have $10,000,000 in the bank when they retire in the future. They are going to start saving monthly for retirement at age 100, and retire at age 700. Interest rates are 2.42% APR. How much of a payment do they have to save per month?

10,000,000 FV

700-100= 600
600x12= 7200 N

2.42 I/YR

PMT -.01


HP 10bII+
Financial Calculator
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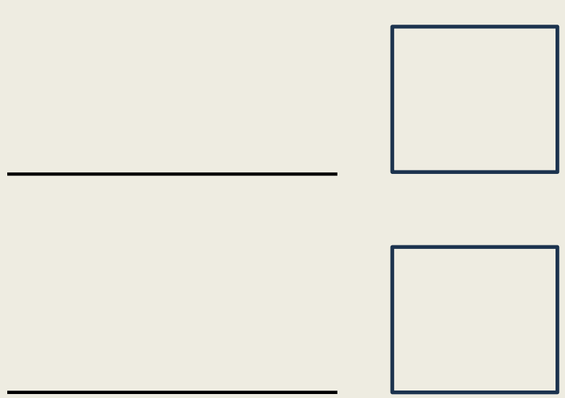
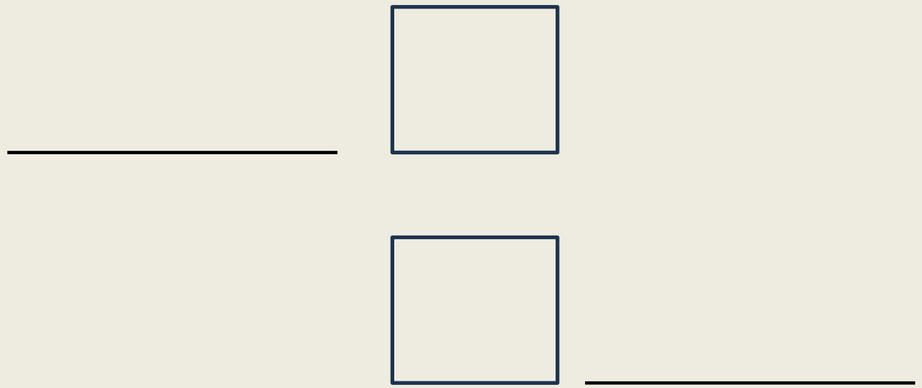
#8) Lump Sum Deposit to grow to a FV: Dustin's Retirement Observation

First, press the Orange Bar key, then move your finger down and press the C ALL key.

What if instead of saving monthly, the historical person in the previous problem wanted to make a single lump sum deposit in the bank (think Present Value) at age 100 and just let it grow to $10,000,000 over 600 years with interest remaining at 2.42% APR. How much would that deposit need to be in year 100?





#8) Lump Sum Deposit to grow to a FV: Dustin's Retirement Observation

What if instead of saving monthly, the historical person in the previous problem wanted to make a single lump sum deposit in the bank (think Present Value) at age 100 and just let it grow to $10,000,000 over 600 years with interest remaining at 2.42% APR. How much would that deposit need to be in year 100?

#8) Lump Sum Deposit to grow to a FV: Dustin's Retirement Observation

What if instead of saving monthly, the historical person in the previous problem wanted to make a single lump sum deposit in the bank (think Present Value) at age 100 and just let it grow to $10,000,000 over 600 years with interest remaining at 2.42% APR. How much would that deposit need to be in year 100?

10,000,000 FV

700-100= 600
600x12= 7200 N

#8) Lump Sum Deposit to grow to a FV: Dustin's Retirement Observation

What if instead of saving monthly, the historical person in the previous problem wanted to make a single lump sum deposit in the bank (think Present Value) at age 100 and just let it grow to $10,000,000 over 600 years with interest remaining at 2.42% APR. How much would that deposit need to be in year 100?

10,000,000 FV

700-100= 600
600x12= 7200 N

2.42 I/YR

PV

#8) Lump Sum Deposit to grow to a FV: Dustin's Retirement Observation

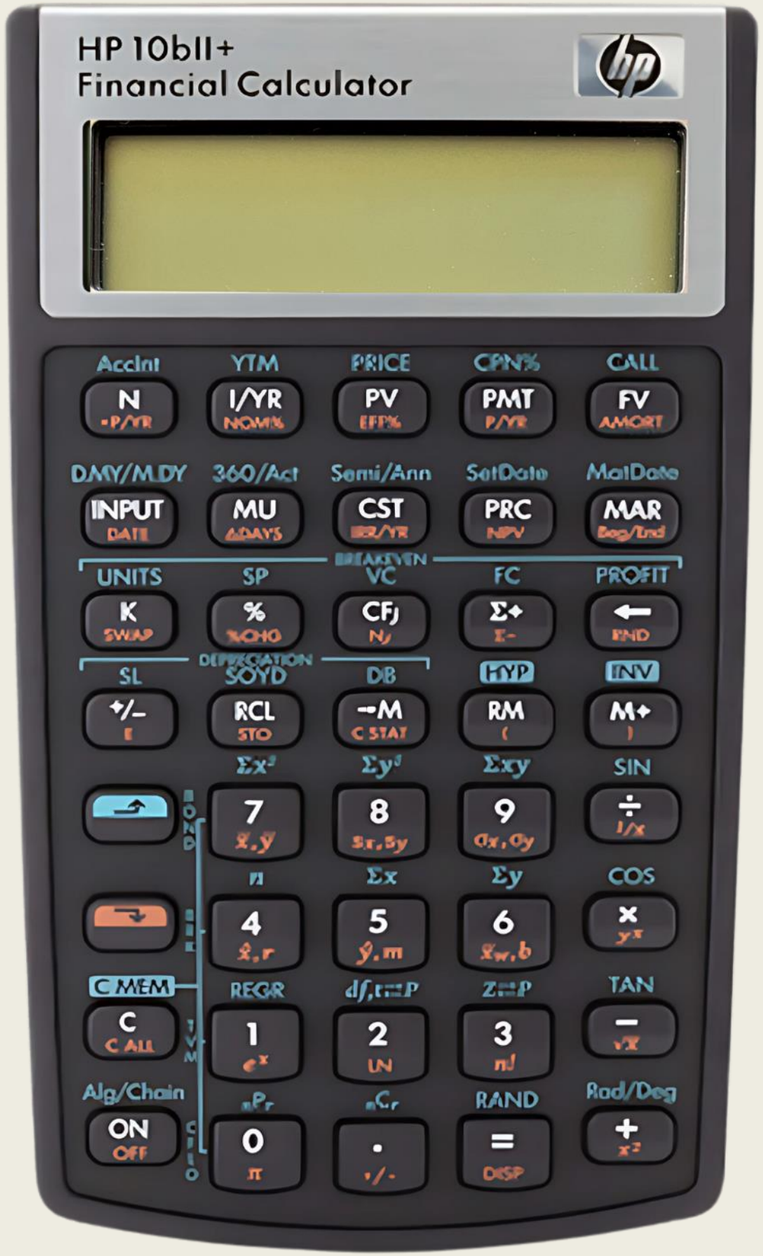
What if instead of saving monthly, the historical person in the previous problem wanted to make a single lump sum deposit in the bank (think Present Value) at age 100 and just let it grow to $10,000,000 over 600 years with interest remaining at 2.42% APR. How much would that deposit need to be in year 100?

10,000,000 FV

700-100= 600
600x12= 7200 N

2.42 I/YR

PV -5.02


HP 10bII+
Financial Calculator
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Semi/Ann
SetDate
MatDate
INPUT
MU
CST
PRC
MAR
UNITS
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Σ+
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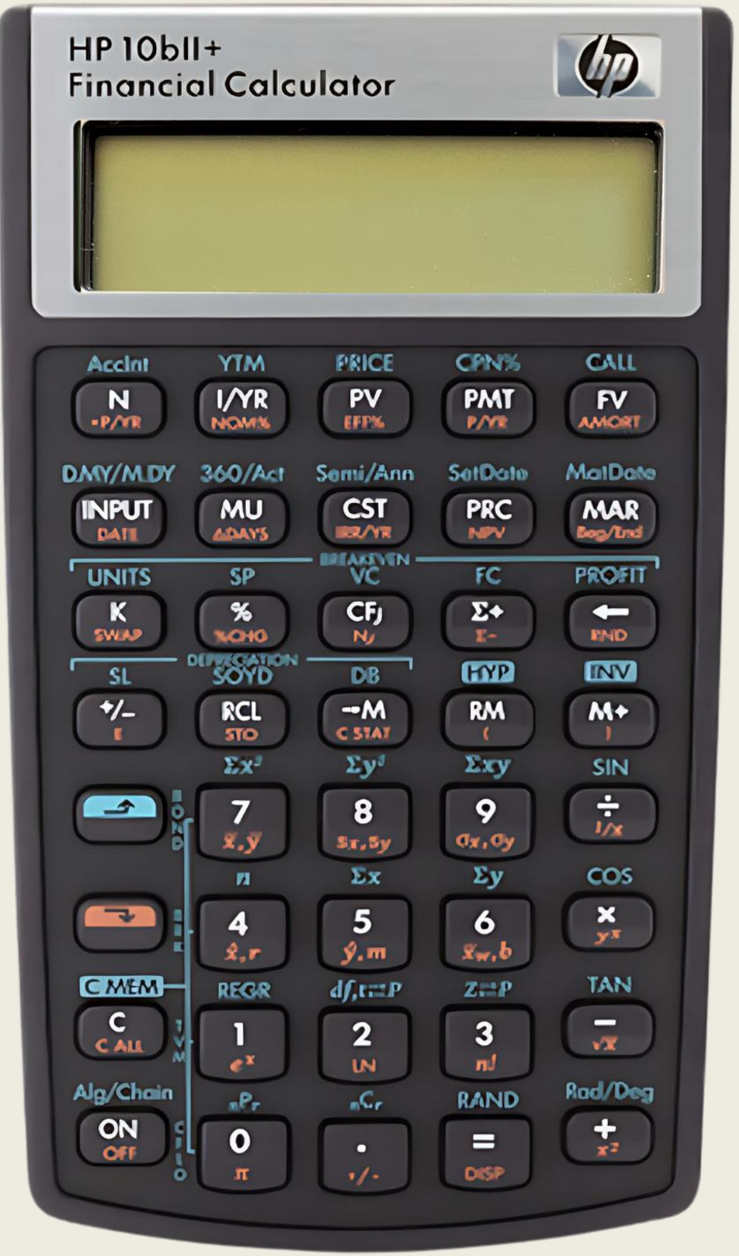
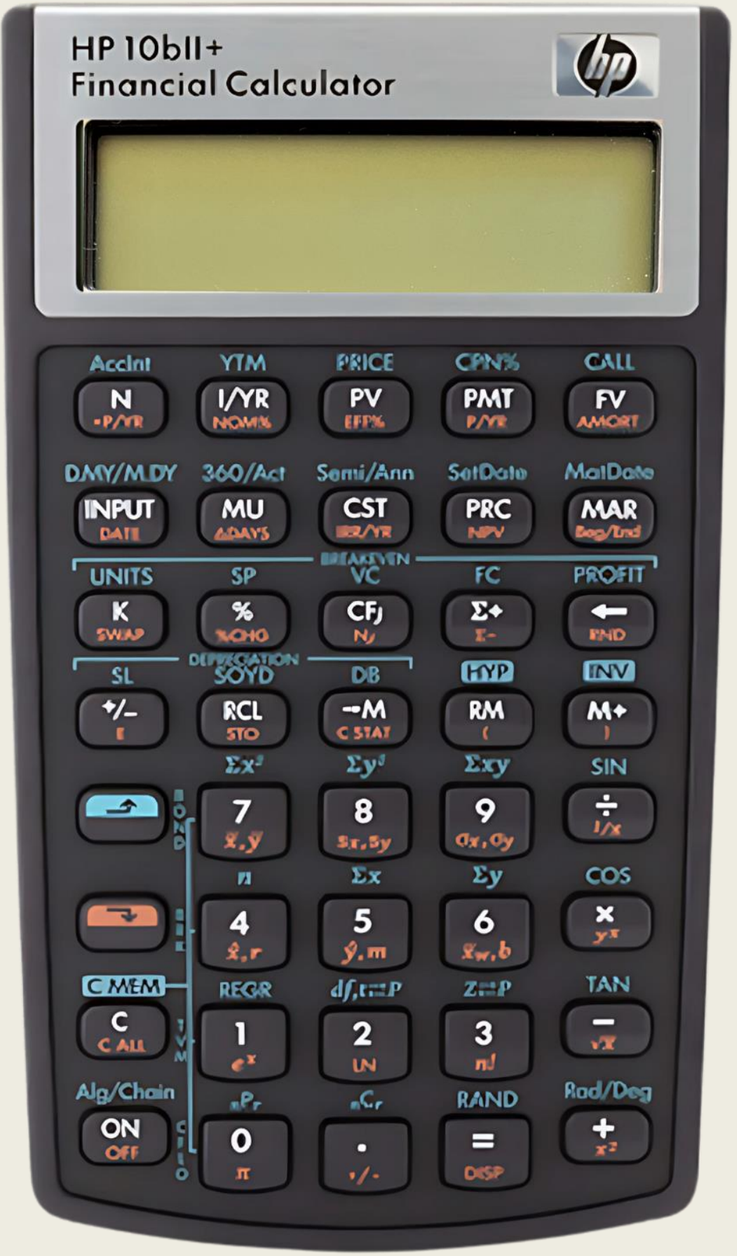


#9) Monthly PMT: Compute a Car Payment, and after doing so we will add a "what if" scenario.

First, press the Orange Bar key, then move your finger down and press the C ALL.

What would the payments be on a $15,000 car loan for 48 months at 7.42% APR? -



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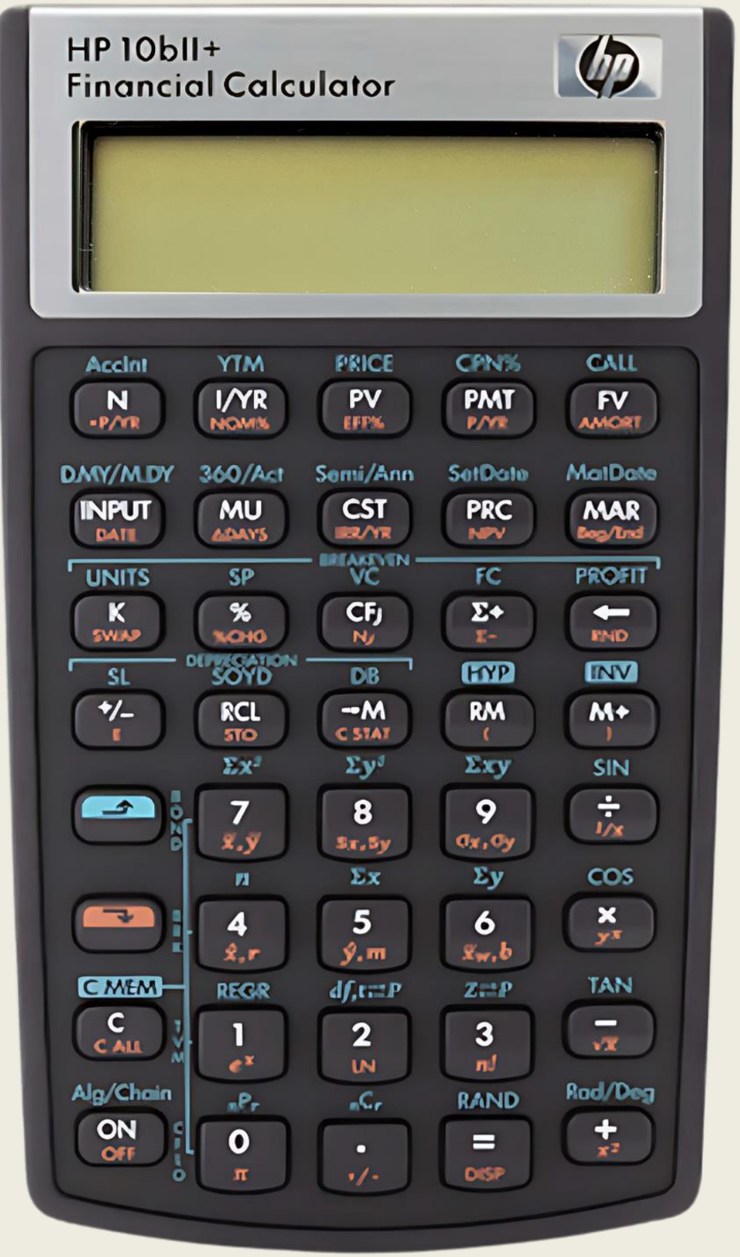
What would the payments be on a $15,000 car loan for 48 months at 7.42% APR? -

15,000 PV

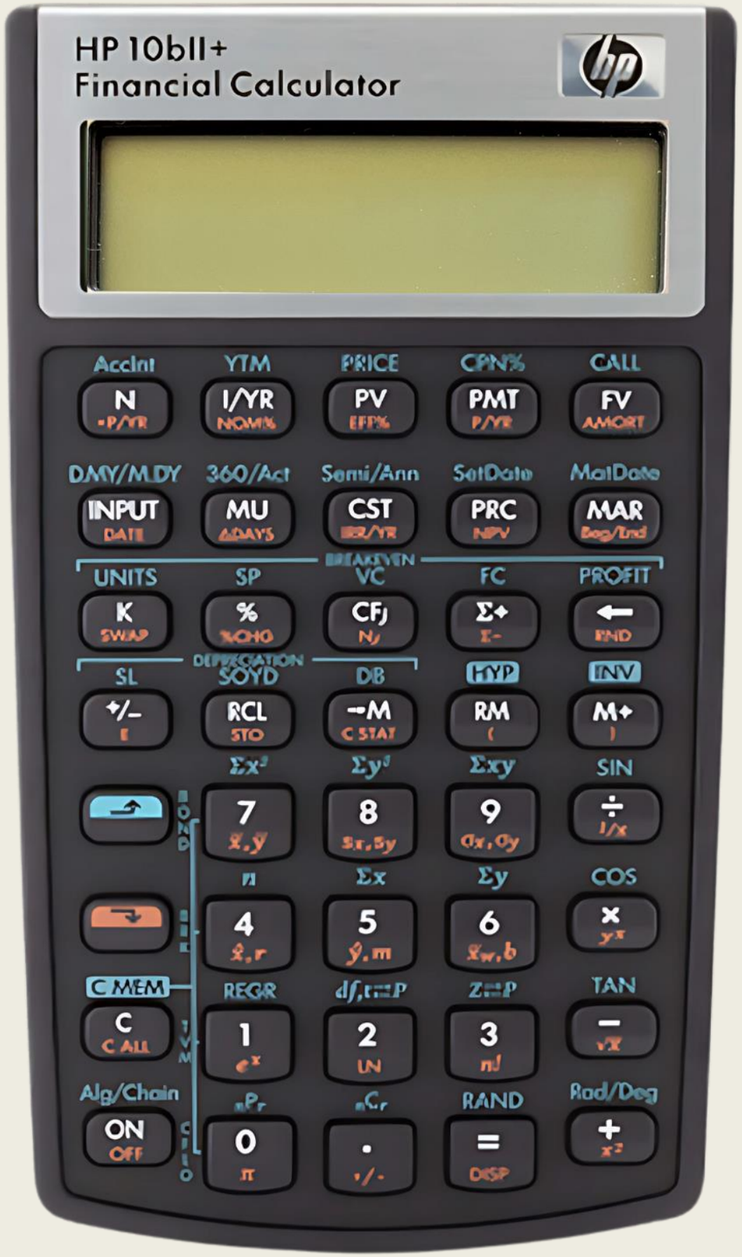


#9) Monthly PMT: Compute a Car Payment, and after doing so we will add a "what if" scenario.

What would the payments be on a $15,000 car loan for 48 months at 7.42% APR? -

15,000 PV

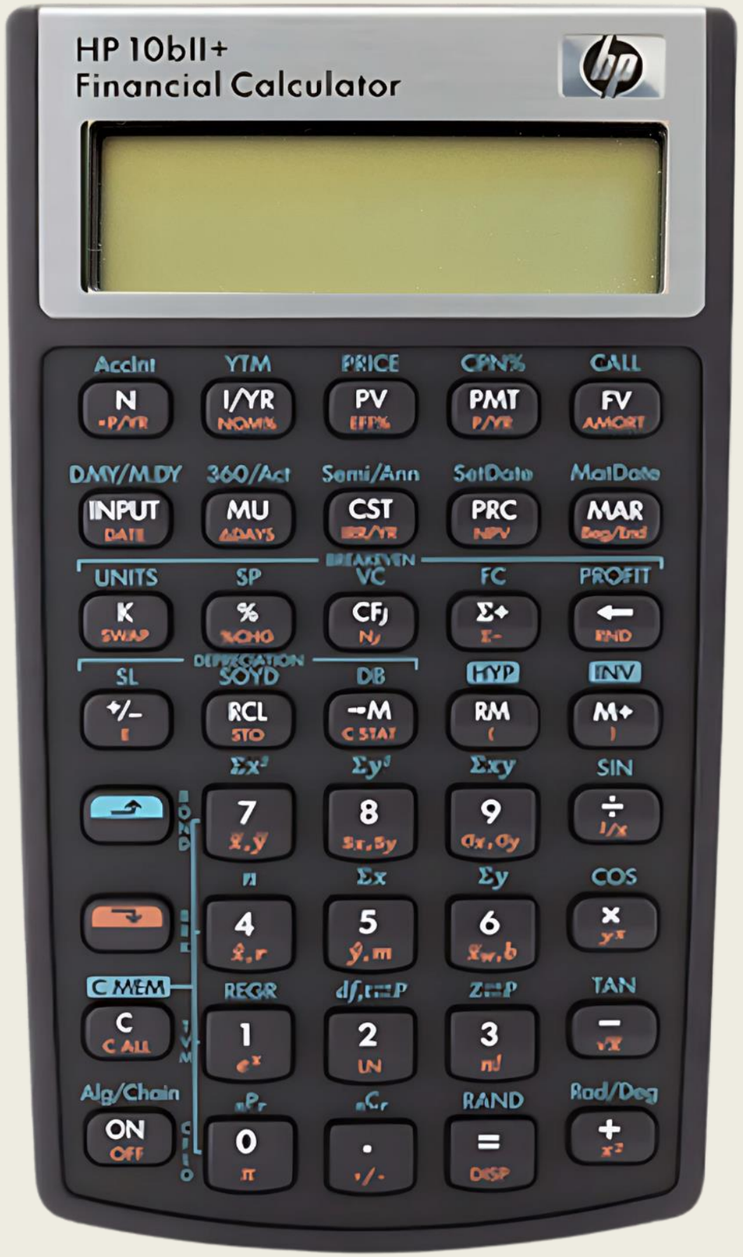
48 N



#9) Monthly PMT: Compute a Car Payment, and after doing so we will add a "what if" scenario.

What would the payments be on a $15,000 car loan for 48 months at 7.42% APR? -

15,000	PV	7.42	I/YR
48	N		



#9) Monthly PMT: Compute a Car Payment, and after doing so we will add a "what if" scenario.

What would the payments be on a $15,000 car loan for 48 months at 7.42% APR?

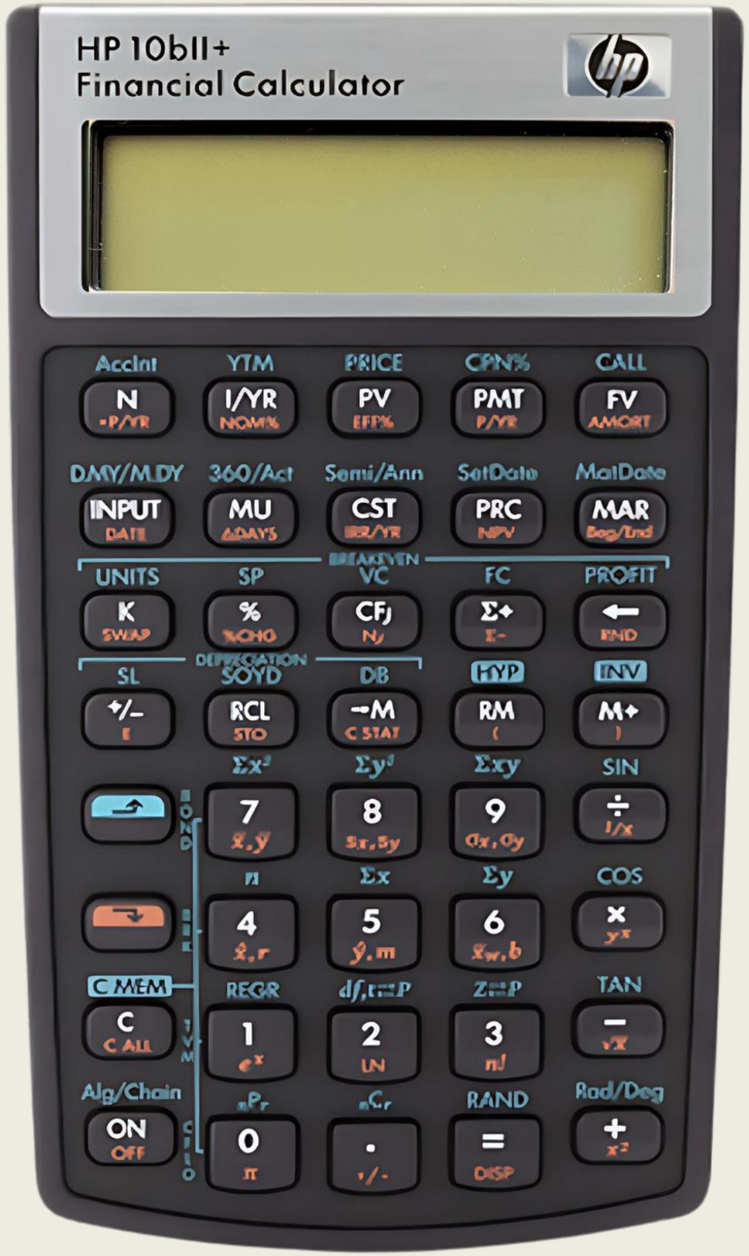
15,000 PV

7.42 I/YR

48 N

PMT -362.12

But **"what if"** you could only afford $300 per month. What is the number of months the loan would be for?



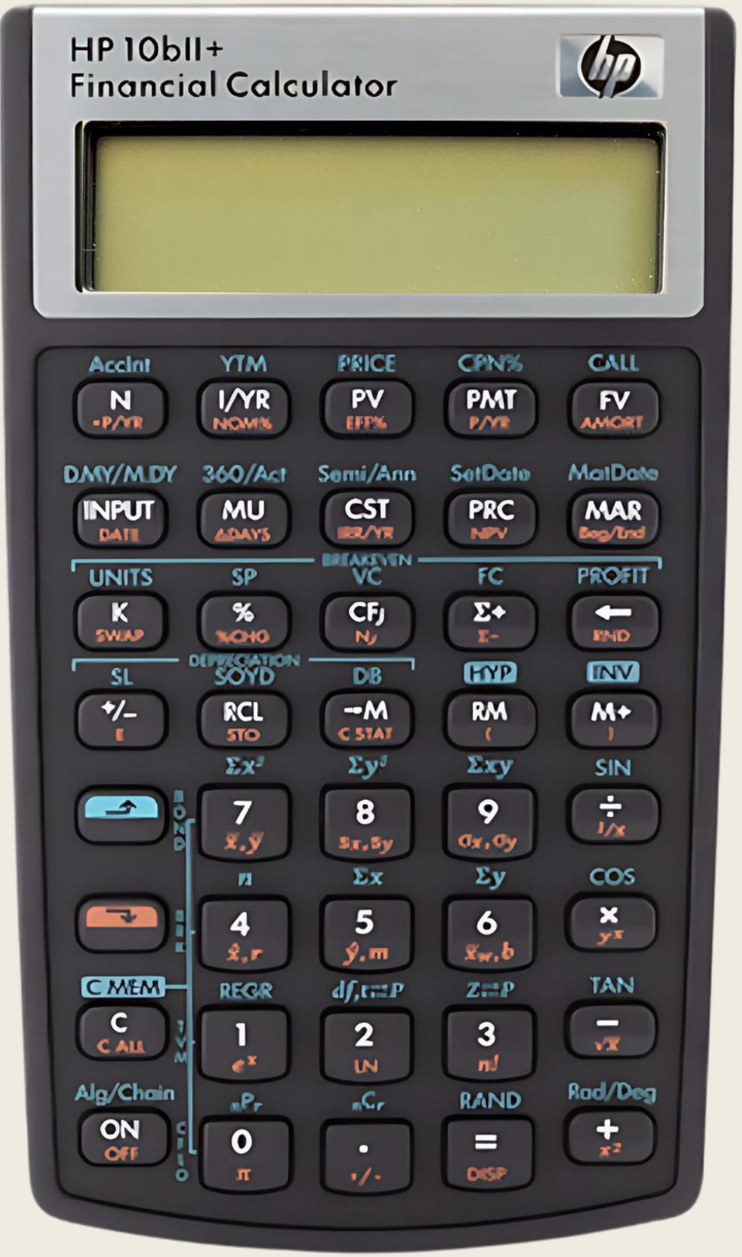
#9) Monthly PMT: Compute a Car Payment, and after doing so we will add a "what if" scenario.

-What would the payments be on a $15,000 car loan for 48 months at 7.42% APR? --But if you could only afford $300 per month, what is the number of months the loan would be for?

15,000	PV	7.42	I/YR
48	N	PMT	-362.12

But **"what if"** you could only afford $300 per month. What is the number of months the loan would be for?

-300	PMT		



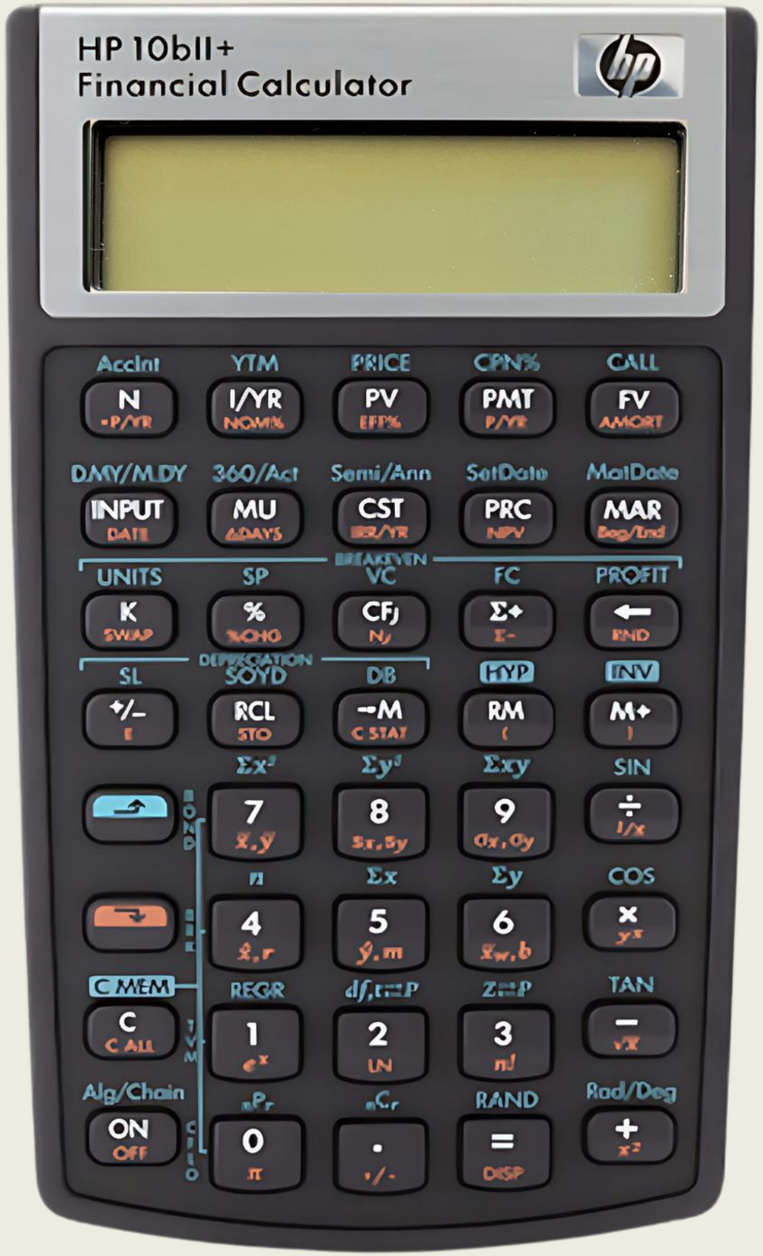
#9) Monthly PMT: Compute a Car Payment, and after doing so we will add a "what if" scenario.

What would the payments be on a $15,000 car loan for 48 months at 7.42% APR? -

15,000	PV	7.42	I/YR
48	N	PMT	- 362.12

But **"what if"** if you could only afford $300 per month? What is the number of months the loan would be for?

-300	PMT		
		N	60


HP 10bII+
Financial Calculator
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CALL
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PV
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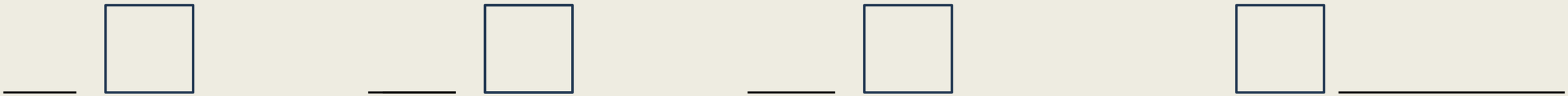
#10) Compute I/YR: Calculate the Return Rate used in a Dave Ramsey Video
First, press the Orange Bar key, then move your finger down and press the C ALL key.

The Dave Ramsey High School Curriculum has a video that begins with saying “Anyone can become a millionaire”… “If you invest just $100 bucks a month, starting at age 16, you will be a millionaire ($1,000,000 in the Future) by the time you are 55.” What annual return rate (I/YR) was he using?



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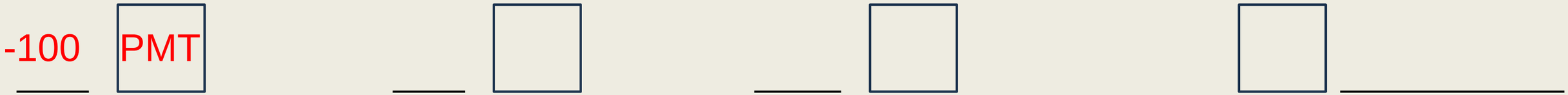

5

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5

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100 PMT

55-16=39
39x12=468 N

1,000,000 FV

#10) Compute I/YR: Calculate the Return Rate used in a Dave Ramsey Video

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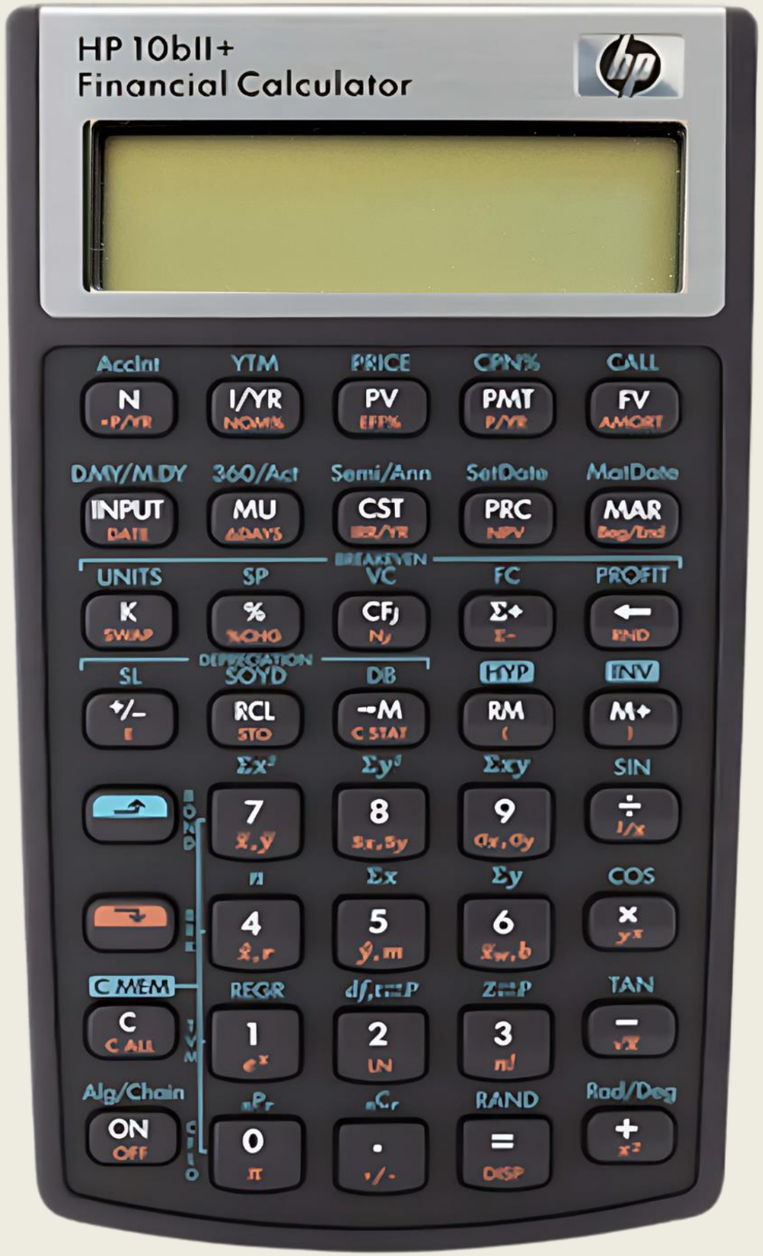
100 PMT

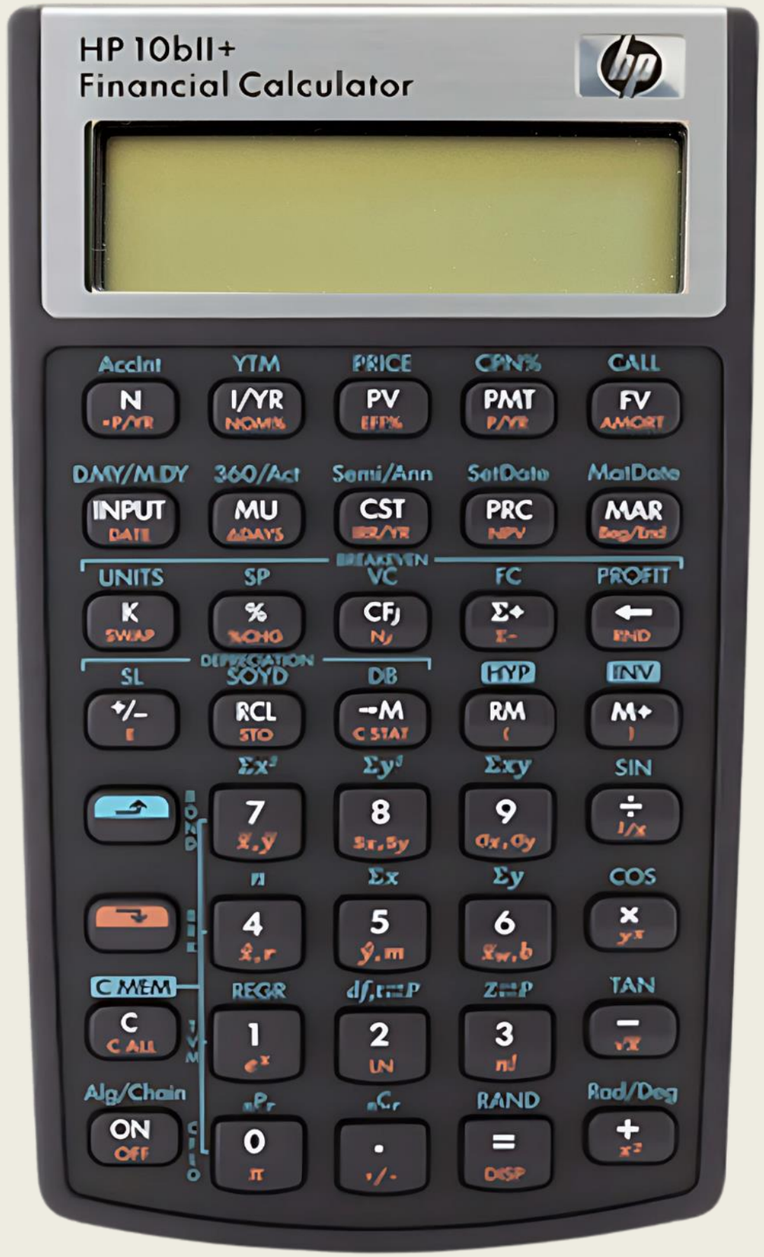
55-16=39
39x12=468 N

1,000,000 FV

I/YR 11.86%

5

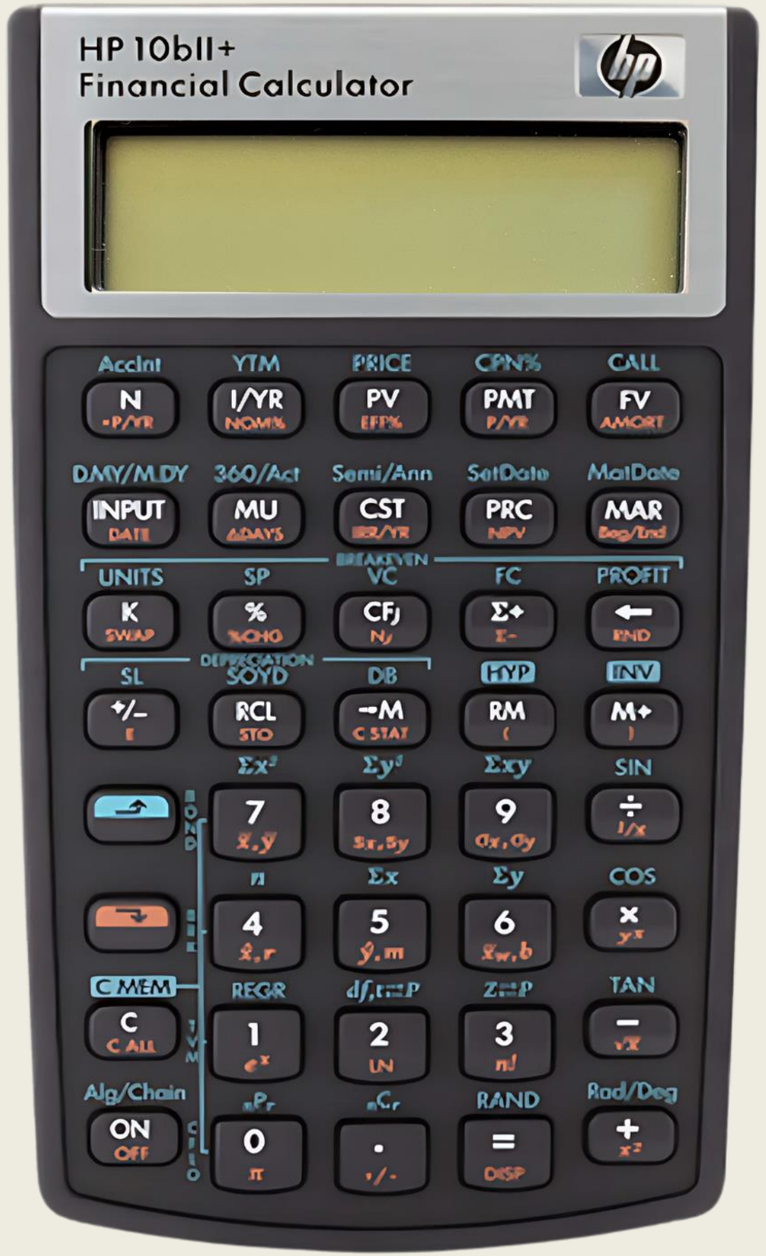

HP 10bII+
Financial Calculator



#11) Compute I/YR: Round Rock "Stock Market Game" Rock Stars. What is the Annual Yield (think Interest Rate or I/YR) that was earned by this Money Matters student?

First, press the Orange Bar key, then move your finger down and press the C ALL key.

On September 20, 2023 a student in RRISD invested $100,000 in an online simulation called The Stock Market Game. As of March 20, 2024 the value of the portfolio was $211,266.34. What was the annualized return (I/YR) on this investment?



#11) Compute I/YR: Round Rock "Stock Market Game"
What is the Annual Yield (think Interest Rate or I/YR) that was earned by this Money Matters student?

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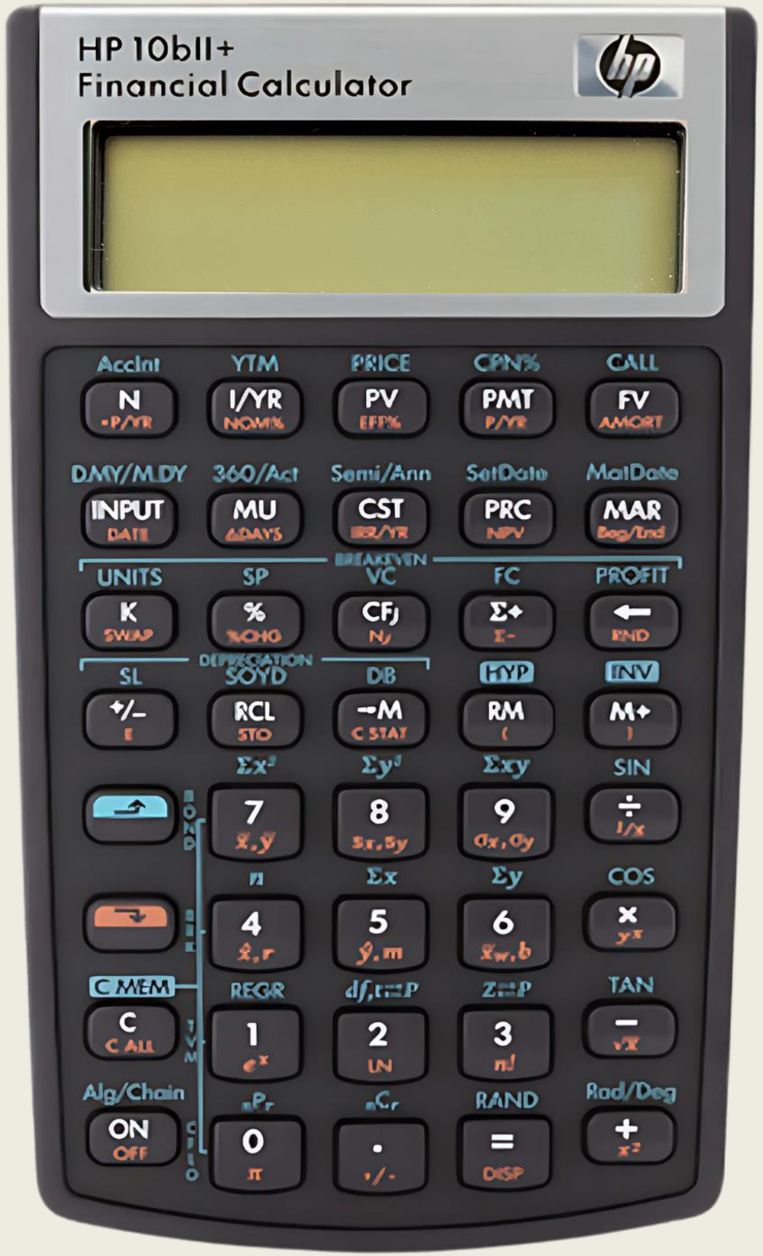
-100,000 PV

1



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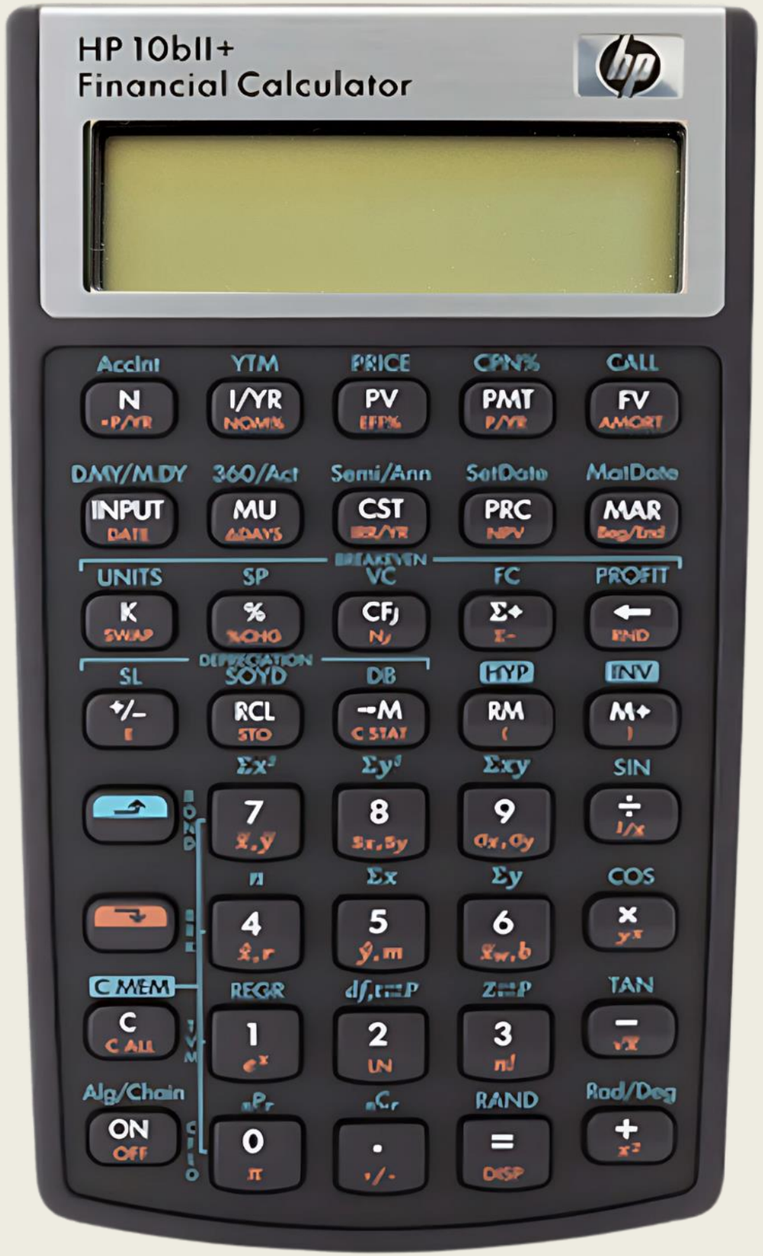
-100,000	PV		
211,266.34	FV		



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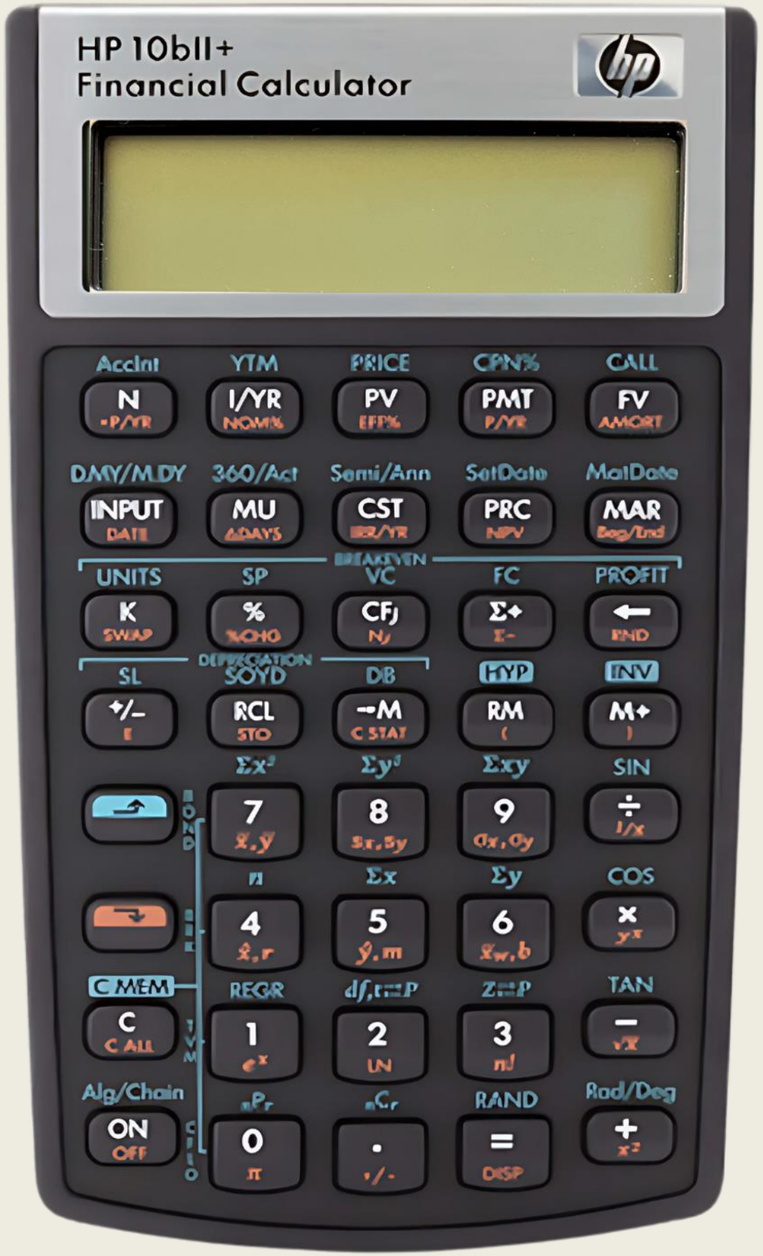
-100,000	PV	6	N
211,266.34	FV		

1



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-100,000	PV	6	N
211,266.34	FV	I/YR	159.31%

1

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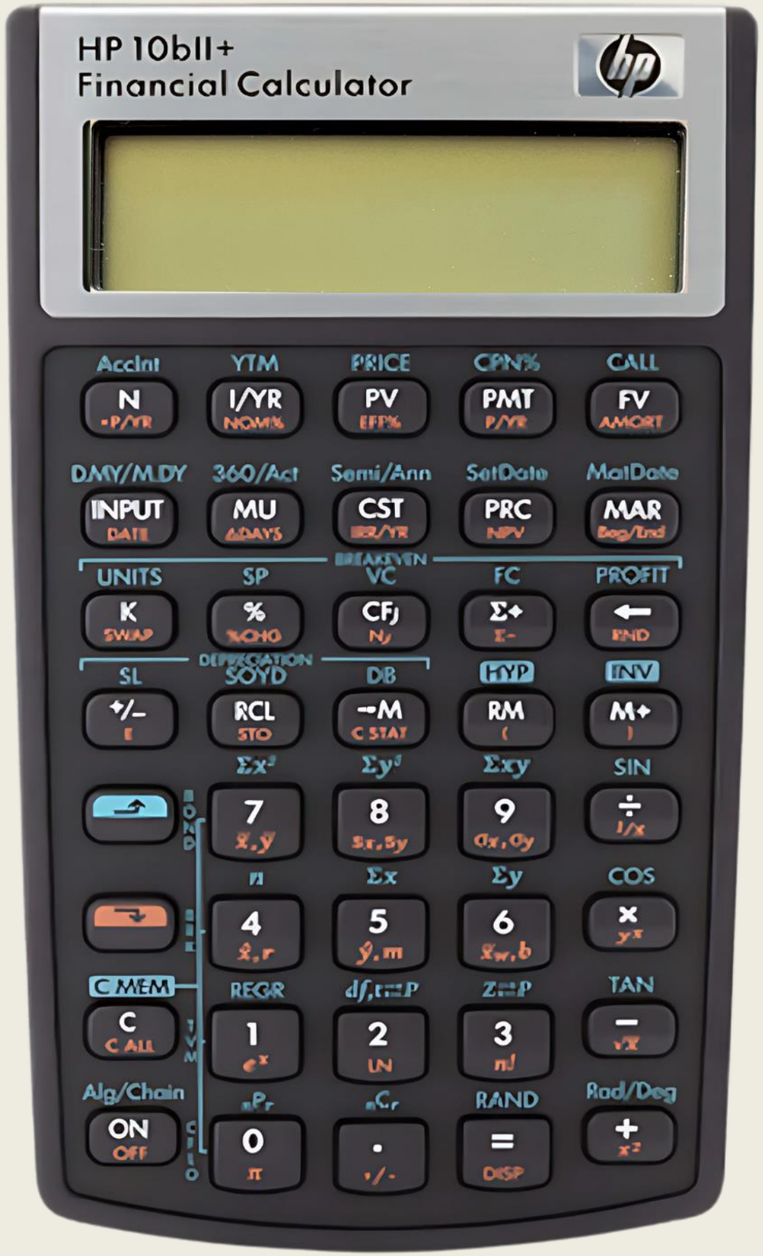
That’s All, Folks!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Problem / Answer Key

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A: 33,39,45,52,58,66,72,78,86,92,98