BEE/CSS 371 Business of Technology
Winter 2017
Lecture 12

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Today's agenda

1. Business plans
2. Time value of money

Remarks on your business plans

Your objective

Convince me that if you quit school tomorrow to do this, it would perform about like you predict.

I have browsed all your abstracts and they all look much better than your brainstorming lists. Thank you.

Time value of money

Business plans

What your plan should explain:

- Your value proposition
- How it's different if that's important
- How you'll create this value
- How you'll make money doing this
- Market analysis, competitors, customers
- Your competitive advantages
- What resources you need to get started
- Where you expect to get those resources
- A *pro forma* budget

If you’re wondering how to analyze costs or estimate revenues for a business, find someone who’s run one and ask them.

For example, if you’d like to know what it costs to set up a pastry kitchen, ask someone who’s done that.

Typical business plan for a *technology business* as might be submitted *to a venture capitalist*

Table of contents

Your plan does not need to follow this format.

Executive summary

One paragraph summary of why this is an interesting business proposition.

The most important part of a business plan because many potential investors will never read past this first paragraph.

Executive summary

Typical questions it might address, *as appropriate* to the business being proposed:

1. Why is this a problem and why are customers willing to pay?
2. How will the problem be solved?
3. Why is the venture uniquely positioned to do this?
4. What are the economics? Is this a growth opportunity?
5. Who's on the team and what partnerships are already in place?

Opportunity and market

1. What is the problem or need being solved?
2. Who is the customer?
3. How large is the total addressable market and how is it growing?
4. Is the current market context favorable?

Solution and concept

1. What is the product or service?
2. What does a day-in-the-life look like for a customer before and after?
3. Which customers have validated the product and are willing to pay for it?
4. What is unique and defendable?
5. What is the business and economic model? What are the margins?

Marketing and sales

1. What are the appropriate marketing mediums to reach customers?
2. What is the most appropriate sales channel?
3. Who are the decision makers and who are the influencers?
4. How long is the expected sales cycle?
5. Are there opportunities for partnerships to advertise and sell?

Product development

If it's product business, especially a technology product:

1. What is the current state of any product development?
2. What will be required to complete and ship products? How did you estimate the work?
3. What are timelines and milestones?
4. What are the key risks?
5. What is the value chain for production and product delivery?
6. Are there any patent, trade secret or other advantages?
7. Are there any regulatory hurdles?

Team

In a typical business plan being presented to investors who don't know you:

1. What are the backgrounds and roles of the founders and early employees?
2. What are the team's passions and skills and why are they committed?
3. What key hires are needed?
4. What head count is needed, by function?
5. Who are the advisors and board members?

Risks

1. What are the key product development risks and external dependencies?
2. What is being done to mitigate risk?
3. Who are your main competitors and how are you differentiated from them?
4. Can large players easily enter the market? Are there any substitutes?
5. What strategies can be used to mitigate competitive threats?

Financial plan

1. What funding is required to meet the market and product goals? What amount is needed now?
2. When will the venture generate positive cash flow?
3. What is the growth opportunity?
4. What are the initial and long-term margins?
5. What other companies exhibit similar margins and growth?
6. What are the key financial assumptions?

Appendix: Detailed financial plan

1. Five-year detailed cash flow, income and balance sheets.
2. Financial assumptions, e.g., customer penetration rates, pricing.
3. Are purchasing decisions cyclical?
4. What are the largest costs, e.g., engineering, regulatory trials, manufacturing or marketing?
5. How will the product and sales costs change as volume grows?
6. Has customer support and maintenance been factored in?

A dollar today is worth more than a dollar promised tomorrow.

We *discount* the future.

Terminology

Interest is money paid for the use of borrowed money.

Principal is the amount borrowed.

Interest rate is the interest payable at the *end* of a period divided by the money owed at the *beginning* of a period. Usually expressed as a %.

Compounding

Simple interest is calculated by multiplying the interest rate x principal x number of periods.

Compound interest is interest added to the principal at the end of each period so that it also earns interest.

Example

You borrow $1000 at 6%/year for two years.
How much do you owe at the end?

Simple interest:

$1000 * (1 + .06 * 2) = $1120

Compound interest:

1st year: $1000 * (1 + .06) = $1060

2nd year: $1060 * (1 + .06) = $1123 ← **An extra $3**

$1 invested at 7% doubles every 10 years.

The power of compounding

Manhattan was supposedly purchased by European explorers for $24 in 1626.

If that $24 had been continuously invested at 7%, it would now be worth $\$6.04 \times 10^{12} =$ $6.04 trillion.

reality check

All loans you will ever encounter will always use compound interest.

They will state it as an APR.

APR

Annual Percentage Rate. A term introduced by the *Truth in Lending Act* of 1968 which standardized disclosure of lending costs.

This is the interest rate for a loan expressed as an annual rate. This is the ***nominal*** rate.

*But the compounding period is usually **monthly** meaning the **effective** interest rate is higher.*

converting nominal to effective

$$Effective\ APR = (1 + Rate\ per\ period)^{Periods\ per\ year} - 1$$

$$Effective\ APR = (1 + Rate\ per\ period)^{Periods\ per\ year} - 1$$

Examples

$$Nominal\ APR = 12\% = 0.12$$

$$Rate\ per\ period = 1\% = 0.01$$

$$Effective\ APR = (1 + 0.01)^{12} - 1 = 0.1268 = 12.68\%$$

$$Nominal\ APR = 18\% = 0.18$$

$$Rate\ per\ period = 1.5\% = 0.015$$

$$Effective\ APR = (1 + 0.015)^{12} - 1 = 0.1956 = 19.56\%$$

Concept of equivalence

Payments that differ in magnitude but are made *at different dates* may be financially ***equivalent*** when discounted at an interest rate.

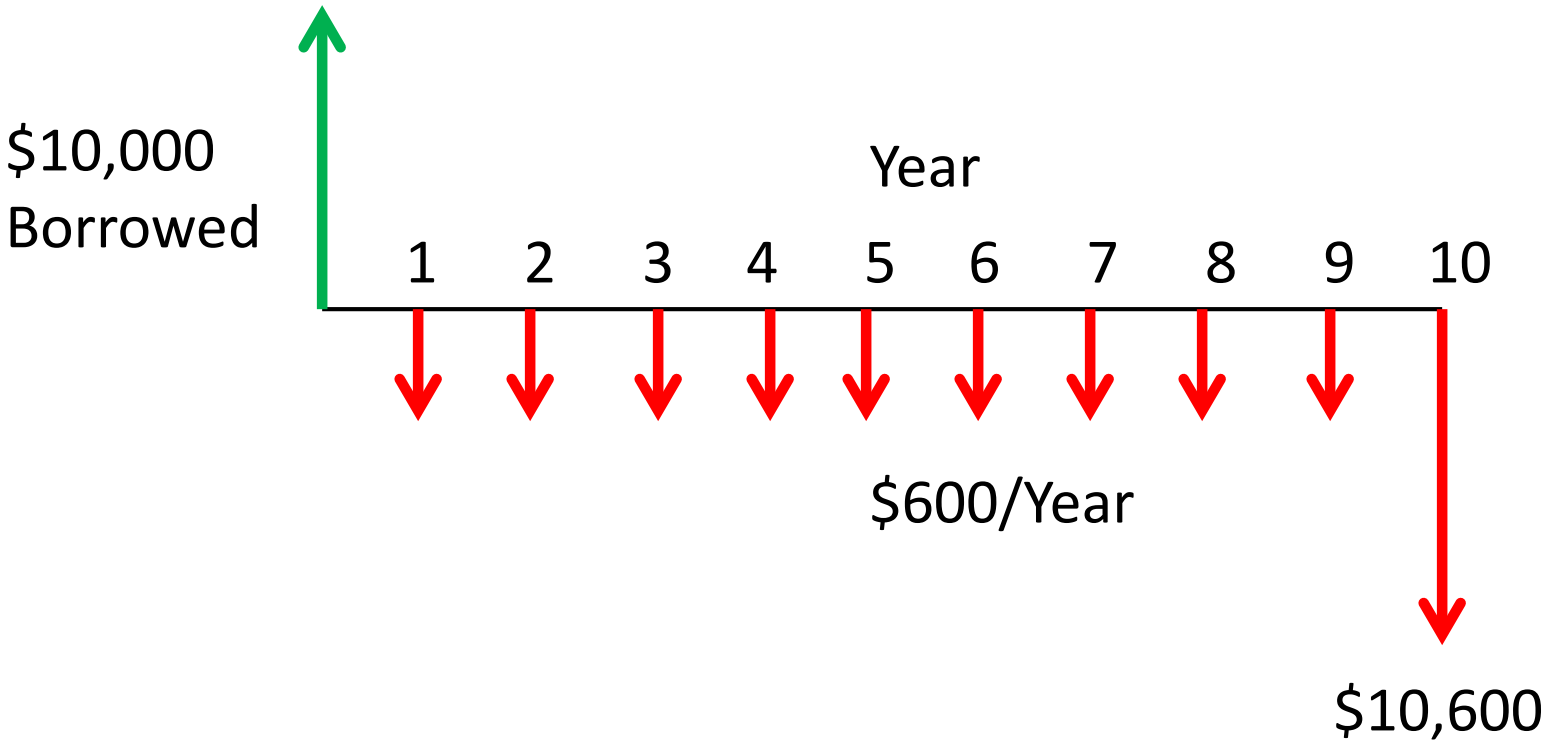
Example

You borrow $10,000 for 10 years at 6% compounded annually.

Any number of repayment schedules might be *equivalent*.

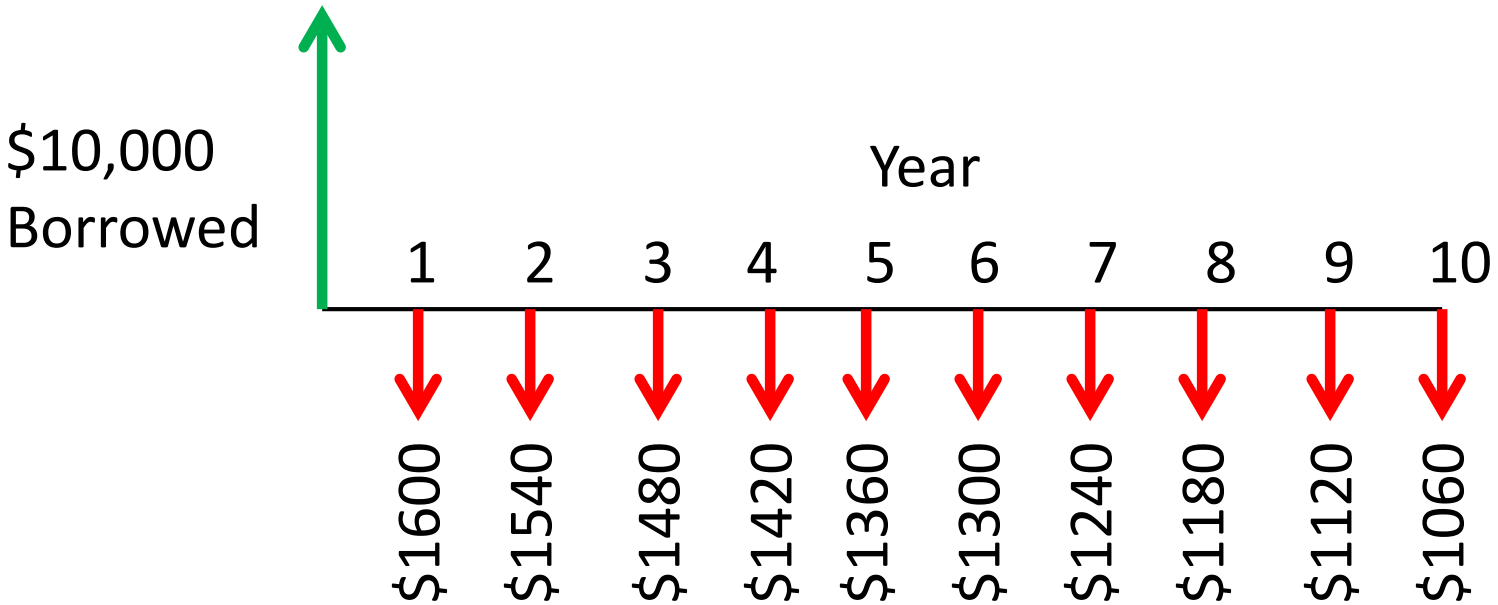
To examine them, we use ***cash flow diagrams***.

Interest only + balloon at the end

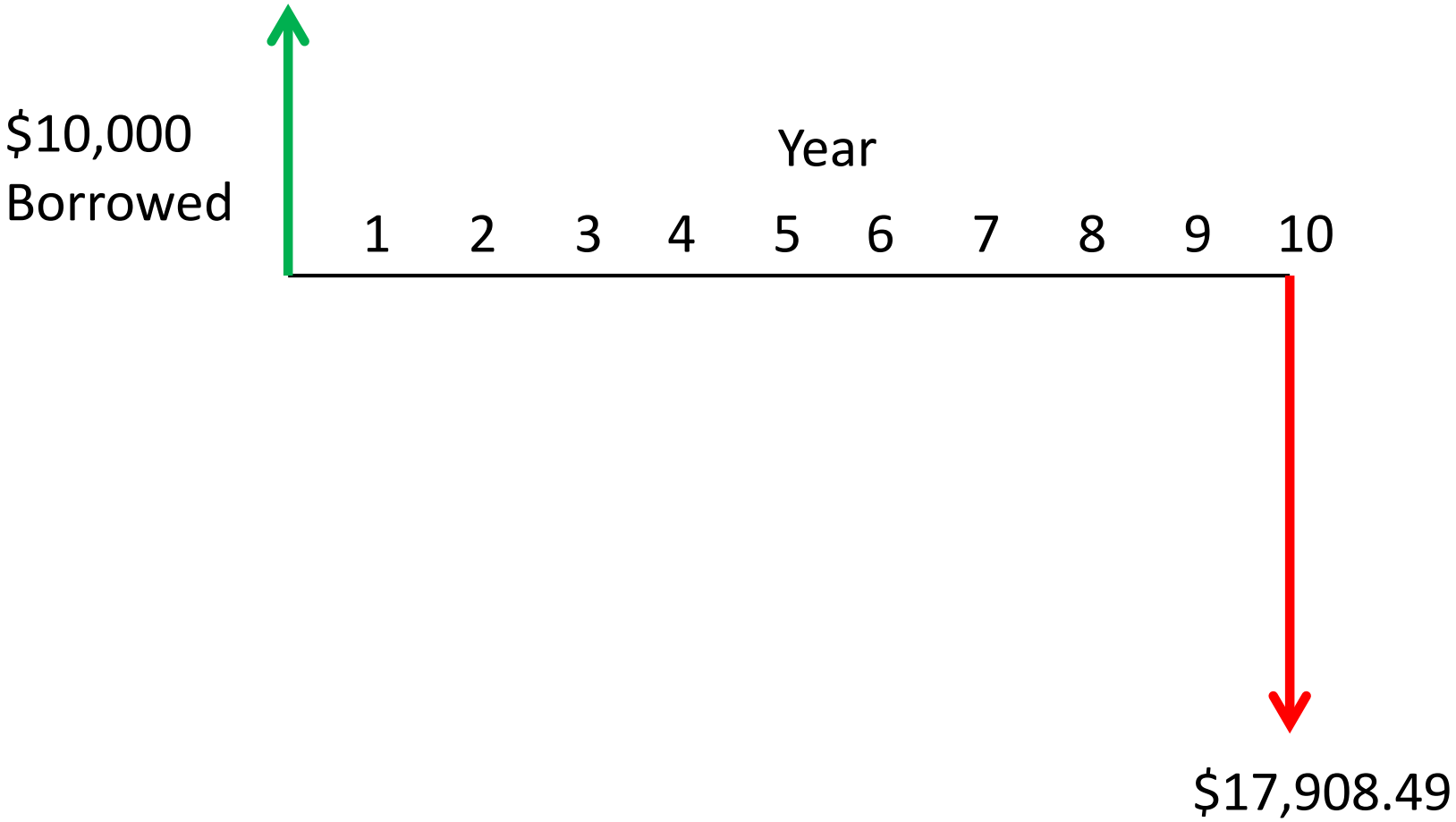


Source: Grant & Ireson, *Principles of Engineering Economy, 5th Ed.*, pg. 28.

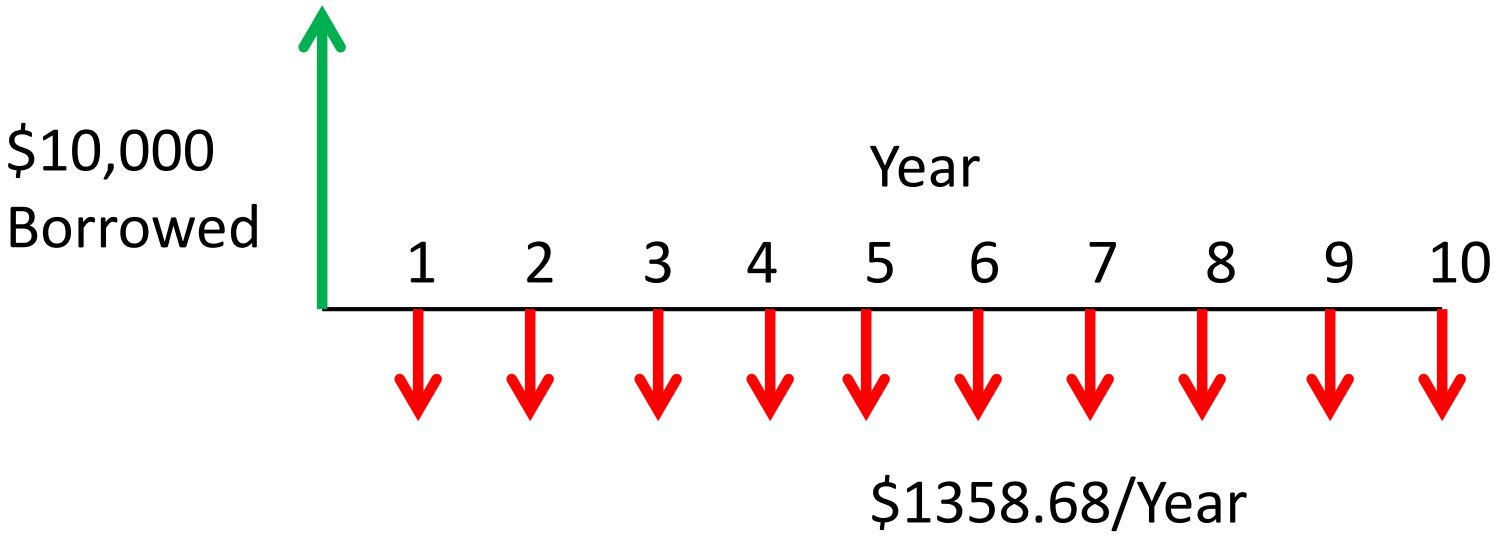
Fixed principal + interest



Single payment



An annuity



A series of equal payments at the end of each period is called an ***annuity***.

Terms

Present value is the value today of any series of discounted payments.

Future value is the value at some future date of any series of discounted payments.

P = Present value

F = Future value

A = Annuity amount at each period

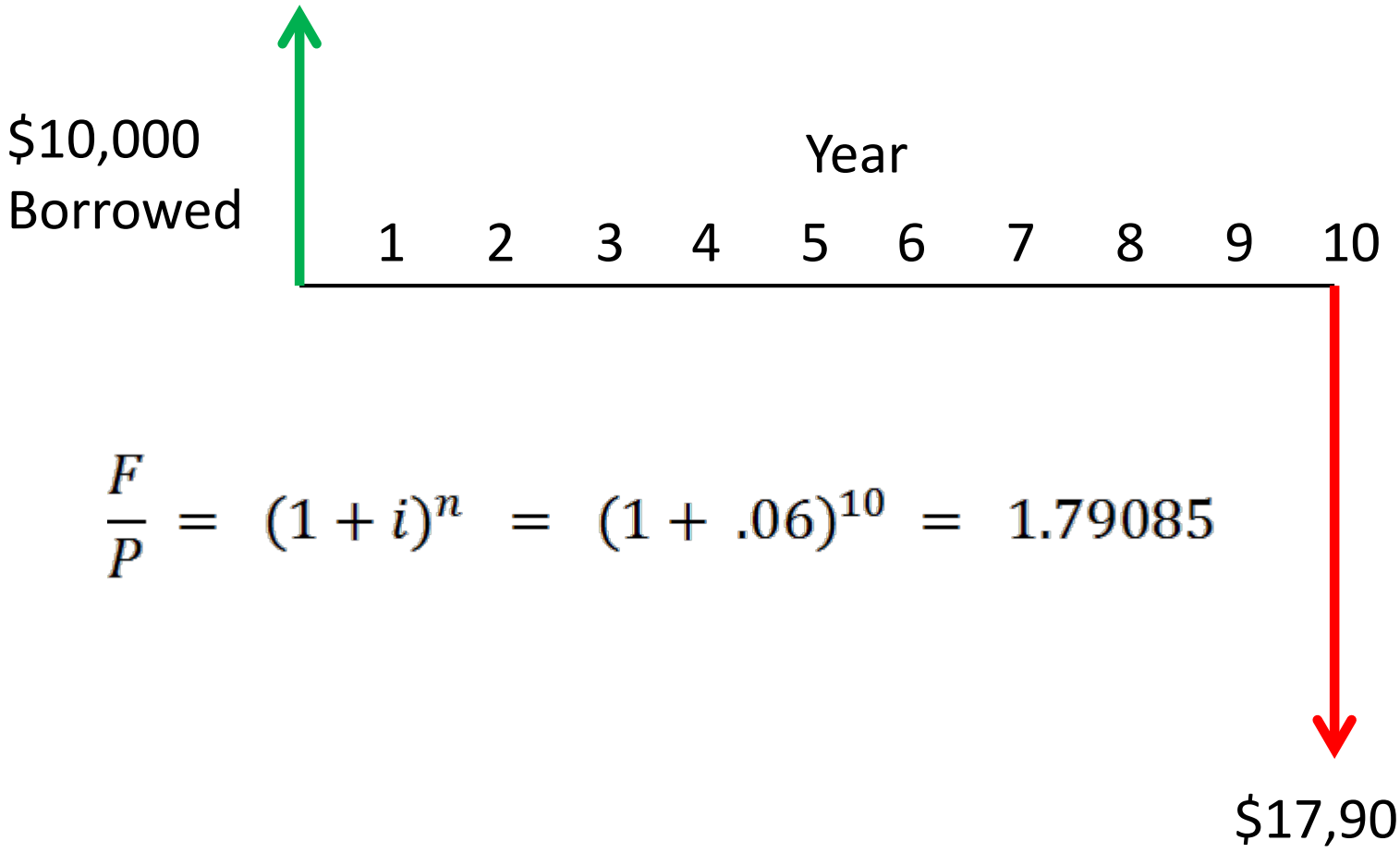
n = Number of periods

i = Interest rate per period

Present and future

$$\frac{F}{P} = (1+i)^n$$

$$\frac{P}{F} = \frac{1}{(1+i)^n}$$

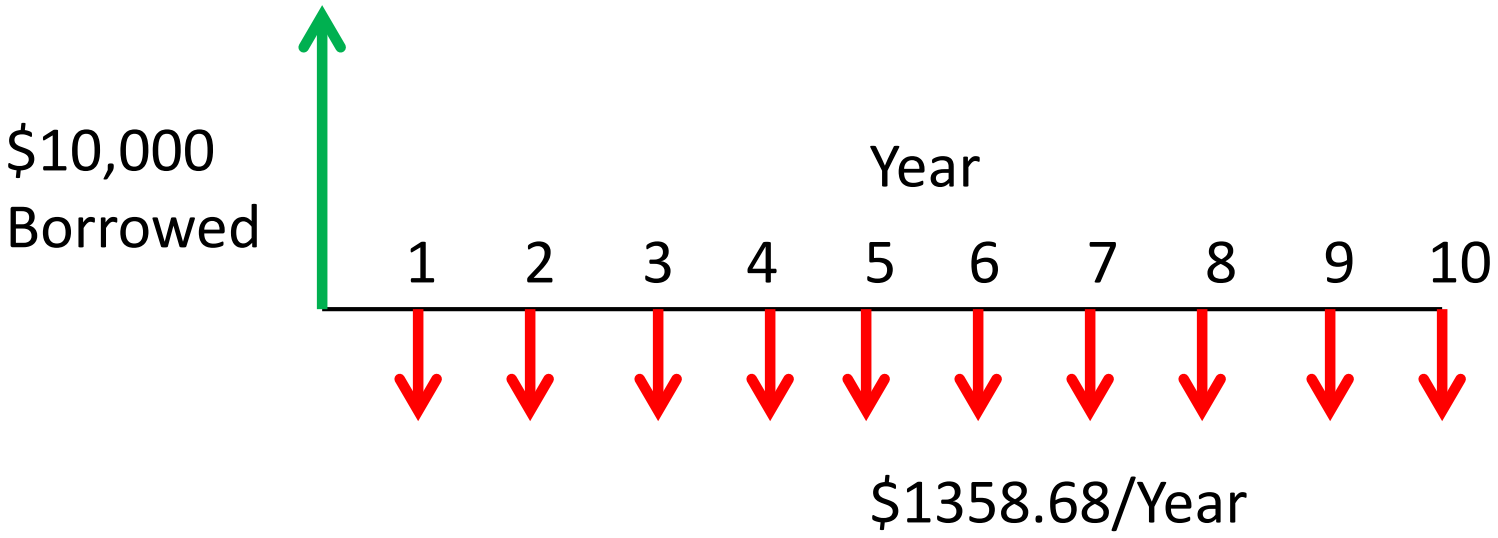


$$\frac{F}{P} = (1+i)^n = (1+.06)^{10} = 1.79085$$

Annuities

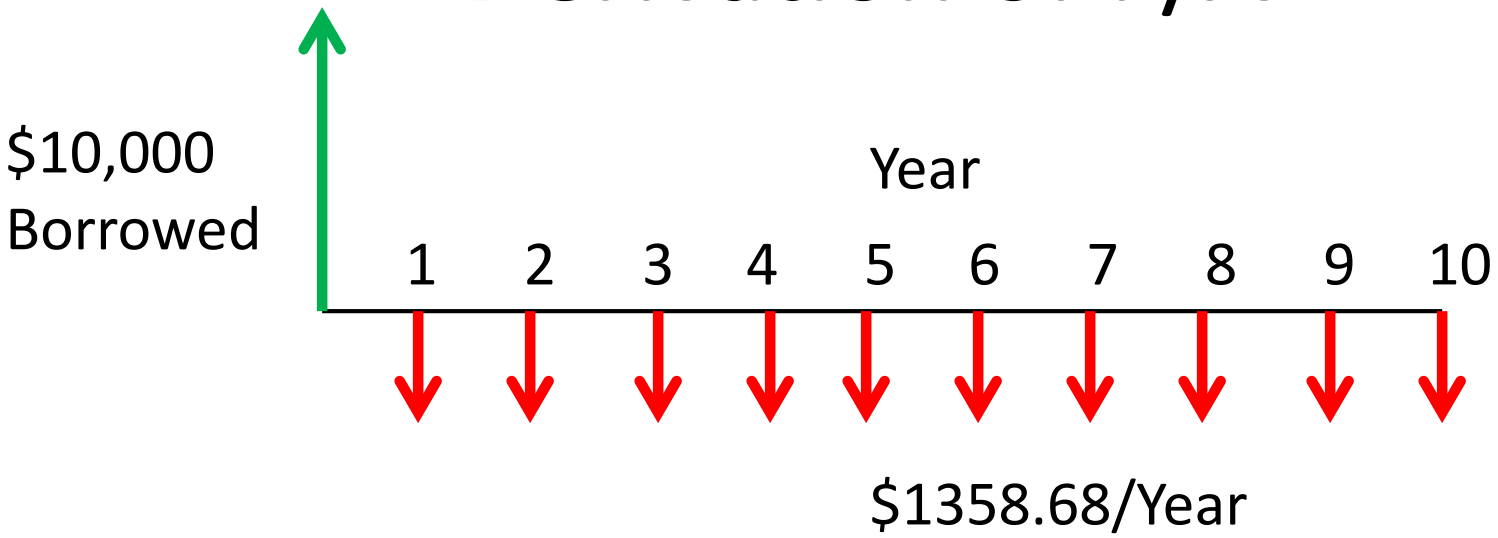
$$\frac{P}{A} = \frac{(1+i)^n - 1}{i(1+i)^n} \qquad \frac{A}{P} = \frac{i(1+i)^n}{(1+i)^n - 1}$$

$$\frac{F}{A} = \frac{(1+i)^n - 1}{i} \qquad \frac{A}{F} = \frac{i}{(1+i)^n - 1}$$



$$\frac{A}{P} = \frac{i(1+i)^n}{(1+i)^n - 1} = \frac{(.06)(1.06)^{10}}{(1.06)^{10} - 1} = 0.13587$$

Derivation of P/A



The present value of an annuity is the sum of the present values of the individual payments.

$$\frac{P}{A} = \sum_{j=1}^{n} \frac{1}{(1+i)^j}$$

This is a *power series*.

Power series

$$s = \sum_{j=1}^{n} \frac{1}{r^j} = \frac{1}{r} + \frac{1}{r^2} + \frac{1}{r^3} + \ \ldots + \frac{1}{r^n}$$

$$rs = 1 + \frac{1}{r} + \frac{1}{r^2} + \frac{1}{r^3} + \ \ldots + \frac{1}{r^{n-1}}$$

$$rs - s = s(r-1) = 1 - \frac{1}{r^n}$$

$$s = \frac{1}{r-1} - \frac{1}{r^n(r-1)} = \frac{r^n - 1}{r^n(r-1)}$$

The present value of an annuity is the sum of the present values of the individual payments.

$$\frac{P}{A} = \sum_{j=1}^{n} \frac{1}{(1+i)^j}$$

Use the *power series* rule.

$$s = \sum_{j=1}^{n} \frac{1}{r^j} = \frac{r^n - 1}{r^n(r-1)}$$

$$s = \frac{P}{A} \qquad r = 1 + i$$

Therefore,

$$\frac{P}{A} = \frac{(1+i)^n - 1}{(1+i)^n(1+i-1)} = \frac{(1+i)^n - 1}{i(1+i)^n}$$

Calculating i and n

Given a conversion factor,

- Easy to calculate n if you know i.
- Easy to calculate i if you know n and F/P or P/F but not so easy for annuities.

Calculating i

Easy enough from F/P:

$$\frac{F}{P} = (1+i)^n$$

$$\left(\frac{F}{P}\right)^{\frac{1}{n}} = 1+i$$

$$i = \left(\frac{F}{P}\right)^{\frac{1}{n}} - 1$$

And because P/F is just the inverse of F/P:

$$i = \left(\frac{P}{F}\right)^{-\frac{1}{n}} - 1$$

Calculating n

Easy enough from F/P:

$$\frac{F}{P} = (1+i)^n$$

$$\log\left(\frac{F}{P}\right) = n\log(1+i)$$

$$n = \frac{\log\left(\frac{F}{P}\right)}{\log(1+i)}$$

And because P/F is just the inverse of F/P:

$$n = \frac{-\log\left(\frac{F}{P}\right)}{\log(1+i)}$$

Calculating n

And from F/A:

$$\frac{F}{A} = \frac{(1+i)^n - 1}{i}$$

$$i\left(\frac{F}{A}\right) = (1+i)^n - 1$$

$$i\left(\frac{F}{A}\right) + 1 = (1+i)^n$$

$$\log\left(i\left(\frac{F}{A}\right) + 1\right) = n\log(1+i)$$

$$n = \frac{\log\left(i\left(\frac{F}{A}\right) + 1\right)}{\log(1+i)}$$

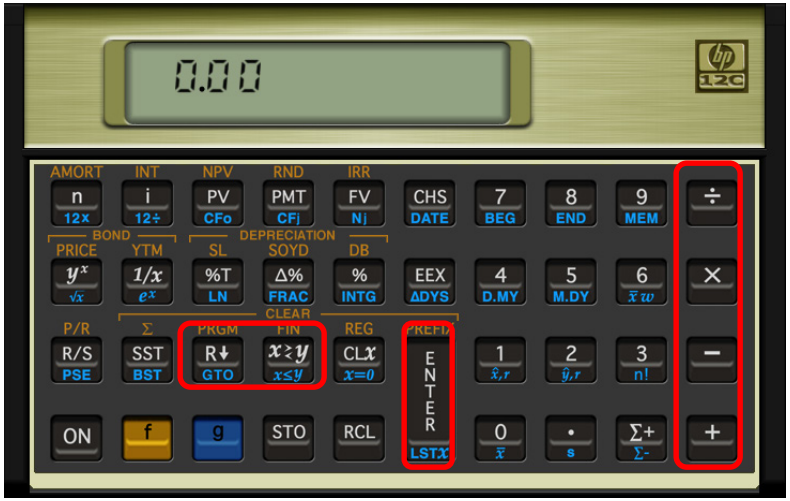
No simple algebraic way to solve for i for an annuity, given F/A and n.

$$\frac{F}{A} = \frac{(1+i)^n - 1}{i}$$

Usual approach is to solve numerically using an iterative approach of making closer and closer estimates.

the workhorse HP-12c

Reverse Polish

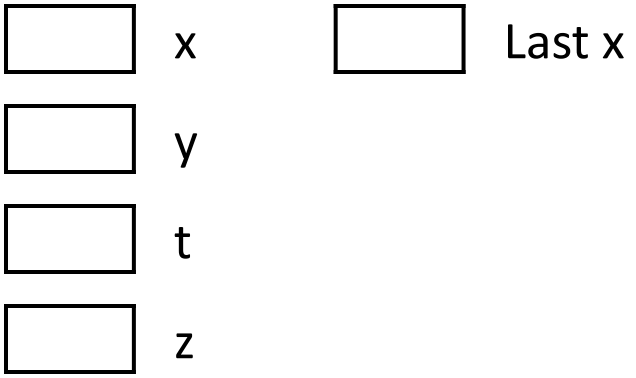


You enter the operands into the stack, then operate on the top elements.

Instead of 5 + 2 =

you type 5 ENTER 2 +

Stack registers



x is always displayed.
Whatever you type is in the x register.
Last value of x always kept in Last x.

Operations:

Push	ENTER
Rotate	R↓
Exchange	x↔y
Arithmetic	÷ − × +

Shift keys

f + 0 thru 9 sets number of decimal places.

f + . sets scientific notation.

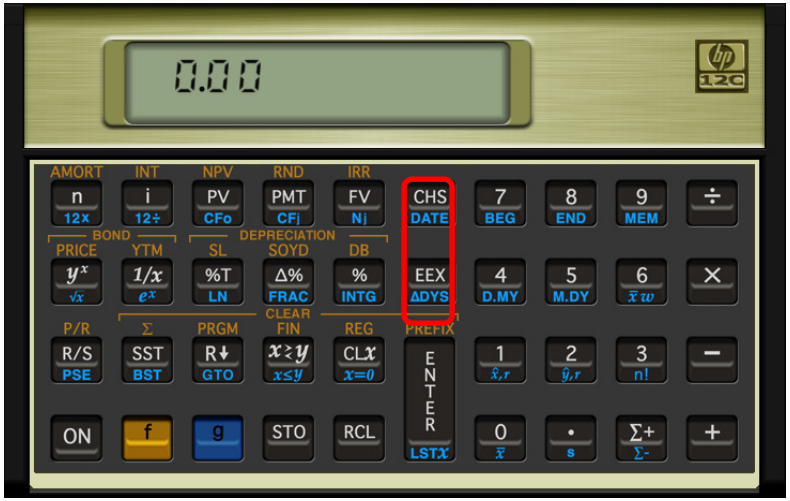
(Unfortunately, they don’t light up on the real thing.)

Clearing registers

f + FIN clears the financial registers.

f + REG clears the stack, Last x and the financial registers.

Entering numbers

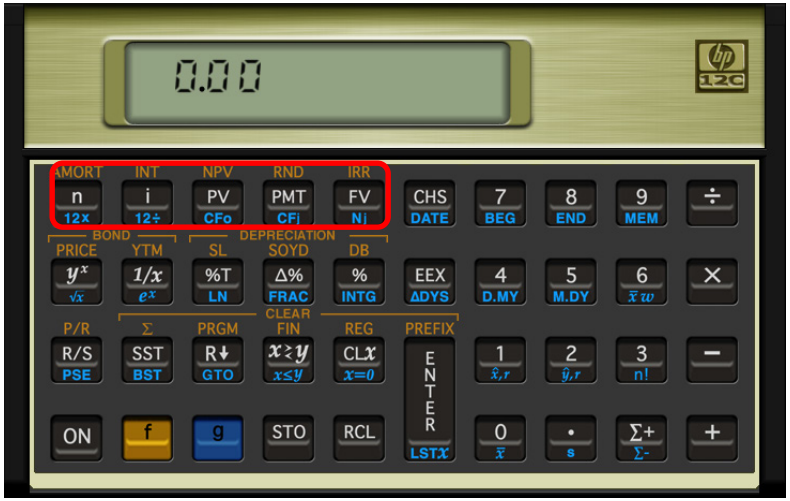


EEX allows you to type scientific notation.

CHS changes the sign of an exponent or of a number *already* typed.

To get this	*Type this*
-5	5 CHS
2E6	2 EEX 6
-7E-3	7 CHS EEX 3 CHS

Financial registers



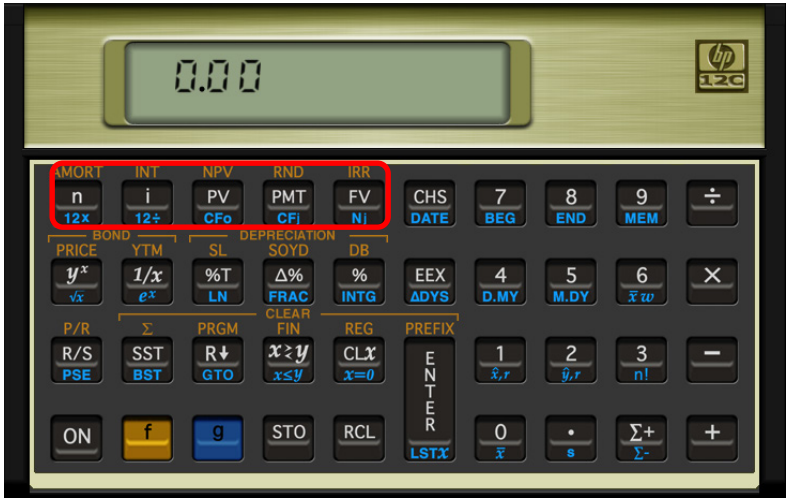
Financial registers

	n		N0		CF0 (R0)
	i		N1		CF1 (R1)
	PV		N2		CF2 (R2)
	PMT		N3		CF3 (R3)
	FV		N4		CF4 (R4)
			⋮		⋮
			N20		CF20 (R.9)

n = number of periods
i = interest rate as a %
PV = present value
PMT = annuity amount
FV = future value

N1 thru N20 and CF0 thru CF20 are for irregular cash flows, where CF*i* is repeated N*i* times.

Financial registers



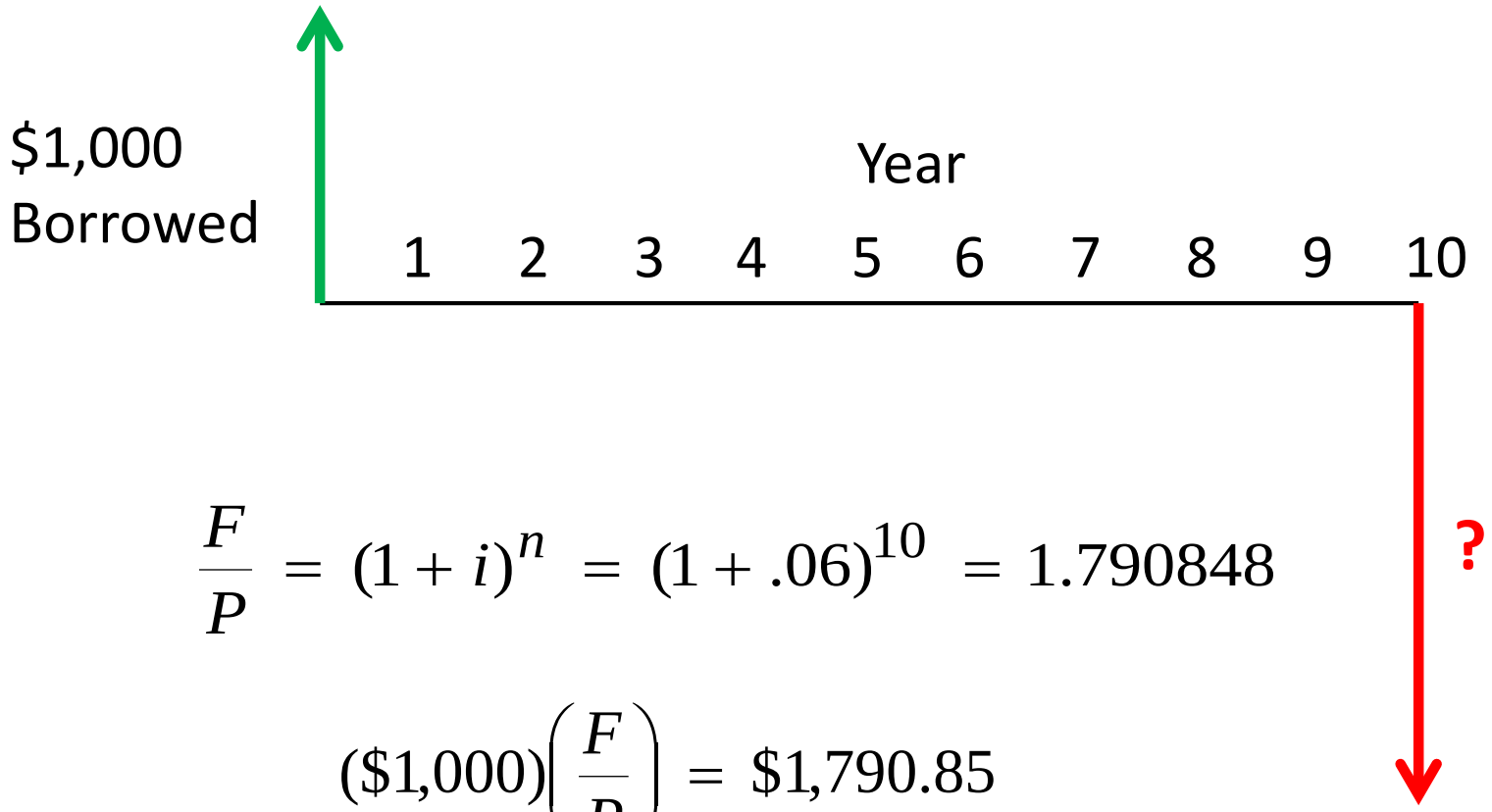
Financial registers

	n		N0		CF0 (R0)
	i		N1		CF1 (R1)
	PV		N2		CF2 (R2)
	PMT		N3		CF3 (R3)
	FV		N4		CF4 (R4)
			⋮		⋮
			N20		CF20 (R.9)

Typing a number and pressing n, i, PV, PMT or FV *stores* that value.

Pressing n, i, PV, PMT or FV alone *calculates* the value based on what's in the other registers.

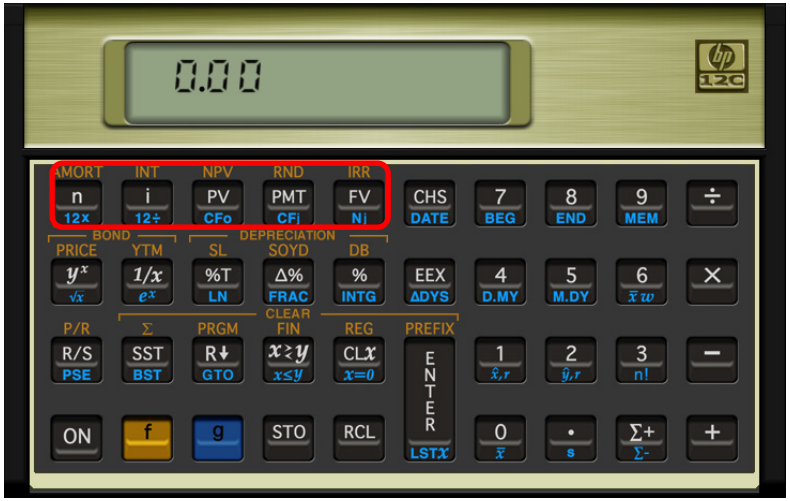
Example: $1000 borrowed for 10 years at 6% per year, compounded annually.



$$\frac{F}{P} = (1+i)^n = (1+.06)^{10} = 1.790848$$

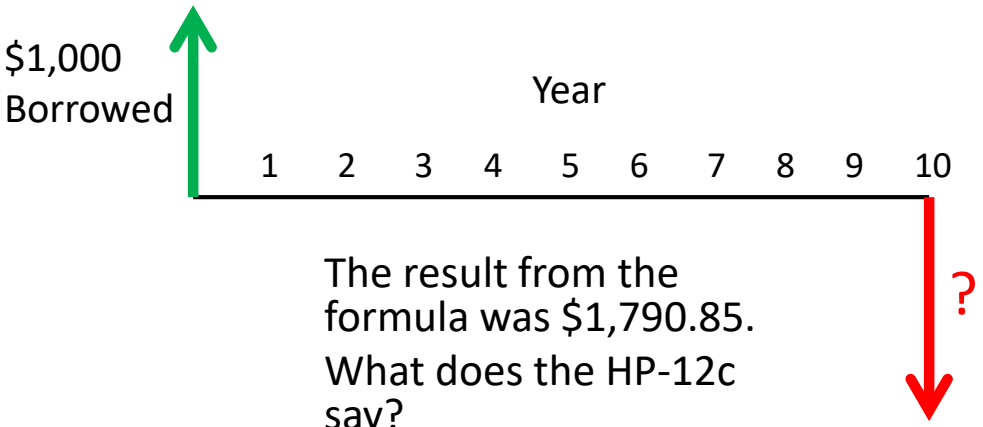
$$(\$1{,}000)\left(\frac{F}{P}\right) = \$1{,}790.85$$

Example: $1000 borrowed for 10 years at 6% per year.



Financial registers

10	n		N0		CF0 (R0)
6	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
0	PMT		N3		CF3 (R3)
?	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



The result from the formula was $1,790.85.

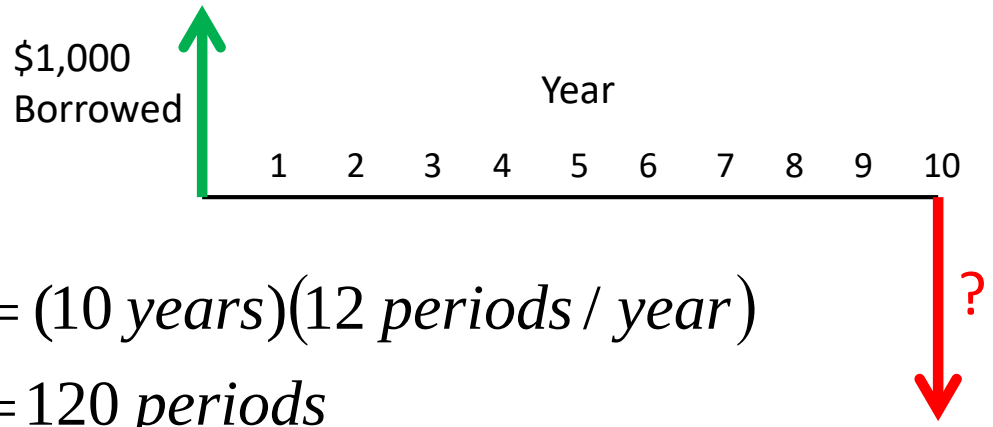
What does the HP-12c say?

Procedure:

1. Clear the registers.
2. Enter n, i and PV.
3. Press FV.

But interest rates on loans in the US are stated as APRs.

Example: $1000 borrowed for 10 years at 6% ***APR***



$$n = (10\ years)(12\ periods/year)$$
$$= 120\ periods$$

$$i = \frac{.06}{12} = .005$$

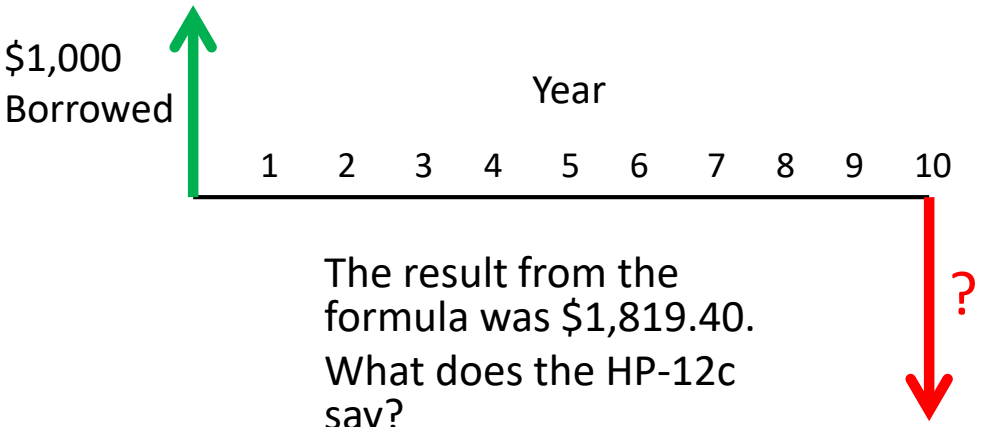
$$\frac{F}{P} = (1+i)^n = (1+.005)^{120} = 1.819397$$

$$(\$1{,}000)\left(\frac{F}{P}\right) = \$1{,}819.40$$

Example: $1000 borrowed for 10 years at 6% APR.

Financial registers

120	n		N0		CF0 (R0)
.5	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
0	PMT		N3		CF3 (R3)
?	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



The result from the formula was $1,819.40.

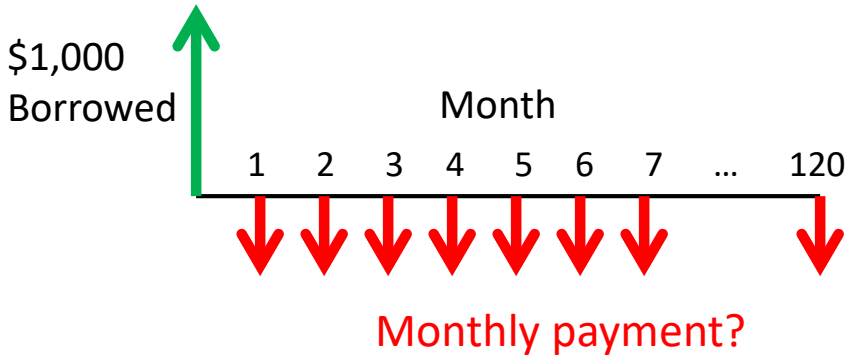
What does the HP-12c say?

Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press FV.

And most loans in the US require monthly payments.

Example: $1000 borrowed for 10 years at 6% APR with monthly payments



$$n = 120 \qquad i = .005$$

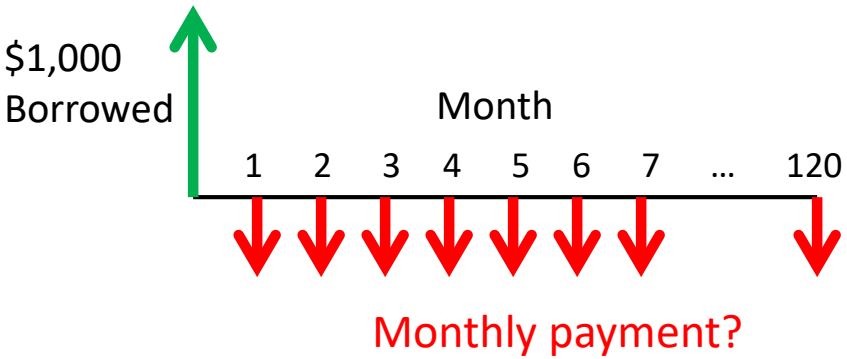
$$\frac{A}{P} = \frac{i(1+i)^n}{(1+i)^n - 1} = \frac{(.005)(1+.005)^{120}}{(1+.005)^{120} - 1} = .011102$$

$$(\$1000)\left(\frac{A}{P}\right) = \$11.10$$

Example: $1000 borrowed for 10 years at 6% APR with monthly payments.

Financial registers

120	n		N0		CF0 (R0)
.5	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
?	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



The result from the formula was $11.10.

What does the HP-12c say?

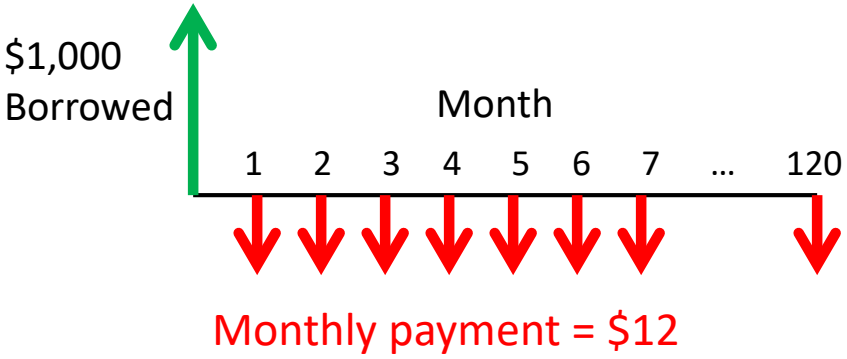
Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press PMT.

Example: $1000 borrowed for 10 years with monthly payments of $12. What's the APR?

Financial registers

120	n		N0		CF0 (R0)
?	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
-12	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



Procedure:

1. Clear the registers.
2. Enter n using the 12x function.
3. Enter PV and PMT
4. Press i.
5. Multiply times 12.

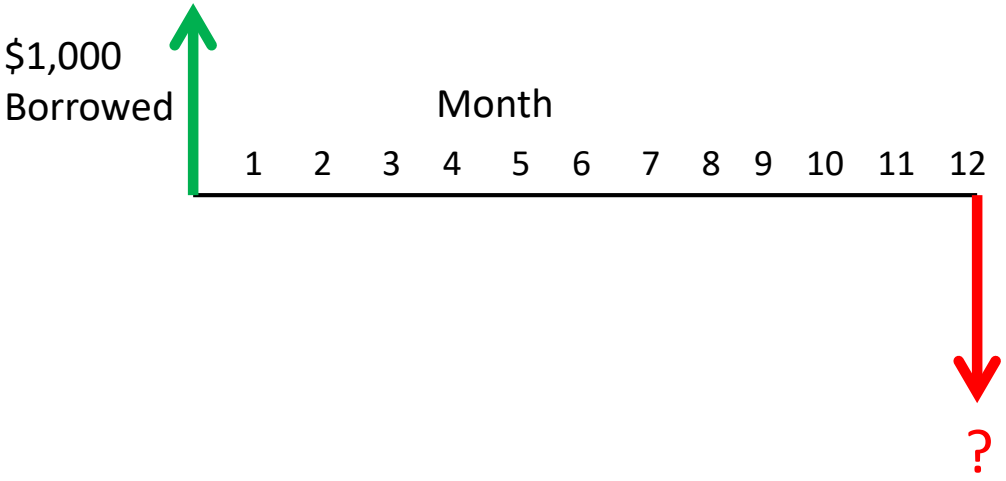
Exercise

You owe $1000 at 29.99% APR. If you make no payments, what will you owe a year from now?

$1000 borrowed for 1 year at 29.99% APR

Financial registers

12	n		N0		CF0 (R0)
2.4992	i		N1		CF1 (R1)
1000	PV		N2		CF2 (R2)
0	PMT		N3		CF3 (R3)
?	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press FV.

Exercise

Ten years ago, Acme Corporation financed a new warehouse in part with a mortgage for $500K for 20 years at 5%.

What's their monthly mortgage payment?

Exercise

Ten years ago, Acme Corporation financed a new warehouse in part with a mortgage for $500K for 20 years at 5%.

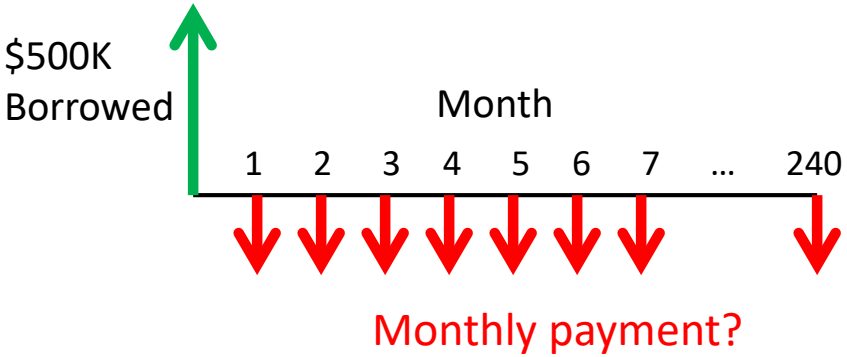
What's their monthly mortgage payment?

Hint: Interest rates on loans in the US are stated as APRs.

$500K borrowed for 20 years at 5% APR with monthly payments.

Financial registers

240	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
500000	PV		N2		CF2 (R2)
?	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



Should be $3,299.78/month.

Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press PMT.

Exercise

Acme has just made their 120^{th} payment on the mortgage. What is the remaining principal on the loan?

Exercise

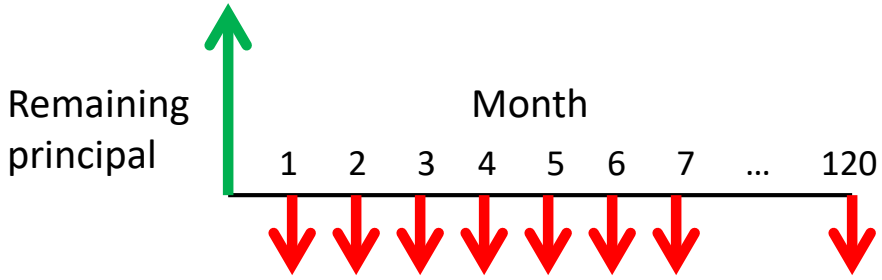
Acme has just made their 120^{th} payment on the mortgage. What is the remaining principal on the loan?

Hint: Acme has 10 years = 120 payments left and the interest rate is unchanged.

Principal remaining after 120th payment

Financial registers

120	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
?	PV		N2		CF2 (R2)
-3299.78	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



Monthly payment = $3,299.78

Remaining principal should be $311,107.59.

Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PMT.
4. Press PV.

Exercise

Ten years ago, Acme Corporation financed a new warehouse in part with a mortgage for $500K for 20 years at 5%.

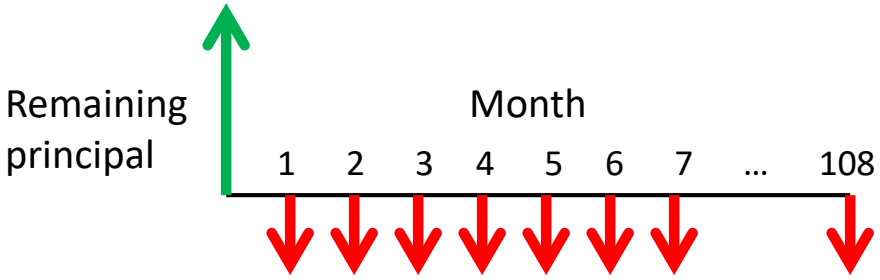
A year from now, Acme will have just made their 132^{nd} payment. Between now and then, how much interest will Acme have paid?

After the 132^{nd} payment, Acme will have $240 - 132 = 108$ payments left.

Principal remaining after 132nd payment

Financial registers

108	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
?	PV		N2		CF2 (R2)
-3299.78	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



Monthly payment = $3,299.78

Remaining principal should be $286,506.94.

Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PMT.
4. Press PV.

After 132nd payment

Remaining principal = $286,506.94

Amount of principal paid off in the year =
Remaining principal after 120th payment –
Remaining principal after 132nd payment
= 311,107.59 – 286,506.94 = $24,600.65

Total of payments = 12 * 3299.78 = $39,597.36

Interest paid = Total payments – Principal paid off
= 39,597.36 – 24,600.65 = $14,996.69

Amortization

Amortize

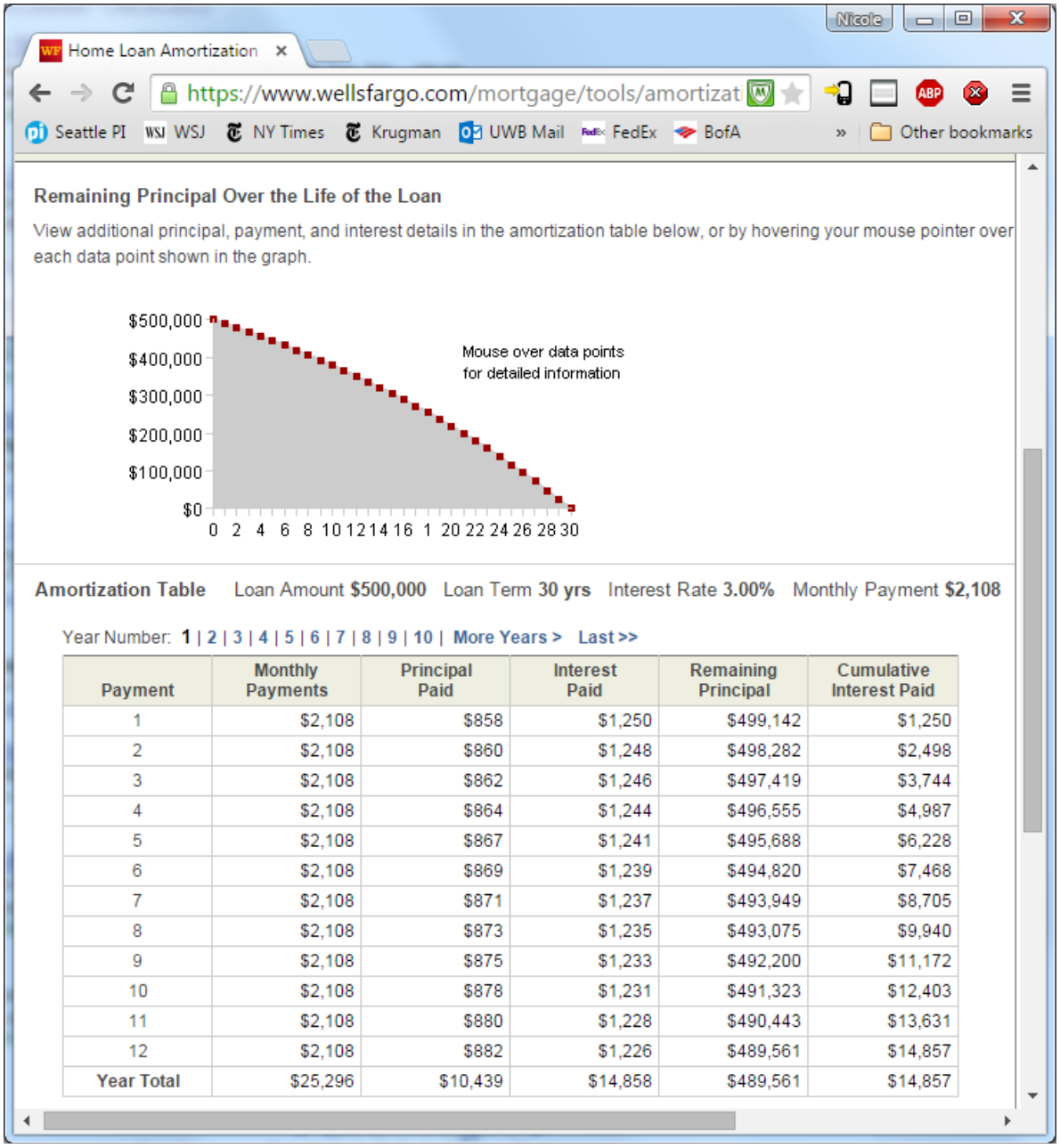
A term used in lending that means each payment will allocated to separate principal and interest amounts.

The allocation is calculated to the *nearest unit, usually a penny*.

When the remaining principal goes to zero, the loan is *fully amortized*.

Most commonly used in mortgage loans.

Typically presented as a table called an *amortization schedule*.



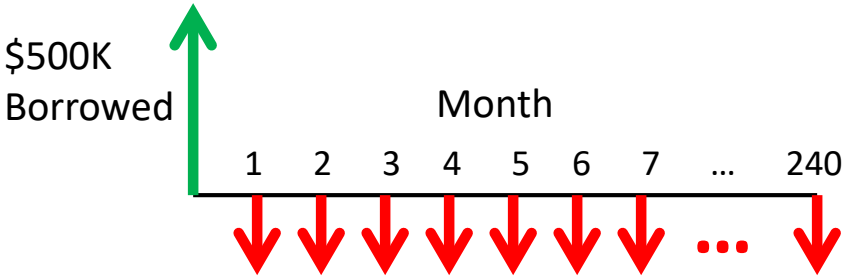
Payment	Monthly Payments	Principal Paid	Interest Paid	Remaining Principal	Cumulative Interest Paid
1	$2,108	$858	$1,250	$499,142	$1,250
2	$2,108	$860	$1,248	$498,282	$2,498
3	$2,108	$862	$1,246	$497,419	$3,744
4	$2,108	$864	$1,244	$496,555	$4,987
5	$2,108	$867	$1,241	$495,688	$6,228
6	$2,108	$869	$1,239	$494,820	$7,468
7	$2,108	$871	$1,237	$493,949	$8,705
8	$2,108	$873	$1,235	$493,075	$9,940
9	$2,108	$875	$1,233	$492,200	$11,172
10	$2,108	$878	$1,231	$491,323	$12,403
11	$2,108	$880	$1,228	$490,443	$13,631
12	$2,108	$882	$1,226	$489,561	$14,857
Year Total	$25,296	$10,439	$14,858	$489,561	$14,857

https://www.wellsfargo.com/mortgage/tools/amortization/

Amortization function

Financial registers

0	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
500000	PV		N2		CF2 (R2)
-3299.78	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



Monthly payment = $3,299.78

How much interest and principal has been paid by the 120th payment?

Procedure:

1. Clear the registers.
2. Enter PV, PMT, n and i.
3. Enter number of payments to amortize.
4. Press AMORT.
5. x contains interest paid
6. y contains principal paid
7. RCL PV to get principal remaining
8. RCL n to get number of payments amortized so far.

Principal remaining after 120th payment

Slight difference between:

1. PV of remaining payments = $311,107.59
2. Amortized remaining principal = $311,107.41

Difference is because under amortization, amounts allocated to principal versus interest are calculated only to the *nearest penny* (or whatever digits of precision you've set via f-key.)

(A bank will care about this difference, I don't.)

Creating an amortization schedule

Because:

1. Principal paid is subtracted from PV.
2. Number of payments amortized added to n.

The amortization function can be used to be used to amortize successive payments.

1. PV always contains remaining principal.
2. n always contains number of payment amortized so far.
3. Works with loans that never fully amortize, e.g., because of a balloon payment at the end.

Exercise

You've just bought a home with $400K, 30-year mortgage at 3% APR.

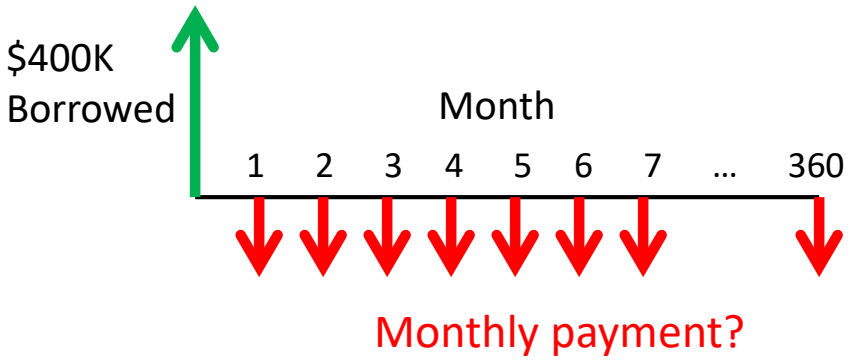
1. What does the cash flow diagram look like?
2. What is your monthly payment?
3. Fill in this table for the first 3 years:

Year	Beginning principal	Principal paid	Interest paid	Ending principal
1	400,000			
2				
3				
Total paid				

$400K borrowed for 30 years at 3% APR with monthly payments.

Financial registers

360	n		N0		CF0 (R0)
.25	i		N1		CF1 (R1)
400000	PV		N2		CF2 (R2)
?	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



Should be $1,686.42/month.

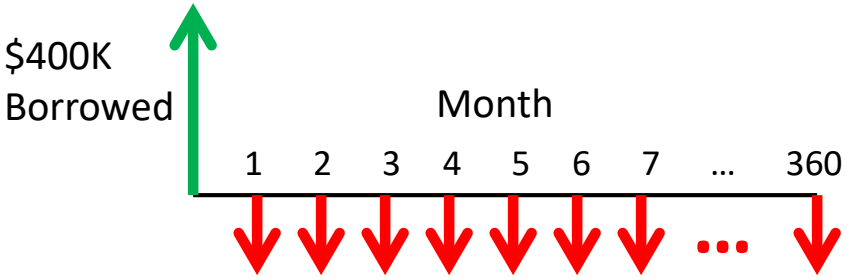
Procedure:

1. Clear the registers.
2. Enter n and i using the 12x and 12÷ functions.
3. Enter PV.
4. Press PMT.

Amortize first year

Financial registers

0	n		N0		CF0 (R0)
.25	i		N1		CF1 (R1)
400000	PV		N2		CF2 (R2)
-1686.42	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



Monthly payment = $1,686.42

Interest paid = $11,885.80
Principal paid = $8,351.24
Principal remaining = $391,648.76

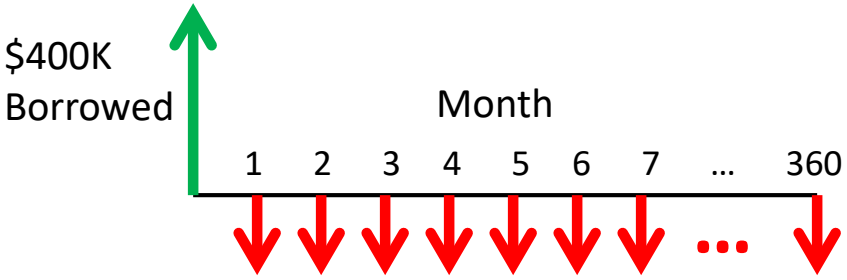
Procedure:

1. Set n = 0.
2. Enter 12 payments to amortize.
3. Press AMORT.
4. x contains interest paid
5. y contains principal paid
6. RCL PV to get principal remaining

Amortize second year

Financial registers

12	n		N0		CF0 (R0)
.25	i		N1		CF1 (R1)
391648.76	PV		N2		CF2 (R2)
-1686.42	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
			N20		CF20 (R.9)



Monthly payment = $1,686.42

Interest paid = $11,631.78
Principal paid = $8,605.26
Principal remaining = $383,043.50

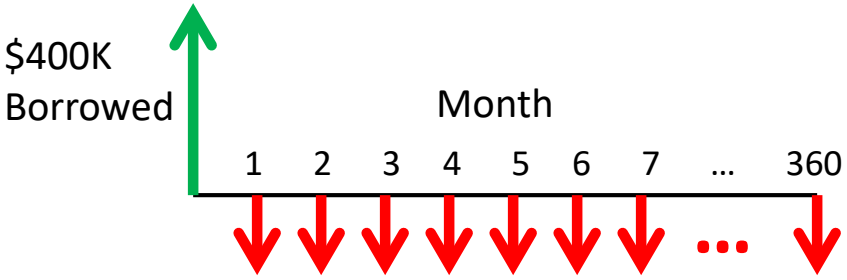
Procedure:

1. Enter 12 payments to amortize.
2. Press AMORT.
3. x contains interest paid
4. y contains principal paid
5. RCL PV to get principal remaining

Amortize third year

Financial registers

24	n		N0		CF0 (R0)
.41667	i		N1		CF1 (R1)
383043.50	PV		N2		CF2 (R2)
-1686.42	PMT		N3		CF3 (R3)
0	FV		N4		CF4 (R4)
		⋮		⋮	
			N20		CF20 (R.9)



Monthly payment = $1,686.42

Interest paid = $11,370.04
Principal paid = $8,867.00
Principal remaining = $374,176.50

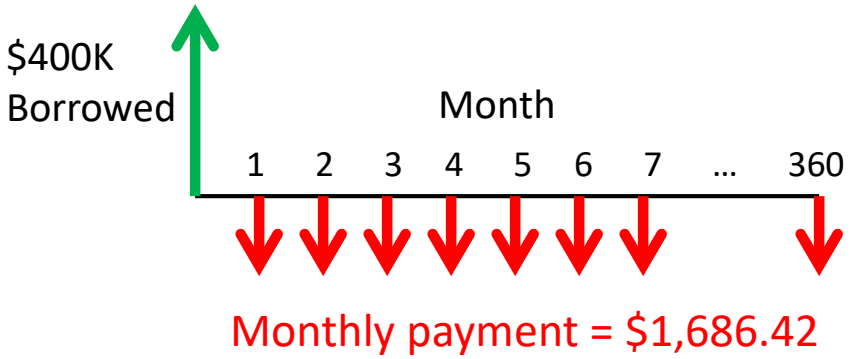
Procedure:

1. Enter 12 payments to amortize.
2. Press AMORT.
3. x contains interest paid
4. y contains principal paid
5. RCL PV to get principal remaining

Exercise

You've just bought a home with $400K, 30-year mortgage at 3% APR.

1. What does the cash flow diagram look like?
2. What is your monthly payment? **$1,686.42**
3. Fill in this table for the first 3 years:



Year	Beginning principal	Principal paid	Interest paid	Ending principal
1	**400,000**	**8,351.24**	**11,885.80**	**391,648.76**
2	**391,648.76**	**8,605.26**	**11,631.78**	**383,043.50**
3	**383,043.50**	**8,867.00**	**11,370.04**	**374,176.50**
Total paid		**25,823.50**	**34,887.62**	