Using a financial solver to analyse reducing-balance loans

Monday, 18 March 2019 6:58 pm

By the end of the lesson I would hope that you have an understanding and be able to apply to questions the following concepts:

- Know how to use the Financial Solver on your CAS to answer questions relating to reducing balance loans
- Understand what it means by:
  - **Number of payments**
  - **Interest rate**
  - **Per annum**
  - **Present Value** of a loan or investment
  - **Payments** made each month
  - **Future value** of the loan or investment
  - Number of **payments per year**
  - Number of **compounding periods per year**

RECAP:

Everyone loves money!
We love thinking about how much of it we have or want
We love to think of how long it's going to take to pay off a mortgage or save up for that dream holiday, car, horse, PS4!

Your CAS has a great piece of software which can help you plan your life.
It can help you plan your course to richness.
It's awesome

Firstly … some language

It wouldn't be Maths without some language now would it!
To be able to understand how to use the CAS we need to understand the language from questions.

Here is an example extracted from the *Cambridge Further Mathematics Units 3 and 4 Textbook:*

Andrew borrows $20000 at an interest rate of 7.25% per annum, compounding monthly. This loan will be repaid over 4 years with payments of $481.25 each month.

Lots of words yo!

Number of Payments: N
When we take out a loan, the bank will expect us to pay it back in a certain time period.
Normally we make payments monthly.
Hence, over 4 years we would look to make 48 payments.

25 × 12

Interest Rate: I
We need to pay the back for the privilege of them loaning us money.
Seems fair as they pay us interest when they borrow money from us!
Interest is given in terms of a percentage.
It's normally quoted as being paid **per annum** which simply means **per year**.

Present Value: PV
This is the one which confuses a lot of people.
We need to remember that the present value isn't just what we start with.
It stands for the size of the investment at any point in time.

The Present Value will change with each payment we make.
More on this later!

Payments: PMT
To be able to pay off the loan, we need to make payments.
Generally speaking, these will be fixed in size i.e. we will make the same payment each month for the duration of the loan

Future Value: FV
The value of the loan or investment at a point in time.
The more we pay off the loan, the less the Future Value becomes.

Payments per year: P/Y
We would hope to make the same number of payments per year.
If we are paying off the loan monthly, then we will be making 12 payments per year. 12

Compounding periods per year: C/Y
This is another one which tricks people.
Exam questions can also try and trick you with this value.
Generally speaking we will always compound monthly. Hence, there will be 12 compounding periods per year. But make sure you check this in the question!!!!!

THOSE PESKY SIGNS

As the calculator seems to be doing all the hard work for you … where can you go wrong?!
Well, there is something you need to know:

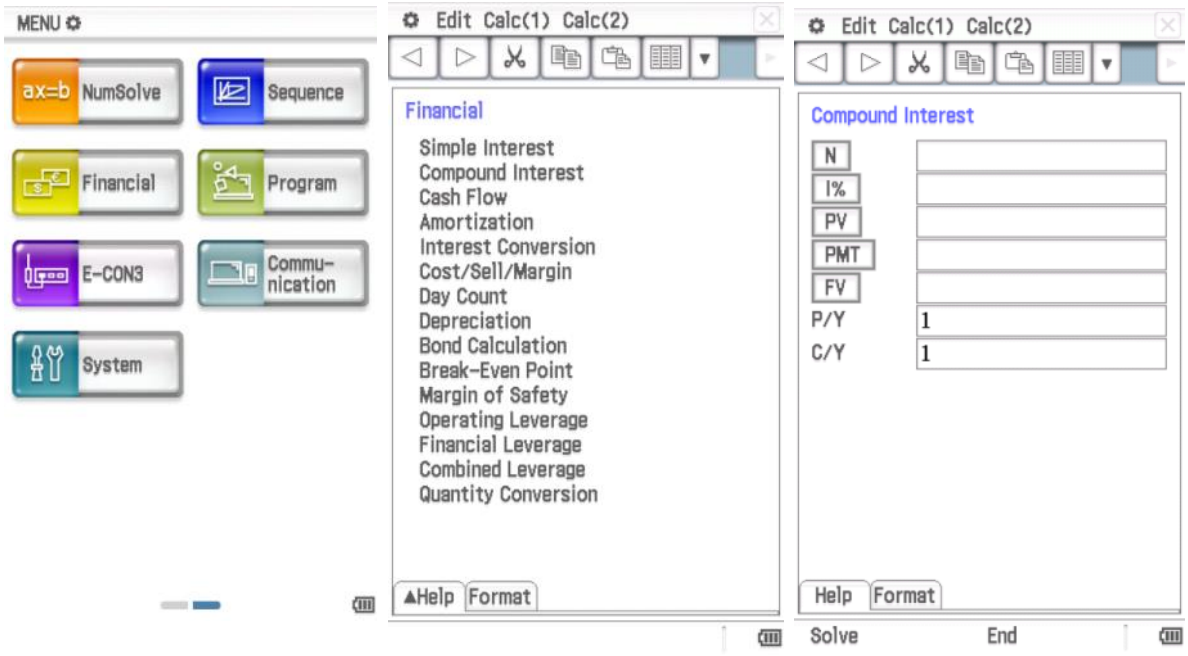
BANK GIVES YOU MONEY then we are left feeling POSITIVE

BANK TAKES MONEY FROM YOU then we are feeling NEGATIVE

So … when you make a payment to the bank you MUST ensure it's a negative value.
If you don't, the calculator will give you some very odd answers!

The CAS: It does all the work for you!

Here is how to use it:



Let's go back to the example and see what value we have and what we are trying to find:

Example 1:
Andrew borrows $20000 at an interest rate of 7.25% per annum, compounding monthly. This loan will be repaid over 4 years with payments of $481.25 each month.

a. How much, correct to the nearest cent, does Andrew owe after 3 years?
b. What is final payment amount Andrew must make to fully repay the loan after 4 years?

Part a:

N: 3 x 12

I: 7 25

PV: 20 000

PMT: - 481 . 25

FV:

P/Y: 12

C/Y: 12

a) $5554 . 36

b)

Part b:

N: 4 x 12

481 . 25

N: 4 x 12

I: 7.25

PV: 20 000

PMT: − 481.25

FV:

P/Y: 12

C/Y: 12

481.25
− 11
$481.14

Example 2:
Sipho borrows $10000 to be repaid in equal payments over a period of 5 years. Interest is charged at the rate of 8% per annum, compounding monthly.

Find:

a. the monthly payment amount, correct to the nearest cent
b. the total cost of repaying the loan to the nearest dollar
c. the total amount of interest paid to the nearest dollar.

Part a:

N: 5 x 12

I: 8

PV: 10 000

PMT: —

FV: 0

P/Y: 12

C/Y: 12

b) $202.76 x 60 = $12165.60

c) 12165.60 − 10 000

= $2165.60

Part b:

Part c:

Example 3:
An amount of $150000 is borrowed for 25 years at an interest rate of 6.8% per annum, compounding monthly.

- What are the monthly payments for this loan?
- How much is still owing at the end of 3 years?

After 3 years, the interest rate rises to 7.2% per annum.

- What are the new monthly payments that will see the loan paid in 25 years.
- How much extra does it now cost (to the nearest 10 dollars) to repay the loan in total?

Part a:

N: 25 x 12

I: 6.8

PV: 150 000

PMT: —

FV: 0

P/Y: 12

C/Y: 12

* a) $1041.11

b) $142 391.84

25 - 3 = 22

N = 22 x 12

I = 7.2

PV = 142 391.84

PMT = —

FV = 0

* c) $1076.18

d) 1076.18 - 1041.11

= 35.07

35.07 x 264 = $9258.48

Part b:

N:

I:

PV:

PMT:

FV:

P/Y:

C/Y: