

Perpetuities

Sunday, 24 March 2019 1:26 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 perpetuities
- Understand what it means to be an perpetuity
- Understand the language used for perpetuities
 - V_0 as the principal
 - r as the rate of interest
 - D as the regular payment per compounding period

RECAP:

I'm loving all the lessons on financial maths.

We have so far looked at the following types of financial problems:

- Reducing balance loans
- Interest only loans
- Annuities

The next one we're going to deal with is called a perpetuity!

WHAT IS A PERPETUITY?

In the last video we looked at the idea of annuities.

This was when we gave the bank some money and asked them to pay you back the same amount of money each month until it ran out.

A perpetuity is very similar to an annuity except that the money NEVER RUNS OUT!

You are effectively living off the interest of the investment each month.

Language, language, language ...

Like we have done in previous videos ... we need to know the language we are using:

V_0 : initial amount of the perpetuity
 r : the interest rate per compounding period
 D : the regular payment received

Remember: **The payment received is the interest earned each month!**

✗  $D = \frac{r}{100} \times V_0$

V_0
 $\boxed{\begin{matrix} r & \text{p.a.} \end{matrix}}$
 D

Let's look at some examples.

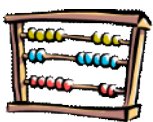
All examples used have been taken, with permission, from the Cambridge Further Mathematics (Units 3 and 4) Textbook:

Example 1:

Elizabeth invests her superannuation payout of \$500000 into a perpetuity that will provide a monthly income without using any of the initial investment.

If the interest rate for the perpetuity is 6% per annum, what monthly payment will Elizabeth receive?

Way 1: The formula



$$D = \frac{r}{100} \times 500\,000$$

$$D = \frac{0.5}{100} \times 500\,000$$

$$r = 6\% \text{ p.a.}$$

$$r = \frac{6\%}{12} \text{ p.m.}$$

$$= 0.5\% \text{ p.m.}$$

$$= \$2500$$

Way 2: THE CAS!



Example 2:

How much money will need to be invested in a perpetuity account, earning interest of 4.2% per annum compounding monthly, if \$200 will be withdrawn every month? Write your answer to the nearest dollar.



$$D = \frac{r}{100} \times V_0$$

$$\times 100 \quad 200 = \frac{0.35}{100} \times V_0$$

$$20000 = 0.35 \times V_0$$

$$20000 \div 0.35 = V_0$$

$$4.2\% \text{ p.a.}$$

$$r = \frac{4.2\%}{12}$$

$$r = 0.35\%$$

$$V_0 = \$57142.86$$

$$V_0 = \$57143$$

Example 3:

DO YOU SEE THE TRICK?



A university mathematics faculty has \$30000 to invest. It intends to award an annual mathematics prize of \$1500 with the interest earned from investing this money in a perpetuity.

What is the minimum interest rate that will allow this prize to be awarded indefinitely?

5%
=