Perpetuities

A **perpetuity** is a type of annuity (payment) where a **permanently invested sum of money** provides an infinite amount of regular payments that **continue forever.**

Many scholarships and grants are provided using a perpetuity investment. In which case the amount paid out is the same as the interest earned from off the lump sum.

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

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

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

Where;

d = the amount of the regular payment per period ($)
V_0 = the principal ($)
r = the interest rate per period (%)

NB: The number of payments each year must be the same as the compounding period of the given interest rate.
(ie. annually, monthly, quarterly, weekly etc.)

Example.1
The Apex club has invested $250 000 from which they wish to establish a community based scholarship for local secondary students. The club invest the sum in a perpetuity account that offers a long-term guaranteed interest rate of 12% p.a.

If the interest is calculated once a year, what would be the annual amount available to the club to distribute via their scholarship program?

Step.1   List all values given

d = ?

V_0 = \$250 000

r = 12% p.a.

Step.2   State the formula used

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

Step.3 Substitute values into the formula

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

$$= \frac{250000 \times 12}{100}$$

$$= \underline{\$30000}$$

Step.4 Answer the question

The Apex club would have \$30 000 available to distribute each year via their scholarship program.

Using the TI-Nspire To Solve Perpetuity Questions

The TI-Nspire CAS Finance Solver can also be used to solve **perpetuity** questions. However, please be aware of the following points:
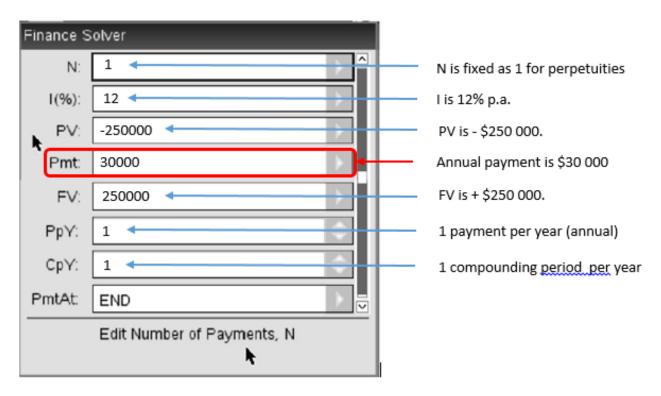
Both PV and FV are entered as the same amount as the balance of a perpetuity never changes. However:

  PV: enter a negative (-) value as it is a negative cash flow
  FV: enter a positive (+) value as it is a positive cash flow

Also as the balance of the investment remains constant:
  N: = 1 (as the number of periods is irrelevant)

Let's repeat the previous example using the TI-Nspire calculator.

Finance Solver		
N:	1	N is fixed as 1 for perpetuities
I(%):	12	I is 12% p.a.
PV:	-250000	PV is - $250 000.
Pmt:	30000	Annual payment is $30 000
FV:	250000	FV is + $250 000.
PpY:	1	1 payment per year (annual)
CpY:	1	1 compounding period per year
PmtAt:	END	

Edit Number of Payments, N

NB: The principal (PV) must be known to use the Finance Solver. If the principal is not known, then one must use the perpetuity formula.

Example.2

A local netball club has $25,000 to establish a perpetuity as a grant to encourage young and talented players in their club.

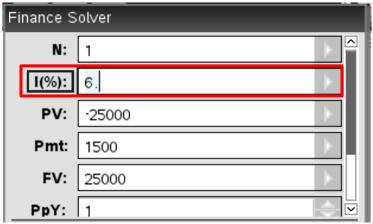The sports club invests the money in bonds that return 5.5% p.a.

1. Find the amount of the annual grant
2. What interest rate (compounded annually) would be required if the perpetuity is to provide $1500 each year?

Part 1

Finance Solver	
N:	1
I(%):	5.5
PV:	-25000
Pmt:	1375.
FV:	25000
PpY:	1

The amount of the annual grant is $1375.00.

Part 2

Finance Solver	
N:	1
I(%):	6.
PV:	-25000
Pmt:	1500
FV:	25000
PpY:	1

The interest rate required to generate $1500 annual payments is 6.0% p.a.