Financial Calculations

Compound interest

This is a financial calculation based on interest paid upon an original sum over time. Each time period i.e. (year / month) will need to factor in the interest accumulated from the previous.

Using a simple **time charting method,** look at example 1

€100,000 principal amount with a 6% interest rate, compounded annually for three years.

**Year 1**

€100,000 x ·06 for one year is €6000 interest.

**Year 2**

Now we have €106,000 x ·06 which produces €6360 of interest, which is added to the total

**Year 3**

From year 2 the new total is; €112,360 X ·06 = €6742 interest to be added to the running total

At the end of year 3 we have €119,102. As you can see a good proposition if you are receiving this interest on your investment.

This mathematical process could become tedious if a large number of time periods are needed.

**A** mathematical formula, for the complete task has been developed;

P (1+i) ⁿ = F

Principal amount x (1 + Periodic Rate) ^ Number of Periods

= Future Amount

* ‘n’ is the number of periods used as a power, the contents of the brackets are raised to the power of the number of periods.
* The periodic rate is expressed as a **fractional** figure (less than 1) **not** a percentage figure
* Note: ‘**n’** is frequently written as ‘**t**’

€100,000 X (1 + ·06) ^ 3 = Future Amount

€100,000 X 1.19 = €119,101·60 to be exact.

Example 2

Calculate how long (to the nearest month), it will take for an investment to increase in value from €30,000 to €32,000 if the rate of interest on the investment account is 4% per annum.

P (1+i) ⁿ = F

i = 4% / 100 = ·04

·04 / 12 = ·0033´ monthly interest

30,000. (1 + ·0033´)^ ⁿ = 32,000

(1 + ·0033´)^ ⁿ = 32,000 / 30,000

(1·0033´)^ ⁿ = 1·06666´

Log(1·0033´)^ ⁿ = Log(·106666´)

n.(·00144524) = ·02802872

·02802872/ ·00144524 = n = 19·39

Answer: 19·39 months

Logs

From the previous example, the problem was to determine the power function as this represented the time required to meet the necessary interest return. At one point in the solution, the log function was applied to both sides of the expression in order to solve the problem. Let’s look at how this worked.

Mathematicians became aware that any number can be expressed as a power using the log base of 10.

For example: 10³ = 1000 and using the log function; Log10 (1000) = 3.

To explain example 2:

6² = 36

6ⁿ = 36

Log10(6)ⁿ = Log10(36)

(·0778151)ⁿ=1·55630

At this point the figure on the right is twice the value on the left. Strangely enough, we know the original power value was 2. For the equation to balance, ‘n’, is now a multiplier instead of a power.

(n) = 1·55630/ ·0778151

(n) = 2

We have now shown a useful property within logs and this was exploited to solve example 2.