Finance

Amount: A principal P placed at an annual rate of interest r for n years accumulates to an amount A_n as follows:

Simple interest: $A_n = P(1+rn)$

Compound interest: $A_n = P(1+r)^n$

Interest compounded q times per year: $A_n = P\left(1+\frac{r}{q}\right)^{nq}$

Nominal and Effective Interest Rates: The rate of interest quoted in describing a given compound interest is called the "nominal rate." The rate per year at which interest is earned during the year is called the "effective rate." The effective rate i corresponding to the nominal rate r, is $i = \left(1+\frac{r}{q}\right)^q - 1$. Note that $i \geq r$. If interest is paid only once per year, i.e., $q = 1$, then the nominal and effective rates are the same. Compounding interest more than once per year, i.e., $q > 1$, yields a larger effective rate. APR (annual percentage rate) is the *nominal* annual interest rate plus one-time fees and additional charges. Although APR is intended to represent the total cost of credit to the consumer, it understates the true (*effective)* rate. An announced APR of 12.99% compounded monthly (as with credit card debt) is effectively a rate of 13.78%.

Present or Discounted Value of a Future Amount: The present quantity P which in n years will accumulate to the amount A_n at the rate of interest r is:

Simple interest: $P = \frac{A_n}{(1+nr)}$

Compound interest: $P = \frac{A_n}{(1+r)^n}$

Interest compounded q times per year: $P = \frac{A_n}{\left(1+\frac{r}{q}\right)^{nq}}$

Amount of an Annuity: If an annuity P is deposited at the end of each year, and interested, compounded annually, is paid on the accumulated deposit at the end of each year, the total amount N accumulated at the end of n years is

$$N = P\frac{(1+r)^n - 1}{r}$$

N is called the amount of an annuity P.

Present Value of an Annuity: The total present amount *P* which will supply an annuity *N* at the end of each year for **n** years, beginning one year hence, (assuming that in successive years the amount not yet paid out earns interest at rate *r*, compounded annually) is

$$P = N\frac{(1+r)^n - 1}{r(1+r)^n} = N\frac{1-(1+r)^{-n}}{r}$$

Amount of a Sinking Fund: If a fixed investment *N* is made at the end of each successive year (beginning at the end of the first year), and interest paid at rate *r*, compounded annually, is paid on the accumulated amount of the investments at the end of each year, the total amount *S* accumulated at the end of *n* years is:

$$S = N\frac{(1+r)^n - 1}{r}$$

S is called the amount of the sinking fund.

Note: These descriptions and formulas have been taken from Burington, R., "Handbook of Mathematical Tables and Formulas"