Compound Interest and Annuity Steps

Start at Step 1, then answer the questions and follow the corresponding steps. Descriptions of variables and explanations are at the end.

**Step 1: Is this an annuity?**

Is the same size payment being made every period (e.g. every week, every month, every year)?

**No:** Regular Compound interest

\[ S = P(1 + r)^n \]

Where \( r \) is the periodic rate, \( n \) is the total number of periods (see Variables and Explanation)

**Yes**

See Step 2.

**Step 2: Present Value or Future Value?**

**Present Value**

Any loan, mortgage, cash-now price, or lottery (think: one amount in, many payments out). See Step 3.

**Future Value**

Savings account, sinking fund, life insurance, or pension (think: many payments in, one amount out). See Step 4.

**Step 3: Is the payment at the end or beginning of each period?**

**End:** Present Value Ordinary Annuity

\[ A = R \left[ \frac{1 - (1 + r)^{-n}}{r} \right] \]

(angle notation \( A = R \cdot a_n \) where \( r \) is the periodic rate, \( n \) is the total number of periods.)

**Beginning:** Present Value Annuity Due

\[ A_{due} = R + R \left[ \frac{1 - (1 + r)^{-(n-1)}}{r} \right] \]
Step 4: Is the payment at the end or beginning of each period?

End: Future Value Ordinary Annuity

\[
S = R \left[ \frac{(1 + r)^n - 1}{r} \right]
\]

(\text{angle notation: } S = R \cdot s_{n|} \text{ where } r \text{ is the periodic rate, } n \text{ is the total number of periods.})

Beginning: Future Value Annuity Due

\[
S_{\text{due}} = R \left[ \frac{(1 + r)^{n+1} - 1}{r} \right] - R
\]

(\text{angle notation: } S = R \cdot s_{n+1|} - R \text{ where } r \text{ is the periodic rate, } n \text{ is the total number of periods.})

Variables and Explanation

\(A\) = present value amount of the account
\(S\) = future value amount of the account
\(P\) = principal (beginning) amount
\(R\) = periodic payment (must be equal)
\(n\) = total # of compounding periods
\(r\) = periodic interest rate

\text{NOTE: } r \text{ and } n \text{ must have matching types (e.g. If } n \text{ is the total number of months, then } r \text{ must be the periodic monthly rate.) } r \text{ is usually given as the nominal rate, sometimes called APR (if the nominal rate is the annual percentage rate); the length of a nominal cycle is usually one year (certain rare businesses have a 2 year nominal cycle). The nominal rate can be adjusted by dividing } r \text{ by the number of periods in one nominal cycle, thus making } r \text{ and } n \text{ match in type.}