Compound Interest & Annuity Flow Chart

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

Yes → **Present** Value or **Future** Value?

Regular Compound Interest

$$S = P(1+r)^n$$

where r is the periodic rate, n is the total number of periods (see note in legend)

Present Value

any loan, mortgage, cash-now price, or lottery (think: one amount in, many payments out)

A

(time line is the account)

R R R R R R

- If the payment is at the **end** of each period → Present Value Ordinary Annuity
- If the payment is at the **beginning** of each period → Present Value Annuity Due

Present Value Ordinary Annuity

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

(angle notation: $A = R \cdot a_{\overline{n|}r}$

where r is the periodic rate, n is the total # of periods (see note in legend)

Present Value Annuity Due

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

(angle notation: $A = R + R \cdot a_{\overline{n-1|}r}$

where r is the periodic rate, n is the total # of periods (see note in legend)

Future Value

savings account, sinking fund, life insurance or pension (think: many payments in, one amount out)

R R R R R R

(time line is the account)

S

- If the payment is at the **end** of each period → Future Value Ordinary Annuity
- If the payment is at the **beginning** of each period → Future Value Annuity Due

Future Value Ordinary Annuity

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

(angle notation: $S = R \cdot s_{\overline{n|}r}$

where r is the periodic rate, n is the total # of periods (see note in legend)

Future Value Annuity Due

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

(angle notation: $S = R \cdot s_{\overline{n+1|}r} - R$

where r is the periodic rate, n is the total # of periods (see note in legend)

Legend

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

NOTE: r and n must have matching types (e.g. If n is the total number of months, then r must be the periodic monthly rate.) r 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 by the number of periods in one nominal cycle, thus making r and n match in type.

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