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)

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

**Yes**

**Present Value or Future Value?**

**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.

**Present Value**

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

\[ A \]

(time line is the account)

- If the payment is at the end of each period

**Future Value**

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

\[ R \]

(time line is the account)

- If the payment is at the beginning of each period

**Present Value Ordinary Annuity**

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

(angle notation: \( A = R \cdot a_{n \mid r} \))

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: \( A = R + R \cdot a_{n-1 \mid r} \))

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

**Future Value Ordinary Annuity**

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

(angle notation: \( S = R \cdot a_{n \mid r} \))

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: \( S = R \cdot a_{n+1 \mid r} - R \))

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