Regular Compound Interest
\[ S = P \left(1 + r \right)^n \]
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)

Future Value
savings account, sinking fund, life insurance or pension
(think: many payments in, one amount out)
\[ S \] (time line is the account)

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