

# Compound Interest & Annuity Flow Chart

## 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)

No ↗

## 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?

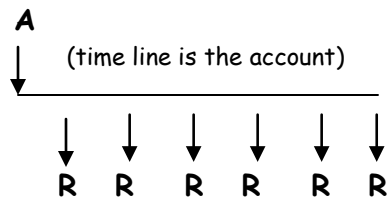
### Legend

$A$  = 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)



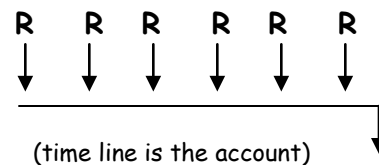
If the payment is at the **end** of each period

If the payment is at the **beginning** of each period



## Future Value

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



If the payment is at the **end** of each period

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:  $A = R \cdot a_{\overline{n}|r}$ )

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 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)