Unit 1
Solving Interest Word Problems
The two common methods of earning interest on a bank account are **simple interest** and **compound interest**.

**Simple interest** means that interest only accrues on the money *you* put into the account and not on interest previously credited to your account.

**Compound interest** means that interest accrues *both* on the money you put into the account and also on interest previously credited to your account.
Unit One: Interest - 2

To solve a problem involving simple or compound interest (e.g., if you have a present balance, what will the balance be – with interest – after a certain period of time), one must know certain terms:

\[ P = \text{present value/principal} \]
\[ F = \text{future value} \]
\[ n = \text{total number of interest periods} \]
\[ r = \text{annual interest rate} \]
\[ m = \text{number of compounding periods per year} \]
\[ i = \text{interest rate per compounding period} \]

(if compound interest is credited monthly, there are 12 periods per year; if quarterly, four; if semi-annually, two, etc.)
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Formula: Future Value – Simple Interest

\[ F = (1 + nr)P \]

(for the usual case where simple interest is credited annually, so \( n \) = number of years)

Formula: Future Value – Compound Interest

\[ F = (1 + i)^n P \]

**Note:** A usual necessary first step in compound interest problems is to calculate \( i \) from \( r \) and \( m \) (given in the problem) according to the formula:

\[ i = \frac{r}{m} \]
Interest Problem

Problem: Vera placed $1,000 in a bank savings account, which pays interest, compounded semi-annually, at an annual rate of 4%. How much money will be in Vera’s account after two and a half years?
Interest Problem – Solution 1

Solution:

1. First, read the problem and understand it.

2. Organize the data to fit the symbols you have learned for finance problems:
   - the present value \(= P\) is $1,000.
   - the annual interest rate \(= r\) is 4%.
   - the interest is compounded semi-annually, or twice a year \(m = 2\).
   - the total time period is two and a half years, so there will be a total of five compounding periods during that time \(n = 5\).
3. The answer the problem wants is the future value of the account will be after two and a half years. We assign the variable $F$ (future value) to that value, since $F$ is the symbol we have learned for future value. We also need to know the interest rate per compounding period, $i$.  

4. Since this is a compound interest problem, the compound interest formula is the proper one. But, first, $i$ must be calculated from $r$ and $m$. 
Interest Problem – Solution 3

5. First, substitute data into the formula for \( i \):

\[
i = \frac{r}{m} = \frac{4}{2} = 2\%
\]

Next, substitute the data, including \( i \), into the compound interest formula:

\[
F = (1 + i)^n P
\]

\[
F = (1 + .02)^5 \times 1000
\]
7. Then solve for $F$:

$$F = (1 + .02)^5 \cdot 1000$$

Using a calculator or a compound interest table, we calculate that

$$(1 + .02)^5 = 1.1040808$$

$$F = 1.1040808 \cdot 1000$$

$$F = $1,104.08$$

(We round money to the nearest cent, unless asked to do otherwise in the problem.)
8. Check the units of measurement in the calculations:

\[ i = \frac{r}{m} = \frac{4}{2} = 2\% \]

\[ \%/\text{yr.} = \%/\text{per.} \]

\[ \text{per.}/\text{yr.} \]

\[ F = (1 + .02)^5 \times 1000 \]

The term \((1 + .02)^5\) is *unitless*. Therefore, the unit of \(P\) (dollars) is unaffected by the multiplication of \(F\) (dollars) by \((1 + .02)^5\).