Simple Interest

**Interest** is the amount of money paid for either borrowing money or earning money on a deposit.

**Simple Interest** is interest that is compounded on the original principal only.

\[ I = Prt \]

- \( I \) = Interest
- \( P \) = principal (present value)
- \( r \) = interest rate (% to decimal)
- \( t \) = time in years

**Example 1:** Find the simple interest on a $1000 investment made for 3 years at an interest rate of 5% per year.

\[ I = Prt \]
\[ = 1000 \times 0.05 \times 3 \]
\[ = 150 \]

**Future Value with Simple Interest**

\[ F = P(1 + rt) \]
\[ \Rightarrow F = P + I \]

- \( F \) = Future Value
- \( P \) = Principal (present value)
- \( r \) = interest rate
- \( t \) = time in years

**Example 2:** Mike borrowed $1200 at 10% simple interest per year. How much is due when the loan matures in 9 months?

\[ P = 1200 \]
\[ r = 0.10 \]
\[ t = \frac{9}{12} \]

\[ F = P(1 + rt) \]
\[ = 1200 \times \left( 1 + 0.10 \times \frac{9}{12} \right) \]
\[ = 1290 \]
Math 1313       Section 4.1
Compounded Interest

Interest that charged or earned on the original principal and also on any previously charged or earned interest.

Future Value with Compound Interest Formula:

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

where \( i = \frac{r}{m} \) and \( n = mt \)

\( F \) = Future Value

\( P \) = present value or principal.

\( r \) = the interest rate per year.

\( m \) = the number of compounding periods per year.

\( t \) = time in years.

Example 3: Find the accumulated amount after 5 years if $1700 is invested at 6.25% per year compounded

a. quarterly.

\[ m = 4 \]

\[ i = \frac{r}{m} = \frac{0.0625}{4} \]

\[ n = mt = 4 \times 5 = 20 \]

\[ F = 1700 \left(1 + \frac{0.0625}{4}\right)^{20} = \$ 2,318.02 \]

b. semiannually.

\[ m = 2 \]

\[ i = \frac{r}{m} = \frac{0.0625}{2} \]

\[ n = mt = 2 \times 5 = 10 \]

\[ F = 1700 \left(1 + \frac{0.0625}{2}\right)^{10} = \$ 2,312.54 \]

Present Value with Compound Interest Formula:

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

where \( i = \frac{r}{m} \) and \( n = mt \)
Example 4: Kim and Ken find that they will need $15,500 to build an addition to their home in 4 years. How much should they invest now at 3.25% per year compounded quarterly to have the desired funds in 4 years?

\[ F = 15,500 \]
\[ t = 4 \]
\[ r = 0.0325 \]
\[ m = 4 \]
\[ \frac{r}{m} = \frac{0.0325}{4} \]
\[ n = m \cdot t = 4 \cdot 4 = 16 \]

\[ P = F \left( 1 + \frac{r}{m} \right)^{-n} \]
\[ = 15500 \left( 1 + \frac{0.0325}{4} \right)^{-16} \]
\[ = 12,417.63 \]

Example 5: A newborn child receives a $5000 gift towards a college education from her grandparents. How much will the $5000 be worth in 17 years if it is invested at 9% per year compounded quarterly?

\[ P = 5000 \]
\[ t = 17 \]
\[ r = 0.09 \]
\[ m = 4 \]
\[ \frac{r}{m} = \frac{0.09}{4} \]
\[ n = m \cdot t = 4 \cdot 17 \]
\[ = 68 \]

\[ F = P \left( 1 + \frac{r}{m} \right)^n \]
\[ = 5000 \left( 1 + \frac{0.09}{4} \right)^{68} \]
\[ = 22,702.60 \]

Example 6: Kim invested a sum of money 4 years ago in a savings account that has since paid interest at the rate of 6.5% per year compounded monthly. Her investment is now worth $19,440.31. How much did she originally invest?

\[ F = 19,440.31 \]
\[ t = 4 \]
\[ r = 0.065 \]
\[ m = 12 \]
\[ \frac{r}{m} = \frac{0.065}{12} \]
\[ n = m \cdot t = 12 \cdot 4 = 48 \]

\[ P = F \left( 1 + \frac{r}{m} \right)^{-n} \]
\[ = 19440.31 \left( 1 + \frac{0.065}{12} \right)^{-48} \]
\[ = 15,000 \]