Investing
Money
Simple and Compound Interest
You will learn two new formulas in this unit...

**Simple Interest Formula** \[ I = Prt \]

where
- \( I \) = interest earned in $
- \( P \) = principal or amount invested in $
  \text{or the amount you are starting with}
- \( r \) = rate of interest in decimals
  \text{(ex. 2\% would be 0.02)}
- \( t \) = time in years the amount is left in the bank
  \text{(ex. 6 months would be 0.5 years)}

**Compound Interest Formula** \[ A = P(1 + \frac{r}{n})^{nt} \]

where
- \( A \) = amount (original amount plus interest earned)
- \( P \) = principal or amount invested in $
  \text{or the amount you are starting with}
- \( r \) = rate of interest in decimals
  \text{(ex. 2\% would be 0.02)}
- \( n \) = number of compounds per year
  \text{(ex. how many times interest is calculated per year)}
- \( t \) = time in years the amount is left in the bank
  \text{(ex. 6 months would be 0.5 years)}
- \( nt \) = \( n \) multiplied by \( t \)
Lesson 1 — Simple Interest

Financial institutions borrow and lend money. When you deposit money into a savings account, you are lending the financial institution money for a period of time. The financial institution pays you interest for borrowing your money. In turn, the financial institution lends your money to individuals who need it. These individuals must pay interest for the money they borrow. The interest rate they pay the financial institution is higher than the interest rate you receive from the same institution. In this way, the financial institution earns a profit on these transactions.

Calculating Simple Interest

When you invest some money in a financial institution, the institution pays you interest for using your money. When you borrow money from a financial institution, you pay interest to the institution. The mathematical formula for calculating simple interest is:

\[ I = Prt, \]

where

- \( I \) = interest
- \( P \) = principal, which is the original amount invested or borrowed
- \( r \) = annual (yearly) rate of interest expressed as a decimal
- \( t \) = length of time expressed in years

Note: The time is always expressed in years or as a portion of a year.

Example 1

Olive Branch invests $1500 in a financial institution that offers her an interest rate of 4% per annum (per year). Calculate the interest Olive will earn at the end of three years.

Solution

In the formula \( I = Prt \), \( P = $1500 \), \( r = 4\% \) or 0.04, and \( t = 3 \).

\[
I = Prt \\
= 1500 \times 0.04 \times 3 \\
= 180
\]

At the end of three years, Olive will earn $180.
Example 2
Calculate the interest Olive will earn at the end of seven months.

Solution
In the formula \( I = Prt \), \( P = \$1500 \), \( r = 4\% \) or 0.04, and \( t = 7/12 \).

\[
I = Prt \\
= 1500 \times 0.04 \times 7/12 \\
= 35
\]

At the end of seven months, Olive will earn $35.

Example 3
Calculate the interest Olive will earn at the end of 100 days.

Solution
In the formula \( I = Prt \), \( P = \$1500 \), \( r = 4\% \) or 0.04, and \( t = 100/365 \).

\[
I = Prt \\
= 1500 \times 0.04 \times 100/365 \\
= 16.44
\]

At the end of 100 days, Olive will earn $16.44.

Using the Simple Interest Formula to find Principal, Rate, or Time

Not only can we use the formula \( I = Prt \) to calculate interest, but we can also use it to calculate the other variables in the formula (principal, rate, and time).

To find the principal, divide the interest by the product of the rate and the time.

\[
P = I / (r \times t)
\]

To find the rate, divide the interest by the product of the principal and time.

\[
R = I / (P \times t)
\]

To find the time, divide the interest by the product of the principal and the rate.

\[
t = I / (P \times r)
\]
Example 4
Treya Pine invested a certain sum of money in a financial institution and earned $200 interest after four years. If the annual interest rate was 5 percent, what amount did Treya invest?

Solution
In the formula \( I = Prt \), \( I = $200 \), \( r = 5\% \) or 0.05, \( t = 4 \), \( P = ? \)

\[
P = \frac{I}{rt}
= \frac{200}{0.05 \times 4}
= $1000
\]
Treya invested $1000.

Example 5
Brooke Poole has $2400 to invest in a financial institution. Calculate the annual rate of interest if she plans to earn $300 on her investment at the end of two years.

Solution
\( I = $300 \), \( P = $2400 \), \( t = 2 \), \( r = ? \)

\[
r = \frac{I}{Pt}
= \frac{300}{2400 \times 2}
= 0.0625 \text{ or } 6.25\%
\]
Brooke requires an annual rate of 6.25% if she wants to earn $300 on her investment at the end of two years.

Example 6
Wade Lake borrows $5000 from the bank. He is charged interest at a rate of 4% per year. Calculate the number of days Wade kept the money if he owes $360 in interest.

Solution
\( I = $360 \), \( P = $5000 \), \( r = 4\% \) or 0.04, \( t = ? \)

\[
t = \frac{I}{Pr}
= \frac{360}{5000 \times 0.04}
= 1.8 \text{ years}
= 1.8 \times 365 = 657 \text{ days}
\]
Wade kept the money for 657 days.

Note that the time is always in years when in the formula. To calculate the number of days, multiply the answer, 1.8 years, by 365.
Assignment 1 — Simple Interest

1. Find the simple interest for each of the following. Round to the nearest cent.

<table>
<thead>
<tr>
<th>Interest</th>
<th>Principal</th>
<th>Rate</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>$100</td>
<td>$1000</td>
<td>5%</td>
<td>2 years</td>
</tr>
<tr>
<td>$25</td>
<td>$1000</td>
<td>5%</td>
<td>6 months</td>
</tr>
<tr>
<td>$3.70</td>
<td>$1000</td>
<td>5%</td>
<td>100 days</td>
</tr>
<tr>
<td>$775</td>
<td>$10,000</td>
<td>7.75%</td>
<td>1 year</td>
</tr>
<tr>
<td>$764.38</td>
<td>$10,000</td>
<td>7.75%</td>
<td>360 days</td>
</tr>
<tr>
<td>$1162.50</td>
<td>$10,000</td>
<td>7.75%</td>
<td>18 months</td>
</tr>
</tbody>
</table>

2. Bob invests $8000 at 6% for one year. Calculate the interest earned.

\[
I = \frac{P \times r \times t}{100} = \frac{8000 \times 0.06 \times 1}{1} = \$480
\]

3. Murray deposits $1200 in a bank account earning 2.25% interest per year. Calculate the interest earned on his deposit after one year.

\[
I = \frac{P \times r \times t}{100} = \frac{1200 \times 0.0225 \times 1}{1} = \$27
\]
4. Mary invests $1575 at 5.5% for 3 months. Calculate the interest earned.

\[ I = P \times r \times t \]
\[ I = 1575 \times 0.055 \times \frac{3}{12} \]
\[ I = 21.66 \]

5. April invests $10 000 at 4% for 30 days. Calculate the interest earned.

\[ I = P \times r \times t \]
\[ I = 10000 \times 0.04 \times \frac{30}{365} \]
\[ I = 32.88 \]

6. Joe invests $3000 at 4.25% for 5 years. Interest is calculated annually. Calculate the interest earned.

\[ I = P \times r \times t \]
\[ I = 3000 \times 0.0425 \times 5 \]
\[ I = 637.50 \]

7. Beth invests $3000 in the bank at 4.25% for 2 years. Interest is calculated semi-annually and added on to the investment. Calculate the interest earned at the end of the 2 years and the balance in her account.

<table>
<thead>
<tr>
<th>Time</th>
<th>Amount (Interest)</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>After 6 months</td>
<td>$3000 x 0.0425 x (6/12)</td>
<td>$63.75</td>
</tr>
<tr>
<td>After 12 months (1 yr)</td>
<td>$3063.75 x 0.0425 x (6/12)</td>
<td>$65.10</td>
</tr>
<tr>
<td>After 18 months</td>
<td>$3128.85 x 0.0425 x (6/12)</td>
<td>$66.49</td>
</tr>
<tr>
<td>After 24 months (2 yrs)</td>
<td>$3195.34 x 0.0425 x (6/12)</td>
<td>$67.90</td>
</tr>
</tbody>
</table>
8. Josh takes the interest earned at the end of every year and adds it to his investment. Calculate the interest he earned after 5 years if he invests $3000 at 4.25% per annum. Interest is calculated annually.

<table>
<thead>
<tr>
<th>Year</th>
<th>Interest (I)</th>
<th>Balance (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>$3000 \times 0.0425 \times 1$</td>
<td>$127.50$</td>
</tr>
<tr>
<td>Year 2</td>
<td>$3127.50 \times 0.0425 \times 1$</td>
<td>$132.92$</td>
</tr>
<tr>
<td>Year 3</td>
<td>$3260.42 \times 0.0425 \times 1$</td>
<td>$138.57$</td>
</tr>
<tr>
<td>Year 4</td>
<td>$3398.99 \times 0.0425 \times 1$</td>
<td>$144.46$</td>
</tr>
<tr>
<td>Year 5</td>
<td>$3543.45 \times 0.0425 \times 1$</td>
<td>$150.60$</td>
</tr>
</tbody>
</table>

9. Rayna invests $20,000 in a financial institution at 10%. Calculate the number of days it will take her investment to earn $1200 in interest.

\[
t = \frac{I}{Pr} = \frac{1200}{20000 \times 0.10} = 0.6 \text{ years} \]

\[
0.6 \times 365 = 219 \text{ days}.
\]

10. Douglas Fir borrows money from his financial institution at an interest rate of 6.25% per year. If he pays $397.50 in interest after four years, calculate the amount of his loan.

\[
P = \frac{I}{rt} = \frac{397.50}{0.0625 \times 4} = \$1590
\]
11. Matt takes $1575 in and puts it into a term deposit at his bank. Six months later he receives a letter saying he has earned $48.72 in simple interest. What is the interest rate of his term deposit?

\[ I = 48.72 \]
\[ P = 1575 \]
\[ r = \frac{I}{P} = \frac{48.72}{1575 \times \left( \frac{6}{12} \right)} \]
\[ = 0.061866 \]
\[ = 6.19\% \]

12. Matilda sells some property and deposits $85,000 into a term deposit earning 4.25% per year. She earns $13,812.50 interest on her investment. How long did Matilda leave her money in the bank?

\[ I = 13,812.50 \]
\[ P = 85,000 \]
\[ r = 0.0425 \]
\[ t = \frac{I}{P \times r} = \frac{13,812.50}{85,000 \times 0.0425} \]
\[ = 3.82 \text{ years} \]
\[ = 3 \text{ years and } 10 \text{ months.} \]

13. Ben invests some money into a friend’s business. He is promised 10% interest for a period of 16 months. At the end of 16 months, Ben is given $10,430.67 in interest. Calculate how much money Ben initially invested in his friend’s business.

\[ I = 10,430.67 \]
\[ P = \] (to be determined)
\[ r = 0.10 \]
\[ t = \frac{16}{12} \]
\[ P = \frac{I}{r + \frac{t}{12}} = \frac{10,430.67}{0.10 \times \left( \frac{16}{12} \right)} = \$78,230.03 \]

14. Jordan invests $7800 for 15 months and earns $780 in interest. What was the annual interest rate?

\[ I = 780 \]
\[ P = 7800 \]
\[ r = \frac{I}{P} = \frac{780}{7800 \times \left( \frac{15}{12} \right)} \]
\[ = 0.08 = 8\% \]
15. Jan takes $16,000 she received for the sale of her horse to the bank and invests it at an annual interest rate of 3.25%. She earns $1,400 in simple interest. How many months did she leave her money in the bank?

\[
\begin{align*}
I &= 1400 \\
P &= 16000 \\
r &= 0.0325 \\
t &= \frac{I}{P \times r} = \frac{1400}{16000 \times 0.0325} \\
&= 2.69 \text{ years} = 32 \text{ months approx.}
\end{align*}
\]

16. Luke Wharm has two years to save $2,800 for a winter vacation. He has $10,000 to invest in a financial institution. Calculate the interest rate he requires to earn enough for his vacation.

\[
r = \frac{I}{P + t} = \frac{2800}{10000 \times 2} = 0.14 \times 100 \\
= 14 \%
\]

17. Preston has $1000 to invest in a financial institution. He decides to purchase a step bond that guarantees him 4.75% for the first year, 5.5% for the second year, and 6.75% for the third year. Calculate the total interest he will earn in three years.

\[
\begin{align*}
\text{Year 1} & \quad 1000 \times 0.0475 \times 1 = 47.50 \\
\text{Year 2} & \quad 1047.50 \times 0.055 \times 1 = 57.61 \\
\text{Year 3} & \quad 1105.11 \times 0.0675 \times 1 = 74.59
\end{align*}
\]

Total in account is $1179.70

$179.70 interest earned.
Lesson 2 – Compound Interest

An investment earns compound interest when the interest from each time period is added to the principal, and then earns interest in the following time periods. As the principal grows, the rate at which you earn interest grows as well, because you are earning "interest on interest." Compounding makes a significant difference in the final value of an investment. Compounding increases the amount you earn when investing, but increases the costs when you borrow money.

Comparing Simple Interest and Compound Interest
The following examples illustrate the difference between simple interest and compound interest. The first example involves simple interest, whereas the second example involves compound interest.

Example 1
Miles West invests $5000 in a financial institution at 6% per annum (simple interest). Calculate his interest at the end of three years.

Solution
In the formula $I = Prt$, $I = ?$, $P = $5000, $r = 6\%$ or 0.06, and $t = 3$.

\[ I = Prt \]
\[ = 5000 \times 0.06 \times 3 \]
\[ = 900 \]

At the end of three years, Miles earns $900 in interest.

Example 2
Miles West invests $5000 in a financial institution at 6% per annum, compounded annually. Calculate his interest at the end of three years.

<table>
<thead>
<tr>
<th>Interest Period</th>
<th>$I = Prt$</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>$5000.00</td>
</tr>
<tr>
<td>1</td>
<td>$I = 5000.00 \times 0.06 \times 1 = 300.00$</td>
<td>5000.00 + 300.00 = $5300.00$</td>
</tr>
<tr>
<td>2</td>
<td>$I = 5300.00 \times 0.06 \times 1 = 318.00$</td>
<td>5300.00 + 318.00 = $5618.00$</td>
</tr>
<tr>
<td>3</td>
<td>$I = 5618.00 \times 0.06 \times 1 = 337.08$</td>
<td>5618.00 + 337.08 = $5955.08$</td>
</tr>
<tr>
<td></td>
<td>Total Interest earned $955.08</td>
<td></td>
</tr>
</tbody>
</table>
**Example 2 Explained...**

**First Year**
To find the interest earned in the first year, use the formula:
\[ I = Prt, \] where \( P = 5000, \) \( r = 6\% = 0.06, \) and \( t = 1. \)

The interest is $300. We add the interest ($300) to the principal ($5000). The investment is then worth $5300 at the end of the first year. The amount $5300 becomes the "new" principal, and we use it to calculate the interest for the second year.

**Second Year**
To find the interest earned in the second year, use the formula:
\[ I = Prt, \] where \( P = 5300, \) \( r = 0.06, \) and \( t = 1. \)

The interest is $318. We add the interest ($318) to the last principal amount ($5300). The investment is then worth $5618 at the end of the second year. The amount of $5618 is the new principal, and we use it to calculate the interest for the third year.

**Third Year**
To find the interest earned in the third year use the formula:
\[ I = Prt, \] where \( P = 5618, \) \( r = 0.06, \) and \( t = 1. \)

**What is the investment worth at the end of three years?**
The interest is $337.08. We add the interest ($337.08) to the past principal amount ($5618). The investment is then worth $5955.08 at the end of the third year.

**Total Interest Earned**
The total interest Miles earns in three years = $5955.08 - $5000 = $955.08.

**Difference between compound and simple interest**
The difference in the interest Miles earns when the interest is compounded (Example 2) compared to when it is simple interest (Example 1) is equal to $955.08 - $900 = $55.08.

*Note that the amount of interest earned when we use compound interest is greater than when we use simple interest*
Compound Interest Formula
Computing compound interest as you did in Example 2 is a lengthy procedure, especially as the length of time is increased. You can set up a spreadsheet to do these calculations, but you may not always have access to a computer. Fortunately, there is a formula for calculating compound interest, making the calculations less time-consuming.

The formula for computing compound interest is

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

\( A = \) final amount (principal + interest)
\( P = \) principal or the amount invested or borrowed
\( r = \) annual (yearly) rates of interest expressed as a decimal
\( n = \) number of compounding periods a year
\( t = \) length of time in years

Note: There are some special words we use to describe the number of interest periods in a year. Here are some examples, along with an explanation and a value for \( n \).

<table>
<thead>
<tr>
<th>Number of Compounding Periods</th>
<th>Explanation</th>
<th>Value of ( n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annually</td>
<td>1 time a year</td>
<td>1</td>
</tr>
<tr>
<td>Semi-annually</td>
<td>2 times a year</td>
<td>2</td>
</tr>
<tr>
<td>Quarterly</td>
<td>4 times a year</td>
<td>4</td>
</tr>
<tr>
<td>Bi-weekly</td>
<td>Every 2 weeks</td>
<td>26</td>
</tr>
<tr>
<td>Weekly</td>
<td>Every week</td>
<td>52</td>
</tr>
<tr>
<td>Daily</td>
<td>Every day</td>
<td>365</td>
</tr>
</tbody>
</table>
Example 3
If Miles West invests $5000 in a financial institution at 6% per annum compounded annually, calculate his interest at the end of three years using the compound interest formula.

Hint: Take a minute to jot down the values of $P$, $r$, $t$, $n$, and $nt$ before you fill in your formula.

\[
P = 5000 \\
r = 6\% \text{ or } 0.06 \\
t = 1 \text{ (1 year)} \\
n = 1 \text{ (compounded annually means once per year)}
\]

\[
nt = 1 \times 1 = 1
\]

\[
A = 5000 \left( 1 + \frac{0.06}{1} \right)^{1 \times 3}
\]

\[
= 5000 (1 + 0.06)^3
\]

\[
= 5000 (1.06)^3
\]

\[
= 5000 (1.191016)
\]

\[
= 5955.08
\]

After three years, the investment is worth $5955.08.

After three years, the interest earned is equal to: $5955.08 - $5000.00 = $955.08.

Note that the compound interest formula calculates the final amount ($A$) an investment is worth, including Principal plus Interest. To calculate the amount of interest ($I$) earned, you must subtract the principal ($P$) from the calculated amount ($A$).
The Effect of Compounding Frequency

When the interest is compounded more than once a year, it is reinvested into the principal more often. Since the principal grows more frequently, the final investment is worth more. In general, the more often an investment is compounded, the greater the amount of interest it earns.

Example 4

If Miles West invests $5000 in a financial institution at 6% per annum compounded quarterly for a period of three years, calculate his interest at the end of three years using the compound interest formula.

\[
P = 5000 \quad r = 0.06 \quad t = 3 \quad n = 4 \text{ (4 times per year)} \quad nt = 12
\]

\[
A = P \left(1 + \frac{r}{n}\right)^{nt} = 5000 \left(1 + \frac{0.06}{4}\right)^{4 \times 3}
\]

\[
= 5000 \left(1 + 0.015\right)^{12}
\]

\[
= 5000 \left(1.015\right)^{12}
\]

\[
= 5000 \left(1.195618\right)
\]

\[
= 5978.09
\]

After three years, the investment is worth $5978.09.

After three years, the interest earned is equal to $5978.09 - $5000 = $978.09.

Note that the investment compounded quarterly (that is, four times a year) earns interest of $978.09, while the investment compounded annually earns interest of $955.08. When the interest is compounded quarterly, it is reinvested into the principal more often. Since the principal grows more frequently, the final investment is worth more. In general, the more often an investment is compounded, the greater the amount of interest it earns.
The Rule of 72
The rule of 72 states that an investment doubles in value when the interest rate multiplied by the number of years of the investment equals 72. For example, if you invest a sum of money at an annual interest rate of 3% for 24 years, it will approximately double in value (3 \times 24 = 72).

In this example, the product of the annual interest rate and the number of years of the investment is equal to 72. The formula for the rule of 72 is

\[ rt = 72, \text{ where} \]

- \( r \) = percent rate compounded annually (ignore the percent, do not change into decimal)
- \( t \) = number of years

Example 5
Ernest Dollar invests $4000 at an interest rate of 6%, compounded annually. Using the rule of 72, estimate how many years it will take Ernest's investment to double.

Solution

\[ t = \frac{72}{r} \]
\[ t = \frac{72}{6} \]
\[ t = 12 \]

It will take approximately 12 years for the investment to double in value.

The rule of 72 does not give an exact value. It approximates an investment's value after a given number of years. The rule is useful as it is a simple method of finding how much an investment is worth without having to use formulas or tables. You can determine how closely the rule of 72 approximates an actual value by using the compound interest formula.
Example 6
Refer to the previous example. Using the rule of 72, the number of years it takes for an investment to approximately double in value at 6% is 12.

Use the compound interest formula to determine the actual value of a $4000 investment with an interest rate of 6 percent compounded annually for 12 years.

Find the difference between the actual value of the investment and the doubled value obtained from the rule of 72.

\[ A = 4000 \left( 1 + \frac{0.06}{1} \right)^{1 \times 12} \]
\[ = 4000 (1 + 0.06)^{12} \]
\[ = 4000 (1.06)^{12} \]
\[ = 4000 (2.0122) \]
\[ = 8048.79 \]

After four years, the investment is worth $8048.79.

The difference between the actual value of the investment and the doubled value obtained from the rule of 72 = $8048.79 - $8000 = $48.79.
Assignment 2 – Compound Interest

1. A principal of $10,000 is invested for four years at 8% compounded annually. Calculate the interest earned using the table below.

<table>
<thead>
<tr>
<th>Year</th>
<th>( I = Prt )</th>
<th>Interest</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( 10,000 \times 0.08 \times 1 )</td>
<td>800</td>
<td>10,800</td>
</tr>
<tr>
<td>2</td>
<td>( 10,800 \times 0.08 \times 1 )</td>
<td>864</td>
<td>11,664</td>
</tr>
<tr>
<td>3</td>
<td>( 11,664 \times 0.08 \times 1 )</td>
<td>933.12</td>
<td>12,597.12</td>
</tr>
<tr>
<td>4</td>
<td>( 12,597.12 \times 0.08 \times 1 )</td>
<td>1007.77</td>
<td>13,604.89</td>
</tr>
</tbody>
</table>

Interest earned is $3,604.89.

2. A principal of $10,000 is invested for four years at 8% compounded annually. Calculate the interest earned using the compound interest formula.

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

\[ = 10,000 \left(1 + \frac{0.08}{1}\right)^4 \]

\[ = 13,604.89 \quad \text{total amount} \]

\[ - 10,000 \quad \text{principal} \]

\[ = \boxed{3,604.89} \quad \text{interest} \]

3. Calculate the interest earned if $1,000 is invested at a rate of 7% compounded annually for 7 years.

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

\[ = 1000 \left(1 + \frac{0.07}{1}\right)^7 \]

\[ = 1,605.78 \]

\[ = 1000 \]

\[ = 605.78 \quad \text{interest} \]
4. Calculate the interest earned if $250 is invested at a rate of 10% compounded semi-annually for 5 years.

\[ A = 250 \left( 1 + \frac{0.10}{2} \right)^{10} \]

\[ A = 467.22 \]  total

\[ -250.00 \]

\[ = 157.22 \]  interest

5. Calculate the interest earned if $50 000 is invested at a rate of 8% compounded daily for 3 years.

\[ A = 50000 \left( 1 + \frac{0.08}{365} \right)^{1095} \]

\[ A = 63560.79 \]  total

\[ -50000 \]

\[ = 13560.79 \]  interest

6. Calculate the interest earned if $4000 is invested at a rate of 6% compounded monthly for 6 years.

\[ A = 4000 \left( 1 + \frac{0.06}{12} \right)^{72} \]

\[ A = 5728.18 \]

\[ -4000 \]

\[ = 1728.18 \]  interest

7. Calculate the interest earned if $800 is invested at a rate of 9% compounded quarterly for 2 years.

\[ A = 800 \left( 1 + \frac{0.09}{4} \right)^{8} \]

\[ A = 955.86 \]

\[ = 155.86 \]  interest.
8. Calculate the interest earned if $25,000 is invested at a rate of 5 \frac{1}{2}\% \text{ compounded semi-annually for 4 years.}\]

\[ P = 25000, \quad r = 0.055, \quad t = 4, \quad n = 2, \quad nt = 8 \]

\[ A = 25000 \left( 1 + \frac{0.055}{2} \right)^8 \]

\[ A = 31059.51 \]

\[ \frac{-25000}{\text{total interest: } 6059.51} \]

9. Find the interest earned and the total amount in the account if $7300 is invested in a bank account that pays 2\% \text{ interest compounded semi-annually for 2 years.}\]

\[ t = 2, \quad n = 2, \quad nt = 4 \]

\[ 7300 \left( 1 + \frac{0.02}{2} \right)^4 \]

\[ = 7596.41 \text{ in total} \]

\[ \frac{-7300}{\text{total interest: } 296.41} \]

10. Find the interest earned and the total amount in the account if $1030 is invested in a bank account that pays 3.15\% \text{ interest compounded semi-annually for 3 years.}\]

\[ A = 1030 \left( 1 + \frac{0.0315}{2} \right)^6 \]

\[ = 1131.25 \text{ total amount} \]

\[ \frac{-1030}{\text{total interest: } 101.25} \]

11. Find the interest earned and the total amount in the account if $15000 is invested in a bank account that pays 2.60\% \text{ interest compounded quarterly for 5 years.}\]

\[ A = 15000 \left( 1 + \frac{0.0260}{4} \right)^{20} \]

\[ = 17075.24 \text{ total in account} \]

\[ \frac{-15000}{\text{total interest: } 2075.24} \]
12. Find the interest earned and the total amount in the account if $5000 is invested in a bank account that pays 2.85% interest compounded monthly for 6 years.

\[
A = 5000 \left(1 + \frac{0.0285}{12}\right)^{72}
\]

\[
A = 5931.25 \text{ total in account.}
\]

\[
\frac{5931.25 - 5000}{5000} = $931.25 \text{ interest.}
\]

13. Find the interest earned and the total amount in the account if $12000 is invested in a bank account that pays 0.65% interest compounded daily for 10 years.

\[
A = 12000 \left(1 + \frac{0.0065}{365}\right)^{3650}
\]

\[
= 12805.90 \text{ total}
\]

\[
\frac{12805.90 - 12000}{12000} = $805.90 \text{ interest.}
\]

14. Willard deposits $10000 into a bank account that pays 2% interest per annum. How long will it take his deposit to double?

\[
72 \div 2 = 36 \text{ years.}
\]

15. Wanda Waite invests $25000 for 18 years. At the end of this time, her investment will be worth $50000. Use the rule of 72 to estimate the interest rate.

\[
72 \div x = 18
\]

\[
18x = 72
\]

\[
x = 4
\]

\[
8 \div 4 = 40%
\]
Deciding How to Invest

As you may have guessed, investing your money is an easy way to increase the amount of money you have. Banks offer a number of different options for investing, so it is important to compare them and decide what is best for you based on your financial goals.

High-Risk Investments

High-risk investments are investments that may increase or decrease in value very rapidly. These investments may produce a large return, but this is not guaranteed. There is the risk that you may lose some or most of the money you invested. An example of a high-risk investment is the stock market.

Low-Risk Investments

You may have a low-risk investment already! If you have a savings account or a chequing account that pays interest, then you have a low-risk investment.

A low-risk investment is one where you will not likely lose any of the money you invest. Your investment will grow reliably and slowly. For example, money deposited into a savings account will be safe, and will pay small amounts of interest into your account on a regular basis.