Lesson 2: Compound Interest. Earning More Money

**Compound Interest:** The situation where interest is regularly added to the principal to, in turn, earn interest. Money invested with compound interest grows by multiplying by the growth factor \((1+i)\) so it is

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

For Compound Interest:

- \(A\) = Final Amount
- \(P\) = Principal
- \(i\) = interest rate *Per period* (remember decimal form) \(\left(\frac{\text{Rate}}{\text{freq}}\right)\)
- \(n\) = number of compounding periods

**Ex 1:** (Complete the chart)

<table>
<thead>
<tr>
<th>Annual Rate</th>
<th>Time (Years)</th>
<th>Compounding Period</th>
<th>Freq: Periods in one year</th>
<th>n</th>
<th>(i = \frac{\text{Rate}}{\text{freq}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>8%</td>
<td>3</td>
<td>annually</td>
<td></td>
<td>3</td>
<td>0.08</td>
</tr>
<tr>
<td>10%</td>
<td>7</td>
<td>semi-annually</td>
<td></td>
<td>14</td>
<td>0.05</td>
</tr>
<tr>
<td>12%</td>
<td>2</td>
<td>quarterly</td>
<td></td>
<td>8</td>
<td>0.03</td>
</tr>
<tr>
<td>10%</td>
<td>3</td>
<td>semi-annually</td>
<td></td>
<td>6</td>
<td>0.05</td>
</tr>
<tr>
<td>12%</td>
<td>2</td>
<td>monthly</td>
<td></td>
<td>24</td>
<td>0.01</td>
</tr>
</tbody>
</table>

**Example 2:** If Maria invests \$2500 in an account that pays 8% compounded quarterly, how much will she have after four years?

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

\[
A = 2500(1.02)^4 = 2500(1.082432) = 2606.08
\]

\[
A = 3431.96
\]

**Example 3:** What will a \$10\,000 Savings Bond be worth in 8 years if it pays 8% a compounded quarterly? How much interest was earned?

\[
A = 10000(1.02)^8 = 10000(1.172875) = 11728.75
\]

\[
A = 11728.75
\]

\[
I = 11728.75 - 10000 = 1728.75
\]
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Example 4: Let’s Compare Simple and Compound interest:

Larry wants to invest $700 for five years. Compare the growth of his investment at 4% per year simple interest, to the same investment at 4% per year compounded annually.

Simple Interest: \[ I = Prt \]
\[ I = 700(0.04)5 \]
\[ I = 140 \]
\[ A = 700 + 140 \]
\[ A = 840 \]

Compound Interest:
\[ A = P(1+i)^t \]
\[ A = 700(1.04)^5 \]
\[ A = 851.65 \]

Look at it in a table:

<table>
<thead>
<tr>
<th>Year</th>
<th>Interest</th>
<th>Value</th>
<th>Year</th>
<th>Interest</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simple</td>
<td>840</td>
<td></td>
<td>Compound</td>
<td>851.65</td>
</tr>
</tbody>
</table>

Look at it on a Graph: Go to Desmos to input the two equations:

Equation for Simple Interest: \[ A = 700 + 28t \]
Equation for Compound Interest: \[ A = 700(1.04)^t \]

Simple:

![Graph of Simple Interest]

Compound:

![Graph of Compound Interest]

What type of function is each?

Simple: Linear
Compound: Exponential

Does a compound interest account yield more money than a simple interest account if the rates are the same and why?

Yea because interest grows!