Simple interest is calculated by multiplying the principle, interest rate, and time together. It is an easy formula, but one which most financial institutions do not use. Instead the more common formula is one calculating compound interest.

Compound interest takes the interest generated by the principle and compounds it. What does that mean? Each time interest is calculated, the accumulated interest is added to the principle before it is calculated. Consider the example below of a loan where the $5000 principle is compounded over a three year term at 5%.

<table>
<thead>
<tr>
<th>Year</th>
<th>Calculation</th>
<th>Interest</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$5000 x 0.05 x 1</td>
<td>$250</td>
<td>$5250</td>
</tr>
<tr>
<td>2</td>
<td>$5250 x 0.05 x 1</td>
<td>$262.50</td>
<td>$5512.50</td>
</tr>
<tr>
<td>3</td>
<td>$5512.50 x 0.05 x 1</td>
<td>$275.63</td>
<td>$5788.13</td>
</tr>
</tbody>
</table>

Total money (principle + interest) = $5788.13
Interest earned = total money – original principle = $788.13

In simple interest, the total interest would have been $750. Using compound interest, the total interest earned is greater by $38.13.

Calculating compound interest would be incredibly painful if we had to do it this way. Fortunately we have a new formula which will do it in one smooth motion. Our new formula is to the right, where P = principle, i = rate (decimal) and n = time (years).

If we redo our original example, then we follow order of operations (BEDMAS) to solve:

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

\[ M = 5000(1 + 0.05)^3 \]
\[ M = 5000(1.05)^3 \]
\[ M = 5000 \times 1.157625 \]
\[ M = 5788.13 \]

Notice we get the same number. The value of M then gives us the sum of principle and interest. To determine interest alone, we just have to subtract the principle from it.

interest = 5788.13 – 5000 = $788.13

Activity 1: Answer the following questions.

a) Write the formula for compound interest in the box to the right:

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

b) What does the P in the formula stand for? _______________

c) What does the i in the formula stand for? ________ (written as a ____________)

d) What does the n in the formula stand for? ___________ (what are the units? __________)

e) Calculate the total owed and the compound interest on a $15,000 loan at 6% over 4 years
Homework:

1. Answer the following questions.
   a) Write the formula for compound interest in the box to the right: _______________________
   b) What does the P in the formula stand for? ______________________
   c) What does the i in the formula stand for? ________ (written as a _____________)
   d) What does the n in the formula stand for? _______________ (what are the units? __________)

2. Use the formula for compound interest \( M = P(1 + i)^n \) to determine the total amount owed and also the interest to be paid.
   a) $6500 borrowed at 4% over 3 years
   b) $8200 borrowed at 6% over 4 years
   c) $10,250 borrowed at 7½% over 5 years
   d) $16,900 borrowed at 8¼% over 6 years
   e) $25,000 borrowed at 3¾% over 9 years
   f) $250,000 borrowed at 4½% over 30 years

3. Calculate the monthly payments for questions a through f above. Remember to determine the total number of months (multiply years by 12) then divide the total owed by that number.
   a) ___________________________
   b) ___________________________
   c) ___________________________
   d) ___________________________
   e) ___________________________
   f) ___________________________

4. The Smiths need to remortgage their home. They are currently paying $2400/month. Will their $300,000 loan at 2⅛% over 25 years increase or decrease their monthly payments, and by how much?