Sample problems from Chapter 11.4

\[ PV = Pmt \frac{1 - \left(1 + \frac{r}{n}\right)^{-nt}}{\frac{r}{n}} \]

<table>
<thead>
<tr>
<th>Variables</th>
<th>What they mean.</th>
</tr>
</thead>
<tbody>
<tr>
<td>( PV )</td>
<td>Present Value, money in the account at the beginning of a time period</td>
</tr>
<tr>
<td>( Pmt )</td>
<td>Payment, the amount that is being deposited</td>
</tr>
<tr>
<td>( r )</td>
<td>Rate, this is the interest rate (written as a decimal)</td>
</tr>
<tr>
<td>( n )</td>
<td>Compounding Periods, number of times the account will compound in one year (if less than one year, the number of times it will compound)</td>
</tr>
<tr>
<td>( t )</td>
<td>Time, the number of YEARS the account is active</td>
</tr>
</tbody>
</table>

This formula will produce the payment for any amortized loan. Some examples would be a home loan or a car loan. In this section, we will be solving for payments, so the formula will be arranged like this:

\[ \frac{PV}{1 - \left(1 + \frac{r}{n}\right)^{-nt}} = Pmt \]

Example 1 (pg 493)

a) \[ \frac{25900}{1 - \left(1 + \frac{0.06}{12}\right)^{-12(4)}} = Pmt \]
Calculator:
Watch for the negative on your calculator! There are two negatives on your calculator. One is for subtraction and is in with the other operations. The other is smaller and down by the decimal, this one is for negative numbers. If you get a syntax error with this formula, you probably used the wrong negative.

\[
25900/\left(\left(1-(1+.06/12)^{-12*4}\right)/(.06/12)\right)
\]

Pmt = $608.26 per month

b) Interest per month I=PRT-> 25900 * .06 * \(\frac{1}{12}\) = 129.50.
So first payment gets 608.26-129.50=478.76 to the principal

c) 25900 – 478.76 = 25421.24 left after first payment

d) Interest per month I=PRT-> 25421.24 * .06 * \(\frac{1}{12}\) = 127.11.
So second payment gets 608.26-127.11 = 481.28 to the principal

e) 25421.24 – 481.28 = 24939.96 left after second payment

Example 2 (pg 494)

\[
\frac{17300}{1-(1+\frac{.12}{4})^{-4(2)}} = Pmt
\]

17300/\left(\left(1-(1+.12/4)^{-4*2}\right)/(.12/4)\right)

Pmt = $2464.50 per quarter

Tech tip
Amortization tables take a lot of time to figure and fill out. I want you to understand how and where the numbers are figured, but also want you to be tech savvy. In MS Excel, there is an amortization table already built in. Depending on your version there could be some small differences but the idea is much the same in most versions.

1) Open Excel
2) Click on “File” and go to “New”
3) This is where the versions are a little different.
   a. With newer versions, there will be a pane on the right that opens and has “Templates” and below that is “On my computer” Click that
b. Older versions will automatically open a dialogue box that has tabs on it like in the next step.

4) Look for a tab that says “Spreadsheet Solutions” (this may vary on older versions also. Just browse through the tabs)

5) Look for “Loan Amortization” and double click.

6) Now you will enter information about your loan and it will calculate the whole table, like part b in example 2 for you.

Example 3 (pg 496)

a) \[
\frac{17400}{1 - \left(1 + \frac{0.09}{12}\right)^{-12(5)}} = Pmt
\]

\[
17400/(((1-(1+.09/12)^{-12*5}))/(.09/12))
\]

Pmt = $361.20 per month

b) \[
\frac{17400}{1 - \left(1 + \frac{0.14}{12}\right)^{-12(5)}} = Pmt
\]

\[
17400/(((1-(1+.14/12)^{-12*5}))/(.14/12))
\]

Pmt = $404.87 per month

b) 60 * 361.20 = 21672 – 17400 = $4272

60 * 404.87 = 24292.20 – 17400 = $6892.20

c) So it costs you 6892.20 – 4272 = $2620.20 to have bad credit.

Sample problems from Chapter 11.5

Example 1 (pg 502)
a) \[ 140000 = Pmt \frac{1-(1+\frac{0.065}{12})^{-12(20)}}{\frac{0.065}{12}} \]

\[ \frac{140000}{1-(1+\frac{0.065}{12})^{-12(20)}} = Pmt \]

\[ 140000/(((1-(1+.065/12)^{-12*20}))/(.065/12)) \]

Pmt = $1043.80 per month

\[ 140000 \frac{1-(1+\frac{0.08}{12})^{-12(20)}}{\frac{0.08}{12}} = Pmt \]

\[ 140000/(((1-(1+.08/12)^{-12*20}))/(.08/12)) \]

Pmt = $1171.02 per month

\[ 140000 \frac{1-(1+\frac{0.065}{12})^{-12(30)}}{\frac{0.065}{12}} = Pmt \]

\[ 140000/(((1-(1+.065/12)^{-12*30}))/(.065/12)) \]

Pmt = $884.90 per month

\[ 140000 \frac{1-(1+\frac{0.08}{12})^{-12(30)}}{\frac{0.08}{12}} = Pmt \]

\[ 140000/(((1-(1+.08/12)^{-12*30}))/(.08/12)) \]

Pmt = $1027.27 per month

b)
1043.80 * 20 * 12 = $250,512 total cost
1171.02 * 20 * 12 = $281,044.80 total cost
884.90 * 30 * 12 = $318,564 total cost
1027.27 * 30 * 12 = $369,817.20 total cost

c)  
<table>
<thead>
<tr>
<th>20 years</th>
<th>30 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5%</td>
<td>110512</td>
</tr>
<tr>
<td>8%</td>
<td>141044.81</td>
</tr>
</tbody>
</table>

Example 2 (pg 503)

\[
\begin{align*}
\frac{195000}{1 - \left(1 + \frac{0.07}{12}\right)^{-12(30)}} &= Pmt = 1297.34
\end{align*}
\]

In example 1 in 11.4, we covered how to find the amount that is going to principal and interest from each payment. Below is some of the table that I created in Excel for you to check the first couple payments and see the last couple payments.

<table>
<thead>
<tr>
<th>Payment Number</th>
<th>Payment</th>
<th>Interest Payment</th>
<th>Principal Payment</th>
<th>Remaining Balance</th>
<th>Accumulated Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>195000</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1297.34</td>
<td>1137.50</td>
<td>159.84</td>
<td>194840.16</td>
<td>1137.50</td>
</tr>
<tr>
<td>2</td>
<td>1297.34</td>
<td>1136.57</td>
<td>160.77</td>
<td>194679.39</td>
<td>2274.07</td>
</tr>
<tr>
<td>3</td>
<td>1297.34</td>
<td>1135.63</td>
<td>161.71</td>
<td>194517.68</td>
<td>3409.70</td>
</tr>
<tr>
<td>Skip a few</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>359</td>
<td>1297.34</td>
<td>15.00</td>
<td>1282.34</td>
<td>1289.82</td>
<td>272034.83</td>
</tr>
<tr>
<td>360</td>
<td>1289.82</td>
<td>7.52</td>
<td>1282.29</td>
<td>0</td>
<td>272042.35</td>
</tr>
</tbody>
</table>

So notice that the last payment is OFTEN not the actual payment from the life of the loan. Usually the last payment is different to make the final amount $0 and the loan paid off.
Example 3 (pg 504)

\[
\frac{75000}{1 - \left(1 + \frac{0.0725}{12}\right)^{-12 \times 25}} = Pmt
\]

\[
75000/((1-(1+.0725/12)^{-12*25}))/(.0725/12))
\]

Pmt = $542.11 per month for loan

Total Payment = \( 542.11 + \frac{654 + 1329}{12} \) = $707.36