Sample problems from Chapter 9.1

Example 1 (pg 379) shows how compound compares to simple interest.

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

This is the real compounding formula. Your book likes to use tables which are not a real world application. All problems from Chapters 9, 10 and 11 can be done with formulas that I will give you. **DO NOT USE** the charts in the book! This will work for the problems the book gives you, but on tests, I will give you rates that are not in the book. **So learn to use the formulas**! When doing an example from the book, you may be a few cents from the answer in the book which is fine. The formula answer is more accurate. If you are off by dollars (unless an extremely large amount) you have done something wrong.

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

<table>
<thead>
<tr>
<th>Variables</th>
<th>What they mean.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(FV)</td>
<td><strong>Future Value</strong>, money in the account at the end of a time period in the future</td>
</tr>
<tr>
<td>(PV)</td>
<td><strong>Present Value</strong>, the amount the account originated with or presently have</td>
</tr>
<tr>
<td>(r)</td>
<td><strong>Rate</strong>, this is the interest rate (written as a decimal)</td>
</tr>
<tr>
<td>(n)</td>
<td><strong>Compounding Periods</strong>, 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><strong>Time</strong>, the number of <strong>YEARS</strong> the account is active</td>
</tr>
</tbody>
</table>

Example 2 (pg 379)

\[
FV = 3800 \left(1 + \frac{0.06}{1}\right)^{1(4)}
\]

Enter in your calculator (I am using a TI-30X for this....some will be different keystrokes): 3800(1+.06/1)^(1*4)

This will give you the amount after the principal has been in the bank for four years. $4797.41.
Example 3 (pg 380)
We really do not need to worry about this since we are not using the tables.

Example 4 (pg 381)
You can disregard the maturity value formula that is given from the book. The interest will be used though.

\[ FV = 2500 \left( 1 + \frac{0.07}{2} \right)^{2(3)} \]

a) On your calculator: \(2500(1+.07/2)^{2*3} = \$3073.14\)

b) So if you would have held onto the money for that time it would not have gained any interest. I always say like burying your money in the backyard or hiding it under the mattress. In this case, we would still have $2500 so the difference from the formula and the money under the mattress is your interest.

3073.14-2500 = $573.14 in interest.

Example 5 (pg 382)

a) \[ FV = 2000 \left( 1 + \frac{0.04}{1} \right)^{1(3)} \] Calculator: 2000(1+.04/1)(1*3) = 2249.73
Interest -> 2249.73 – 2000 = 249.73

b) \[ FV = 2000 \left( 1 + \frac{0.06}{2} \right)^{2(5)} \] Calculator: 2000(1+.06/2)(2*5) = 2687.83
Interest -> 2687.83 – 2000 = 249.73

c) \[ FV = 2000 \left( 1 + \frac{0.08}{4} \right)^{4(6)} \] Calculator: 2000(1+.08/4)(4*6) = 3216.87
Interest -> 3216.87 – 2000 = 1216.87

d) \[ FV = 2000 \left( 1 + \frac{0.12}{12} \right)^{12(2)} \] Calculator: 2000(1+.12/12)(12*2) = 2539.47
Interest -> 2536.47– 2000 = 536.47
Example 6 (pg 383)

a) \( FV = 15000 \left( 1 + \frac{0.06}{2} \right)^{2(15)} \) Calculator: \( 15000(1+0.06/2)^{(2*15)} = 36408.94 \)

b) \( FV = 15000 \left( 1 + \frac{0.08}{2} \right)^{2(15)} \) Calculator: \( 15000(1+0.08/2)^{(2*15)} = 48650.96 \)

c) \( FV = 15000 \left( 1 + \frac{0.10}{2} \right)^{2(15)} \) Calculator: \( 15000(1+0.10/2)^{(2*15)} = 64829.14 \)

Example Test Question
As a freshman in college, I invested $3300 that I got from graduation in an account to use for a down payment on a home. I put the money in an account that was compounding monthly at 4.75% and left it for 8 years. How much money will I have in the account when I make a down payment on my first home and how much is from interest?

\[ FV = 3300 \left( 1 + \frac{0.0475}{12} \right)^{12(8)} = 4821.92 \]  
Interest is \( 4821.92 - 3300 = 1521.92 \)

As you can see the interest rate 4.75% is not in your book, so you will have to use the formulas for the test!

Sample Problems from 9.2

Example 1 (pg 390)
Daily compounding always uses 365 unlike simple interest that could use either.

\[ FV = 12500 \left( 1 + \frac{0.035}{365} \right)^{60} = 12572.12 \]

Interest is \( 12572.12 - 12500 = 72.12 \)

Here are two ways to look at why \( nt \) was just 60.
Notice how the power of \( nt \) changed. Since the period was less than one year, we used the number of times the account compounded in the time it was left. The other way to look at this is to think of \( n \) as being 365 and \( t \) as being \( 60/365 \). Becky left the money for
that much of the year. So if we have \( nt \) we substitute to have \( 365(60/365) \) which is just 60.

**Example 2 (pg 391)**

From the table on the back cover
- Jan 10 -> 10\(^{th}\) day of the year
- Feb 18 -> 49\(^{th}\) day
- Mar 3 -> 62\(^{nd}\) day
- Apr 10 -> 100\(^{th}\) day

\[
FV = 2463 \left(1 + \frac{0.035}{365}\right)^{39} = 2472.23
\]

Then deposits which means add so 2472.23 + 1320 = 3792.23 is now in the account

\[
FV = 3792.23 \left(1 + \frac{0.035}{365}\right)^{13} = 3796.96
\]

Then another deposit 3796.96 + 840 = 4636.96 which is now in the account

\[
FV = 4636.96 \left(1 + \frac{0.035}{365}\right)^{38} = 4653.89
\]

is the amount in the account on April 10.

To find the interest that accrued we use the money that we placed in the account and take it away from the final amount in the account.

2463 + 1320 + 840 = 4623 that we put in the account

4653.89 - 4623 = 30.89 in interest

**Example 3 (pg 391)**

Days of the year
- July 20 -> 201
- Aug 29 -> 241
- Sept 29 -> 272
- Oct 1 -> 274

\[
FV = 24800 \left(1 + \frac{0.035}{365}\right)^{40} = 24895.30 \text{ to Aug 29}
\]

24895.30 – 3800 = 21095.30
Interest = 24895.30 – 24800 = 95.30

\[ FV = 21095.30 \left(1 + \frac{0.035}{365}\right)^{31} = 21158.10 \text{ to Sept 29} \]

21158.10 – 8200 = 12958.10
Interest = 21158.10 – 21095.30 = 62.80

\[ FV = 12958.10 \left(1 + \frac{0.035}{365}\right)^{2} = 12960.59 \text{ to Oct 1} \]

Interest = 12960.59 – 12958.10 = 2.49

Total interest = 95.30 + 62.80 + 2.49 = 160.59

Example 4 (pg 392)

\[ FV = 20000 \left(1 + \frac{0.04}{365}\right)^{365(2)} = 21665.65 \text{ Interest 21665.65 – 20000 = 1665.65} \]

Example 5 (pg 393)
No chart used.

Example 6 (pg 394)

\[ FV = 14650 \left(1 + \frac{0.035}{365}\right)^{365(1)} = 15171.80 \]

Here we are a few dollars off, but the book is associating the “quarter table” when the way the problem reads there are no quarters involved.

Inflation 14560 * 1.042 = 15265.30 so

15265.30 – 15171.80 = 93.50 loss in purchasing power.

Example Test Question

I deposited $12,000 and left it for 6 months. Then I deposited another $1500 and left that for 3 months. The account is compounded monthly at 5.5%. How much money is the account at the end of the time periods? How much did I make from interest?

Account:
Deposit 1500 so 12333.80 + 1500 = 13833.80

\[ FV = 12000 \left( 1 + \frac{0.055}{12} \right)^{6} = 12333.80 \]

Interest:

\[ 14024.89 - (12000 + 1500) = 524.89 \]

Sample Problems from 9.3

Still compound interest but now we are looking for the value that we have to invest now (Present Value) to get an (Future Value) amount at a later time.

Example 1 (pg 399)

\[ 12000 = PV \left( 1 + \frac{0.05}{1} \right)^{1(3)} \]

\[ \frac{12000}{(1 + \frac{0.05}{1})^{1(3)}} = PV \]

Calculator: 12000/((1+.05/1)^(1*3)) = 10366.05

So $10366.05 is the amount that you would have to put in this account today to have $12,000 in 3 years.

Therefore the interest is the difference between the two 12000 – 10336.05 = 1663.95

Example 2 (pg 401)

\[ 280000 = PV \left( 1 + \frac{0.06}{2} \right)^{2(1)} \]

\[ \frac{280000}{(1 + \frac{0.06}{2})^{2(1)}} = PV \]
You can check this by putting it into the compound formula like we did in 9.1 and 9.2. If you notice the book is a bit off. Ours would be much closer using the formula instead of a chart if you allow the calculator to do the work since there is no rounding.

Example 3 (pg 401)

Down payment = 8,000,000 * 40% = 3,200,000.

They need this amount in 3 years so it is a future value.

\[ 3200000 = PV \left( 1 + \frac{0.06}{1} \right)^{1(3)} \]

\[ \frac{3200000}{\left( 1 + \frac{0.06}{1} \right)^{1(3)}} = PV \]

Calculator: 3200000/((1+.06/1)^(1*3)) = 2,686,781.71

Example 4 (pg 402)

a) \( FV = 120000 \left( 1 + \frac{0.15}{1} \right)^{1(4)} \) = 209880.75 is the amount the business would be worth assuming that growth over a four year period.

b) \[ 209880.75 = PV \left( 1 + \frac{0.06}{4} \right)^{4(4)} \]

\[ \frac{209880.75}{\left( 1 + \frac{0.06}{4} \right)^{4(4)}} = PV = 165392.55 \]

This is the amount that the business would have to sell for today to make the same amount of money that you projected it to sell for in part a.
Example Test Question

I am setting up a fund for my son to go to college. I figure that he will need $50,000 by the time he is old enough to go to college. I found an account that pays 5.75% compounded monthly and I will be leaving the money for 17 years. What do I need to put in the account today to have money for his college?

\[
50000 = PV \left(1 + \frac{0.0575}{12}\right)^{12 \times (17)}
\]

\[
\frac{50000}{\left(1 + \frac{0.0575}{12}\right)^{12 \times (17)}} = PV = 18856.50
\]

I would have to put $18,856.50 in this account today to have $50,000 in 17 years.