More Applications of Systems of Equations

In this worksheet, you will answer several application questions by solving systems of linear equations.

You inherit $30,000 from a relative you never knew. You wisely choose to invest it for your retirement. You’ve heard many times that it’s a good idea to *diversify* your investments – that is to say, not to invest all your money in one place. So you decide to break it up into three separate investments: a Stock Market portfolio, a Government Bond, and a Money Market account. Let \( x \) be the amount you invest in the Stock Market, let \( y \) be the amount you invest in the Government Bond, and let \( z \) be the amount that you put in the Money Market account.

(a) Write an equation that states that your total investments will be $30,000.

(b) The following table represents the predicted annual interest rates for each of the investments:

<table>
<thead>
<tr>
<th>Stock Market</th>
<th>Government Bond</th>
<th>Money Market</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>7.5%</td>
<td>5%</td>
</tr>
</tbody>
</table>

You would like to have a total first-year return on your investment of 8.5%. That means, after one year of accruing interest, the total interest should be 8.5% of $30,000. Write an equation that expresses this.

(c) Your relative’s will requires that if you invest the money, you invest exactly as much in Government Bonds as you do in the Stock Market. Express this as an equation.

(d) You should now have three equations involving the three variables \( x \), \( y \) and \( z \). Write down an augmented matrix that represents the system, then solve it. (You may use your graphing calculator to row-reduce the matrix.) How much will you put in each investment?
You’ve discovered what you think is the perfect recipe for nacho dip: cheddar cheese, hot salsa, and peanut butter. So you’ve decided to start a business selling this stuff, and you need to determine how many supplies to purchase for the first batch. Let $x$ represent the number of cups of cheddar cheese, $y$ the number of cups of hot salsa and $z$ the number of cups of peanut butter. Note that if you add these all together, you get the total number of cups of nacho dip.

(a) You would like to start out by making 3000 cups of the nacho dip. Write an equation that says the total number of cups of nacho dip will be 3000.

(b) With some experimentation, you decide there should be twice as much hot salsa as peanut butter. You also decide there should be three times as much cheese as peanut butter. Write these facts as equation involving the variables $x$, $y$ and $z$.

(c) Solve this system of 3 equations to find out how much of each ingredient you should buy.
The coffee shop you own and operate roasts its own beans and sells them as blends. You roast 200 pounds of Kona beans and 300 pounds of Arabian beans each month. You’ve named the two blends that you sell “Foggy Morning” and “Columbia Valley”. Each pound of Foggy Morning blend is made of half a pound of Kona beans and half a pound of Arabian beans. Each pound of Columbia Valley Blend is really a third of a pound of Kona beans mixed with two-thirds of a pound of Arabian beans. How many pounds of each blend should you mix and sell each month in order to use up all of your roasted beans, with no leftovers?