Finite Math Section 2_3
Solutions and Hints

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for the book:
Finite Mathematics, 7th Edition
by S. T. Tan.

DO NOT PRINT THIS OUT AND TURN IT IN !!!!!!!!
This is designed to assist you in the event you get stuck.
If you do not do the work you will NOT pass the tests.

Section 2.3:

As with section 2.2 this section is often skimmed or skipped as the calculator offers a much easier way than the Gauss-Jordan method.

I strongly encourage you to learn how to use the calculator to solve these problems. It's rather straight forward:

1. Enter the augmented matrix into the calculator (say under the name [A])
2. Select the function rref (from matrix function)
3. Then select the matrix you created in step 1
   (i.e. on the screen should be rref [A])
4. Press enter and the calculator should display the Row REduced Form of the entered matrix.

Problems 13 to 32:
Either use the calculator to solve these or use it to check your final result.

Problem 34:
A dietitian wishes to plan a meal around three foods. The meal is to include 8800 units of vitamin A, 3380 units of vitamin C and 1020 units of calcium. The number of units of the vitamins and calcium in each ounce of the foods is summarized by the below table:

	Food I	**Food II**	**Food III**
Vitamin A	400	1200	800
Vitamin C	110	570	340
Calcium	90	30	60

Determine the amount of each food the dietitian should include in the meal in order to meet the vitamin and calcium requirements.

Note this problem will be solved using the rref function of the TI-83. See the beginning of this document for directions on how exactly to use this function.

The system of equations is created as follows:

Let x = ounces of food I in the meal
Let y = ounces of food II in the meal
Let z = ounces of food III in the meal

The needed amount of vitamin A is 8800 units
The amount of vitamin A from food I = 400x
The amount of vitamin A from food II = 1200y
The amount of vitamin A from food III = 800z
So we have:
Eq 1: $400x + 1200y + 800z = 8800$

The needed amount of vitamin C is 3380 units
The amount of vitamin C from food I = 110x
The amount of vitamin C from food II = 570y
The amount of vitamin C from food III = 340z
So we have:
Eq 2: $110x + 570y + 340z = 3380$

The needed amount of calcium is 1020 units
The amount of calcium from food I = 90x
The amount of calcium from food II = 30y
The amount of calcium from food III = 60z
So we have:
Eq 3: $90x + 30y + 60z = 1020$

So the system of equations is:
Eq 1: $400x + 1200y + 800z = 8800$
Eq 2: $110x + 570y + 340z = 3380$
Eq 3: $90x + 30y + 60z = 1020$

The augmented matrix is thus:

$$\left[\begin{array}{ccc|c} 400 & 1200 & 800 & 8800 \\ 110 & 570 & 340 & 3380 \\ 90 & 30 & 60 & 1020 \end{array}\right]$$

Using rref (or Gauss-Jordan elimination) we arrive at:

$$\left[\begin{array}{ccc|c} 1 & 0 & 1/2 & 10 \\ 0 & 1 & 1/2 & 4 \\ 0 & 0 & 0 & 0 \end{array}\right]$$

Which means:
$1x + 0y + 1/2z = 10$
$0x + 1y + 1/2z = 4$
$0x + 0y + 0z = 0$

Since the bottom row is all zeros (0 = 0) we know there are an infinite number of solutions to this problem. To express this we must place x, y and z into terms of t.

Let z = t.
Then we also have:
$x + 1/2z = 10 \rightarrow x + (1/2)t = 10 \rightarrow x = 10 - 0.5t$
and
$y + 1/2z = 4 \rightarrow y + (1/2)t = 4 \rightarrow y = 4 - 0.5t$

So our answer is:

The dietitian may put any amount *t* ounces of food III into the meal. He then must put (10 – 0.5t) ounces of food I and (4 – 0.5t) ounces of food II into the meal.
