

Sections 3.4 and 3.5 Systems of equations in three variables and applications

Working with “3 equations and 3 unknowns” is much like the “2 equations–2 unknowns”.

The technique I prefer is to select one equation and use it to eliminate the same letter in the remaining two equations. Once that has been achieved, we have the familiar “2 equations–2 unknowns”.

Example 2 page 180

$$\begin{cases} x + y + z = 4 \\ x - 2y - z = 1 \\ 2x - y - 2z = -1 \end{cases}$$

I select the top equation to use to eliminate the letter z in the other two equations:

$$\begin{array}{rcl} x + y + z = 4 & & 2x + 2y + 2z = 4 \\ x - 2y - z = 1 & \text{and} & 2x - y - 2z = -1 \\ \hline 2x - y & = & 5 \qquad 4x + y & = & 3 \end{array}$$

We now have two equations – two unknowns exactly like the previous unit.

Remember that you are to only add equations together **if you can eliminate** at least one letter.

Again, the text belabors the terms consistent and dependent. We continue to ignore these.

When doing the word problems, remember:

- A *Let* statement that contains an algebraic definition of all “participants” in the problem.
- An exact translation from English to algebra.
- A proper sentence (containing a subject, verb and is properly punctuated) that contains neither pronouns nor abbreviations. That closing sentence must address the problem. That is, it must answer the question asked or state the item found.

Math 104 Section 3.5 problem 3 from page 190

3. This problem describes 3 numbers. After the first sentence we should have written the following:

Let  $f = 1^{\text{st}}$  number  
 $s = 2^{\text{nd}}$  number  
 $t = 3^{\text{rd}}$  number

and

$$f + s + t = 26$$

“Twice the first minus the second is 2 less than the third.”

$$2 * f - s = t - 2$$

“The third is the second minus three times the first.”

$$t = s - 3 * f$$

so now we have

$$\begin{cases} f + s + t = 26 \\ 2f - s = t - 2 \\ t = s - 3f \end{cases}$$

Now we need each our equations in the same order ....

$$f + s + t = 26$$

$2f - s - t = -2$  We will add line 1 to line 2 and we will add line 2 to line 3 to eliminate

$$3f - s + t = 0$$

$t$ .

$$3f = 24$$

so  $f = 8$  and  $5 * 8 - 2s = -2$  gives  $-2s = -42$  so  $s = 21$ .

$$5f - 2s = -2$$

Finally  $8 + 21 + t = 26$  leads us to  $t = -3$ .

Finishing the problem with a sentence: The three numbers are 8, 21 and  $-3$ .