

## Solving Linear Systems on the TI-85

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**Propose:** To introduce the students to the SIMULT package on the TI-85.

**Target:** The students gain skill using the SIMULT package of the TI-85 and understand to two different phenomenon that can occur when the system is singular.

A. Solve each of the following systems "by hand," clearly indicating all the steps.

$$\begin{array}{rclcl} 1. & x & + & y & + & z & = & 3 \\ & -x & + & 2y & - & z & = & 0 \\ & 3x & - & y & + & 2z & = & 2 \end{array}$$

$$\begin{array}{rclcl} 2. & x & + & 5y & - & z & = & 2 \\ & 4x & - & y & + & 3z & = & 3 \\ & 8x & - & 2y & + & 6z & = & 7 \end{array}$$

$$3. \quad 3x + y + z = 0$$

$$\begin{array}{rcccccc} -5x & + & 5y & + & z & = & 0 \\ x & + & 2y & + & z & = & 0 \end{array}$$

The TI-85, henceforth referred to as "IT", has a built-in package for solving systems of  $n$  linear equations in  $n$  unknowns. We will use IT to solve each of the above problems 1-3. To access this package choose **2nd SIMULT** from the keyboard. IT asks for the **Number=**, meaning the number of equations and (equal) number of unknowns (the  $n$  above).

For our purpose choose Number= 3. (Press 3 then **ENTER** from the keyboard.) IT now asks for the coefficients of the 1st equation.

$a_{1,1}$  is the first coefficient in the first equation,  
 $a_{1,2}$  is the second coefficient in the first equation,  
 $a_{1,3}$  is the third coefficient in the first equation, and  
 $b_1$  is the constant in the first equation.

To enter problem #1 above into IT we enter

$a_{1,1}= 1$  (Press 1 and *arrow down* from the keyboard.)  
 $a_{1,2}= 1$  (Press 1 and *arrow down* from the keyboard.)  
 $a_{1,3}= 1$  (Press 1 and *arrow down* from the keyboard.)  
 $b_1= 3$  (Press 3 and *arrow down* from the keyboard.)

Now IT asks for the coefficients of the second equation. Enter them in similar fashion.

$a_{2,1}= -1$  (Remember to use (-) 1 to enter the negative of 1.)  
 $a_{2,2}= 2$   
 $a_{2,3}= -1$   
 $b_2= 0$

Finally IT asks for the coefficients of the third equation. Enter them, again in similar fashion.

$a_{3,1}= 3$   
 $a_{3,2}= -1$   
 $a_{3,3}= 2$   
 $b_3= 2$

(You can *up arrow* back through the entries to double check to see

if they are correct, if you wish.)

Now for the moment of truth: choose **SOLVE** from the bar menu (F5) and record the result. \_\_\_\_\_ Does it check with you "hand calculation?" \_\_\_\_\_ I bet IT was quicker, once you got the problem into the machine that is.

To enter a new 3 by 3 system into IT choose **COEFS** from the bar menu. This let's you change the coefficients to the ones in the new system by repeating the process described above.

What is IT's result for problem 2? \_\_\_\_\_

What is IT's result for problem 3? \_\_\_\_\_

Notice, unfortunately IT does not distinguish between the very different phenomenon that occurs and problem 2 and 3. If your life depended on finding values for  $x$ ,  $y$ , and  $z$  that satisfied a given 3 by 3 system of linear equations, which system would you prefer to be dealing with, #1, #2, or #3? \_\_\_\_\_ Why? \_\_\_\_\_

With which of these systems would you be doomed? \_\_\_\_\_ Why? \_\_\_\_\_

If you are trying to solve a system and IT replies "ERROR 03 SINGULAR MAT", what do you do next? (Remember, your life, not to mention your grade, depends on it.) \_\_\_\_\_