MATH 54 – HINTS TO HOMEWORK 1

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Here are a couple of hints to Homework 1. Make sure to attempt the problems before you check out those hints. Enjoy!

1. Section 1.1: Systems of linear equations

1.1.15. All you have to do are row-reductions until it is easier to see whether the equation has a solution or not. In particular, if one of the rows is of the form:

$$\begin{bmatrix} 0 & 0 & 0 & 0 & b \end{bmatrix}$$

then the system has no solution!

1.1.20. Solve the system as if h was a number! It might be useful to divide the second row by -2. Again, use the fact that if one of the rows is of the form:

$$\begin{bmatrix} 0 & 0 & 0 & 0 & b \end{bmatrix}$$

then the system has no solution!

The answer is $\boxed{h \neq -4}$

1.1.28. One way to do this is to start with the augmented matrix:

$$\begin{bmatrix} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & -1 \end{bmatrix}$$

And, for example, multiply each row by 2, or add the third row to the second, or interchange the first and second row. There's a whole world of different possibilities; just make sure not to destroy the system by either making it inconsistent, or by adding infinite solutions.

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SECTION 1.2: ROW REDUCTION AND ECHELON FORMS

1.2.5. Just argue by the number of pivots! There are three possible echelon forms here:

$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} \circ & \star \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} \circ & \star \\ 0 & \circ \end{bmatrix}$$

Where $\circ$ stands for 'pivot,' and $\star$ is any number (could be zero or not).

1.2.15, 1.2.23, 1.2.26. In each of the problems, the following fact will help you solve the problem:

Fact: A system is consistent if and only if in the row echelon form of the augmented matrix there is no row of the form

$$\begin{bmatrix} 0 & 0 & 0 & \cdots & b \end{bmatrix}$$

Where $b \neq 0$.

For **1.2.23**, **1.2.26**, it'll help to draw a picture of what the matrix in question looks like.

For **1.2.26**, try out a concrete example to convince you of this! Can you solve for z? If yes, can you solve for y? Finally, can you solve for x?

1.2.30. Underdetermined means 'fewer equations than unknowns'. Find two equations in three unknowns which give you a contradiction, such as $0 = 1$. The easiest way to do this is to write one equation, and then rewrite the same equation, but with a different number on the right.