Name:______________________________ Recitation Section:__________

Math 1553 Quiz 1, Spring 2020 (10 points, 10 minutes)
Lecture A (8:00 AM)

Solutions

Show your work on problem 4 or you may receive little or no credit. You do not need to show work or justify your answers on problems 1 through 3.

1. (1 point) Which of the following describes the set of all (x, y, z) in $\mathbf{R}^3$ that satisfy the equation $3x - y + z = 1$? Clearly circle one answer below.

(i) A single point in $\mathbf{R}^3$.

(ii) A line in $\mathbf{R}^3$.

$\boxed{\text{(iii)}}$ A plane in $\mathbf{R}^3$.

2. (1 point) Determine whether the following equation in the variables x, y, and z is linear or not linear. Clearly circle your answer.

$5x - \sin(4)y - 3^{1/4}z = 1$ $\boxed{\text{LINEAR}}$ NOT LINEAR

Note that $-\sin(4)$ and $-3^{1/4}$ are just real numbers that are coefficients for the y and z terms.

3. (4 points) Write a consistent system of three linear equations in the two variables x and y.

Solution.

Many possibilities. For example, you can take a consistent system of two equations in x and y and add them together to get the third equation and make the system consistent.

$$\begin{aligned} x + y &= 4 \\ x - y &= 2 \\ 2x &= 6. \end{aligned}$$

You could even use the equation "$0 = 0$" as an equation if you want.

Turn over to the back side for problem 4!

4. (4 points) Find all real values of h (if there are any) so that the following system of linear equations is inconsistent:

$$-2x + 3y = 6$$
$$8x - hy = 2.$$

Solution.

The answer is $h = 12$.

The student can use augmented matrices if they desire, or write things out the long way. We eliminate the $8x$ term in the second equation by adding four times the first equation to the second.

$$\left(\begin{array}{cc|c} -2 & 3 & 6 \\ 8 & -h & 2 \end{array}\right) \xrightarrow{R_2 = R_2 + 4R_1} \left(\begin{array}{cc|c} -2 & 3 & 6 \\ 0 & 12-h & 26 \end{array}\right)$$

The second line says $(12-h)y = 26$. If $h = 12$ then we will get $0 = 26$, making the system inconsistent. If $h \neq 12$ then we will be able to solve for y in terms of h and then back-substitute to get x, however these extra steps are not necessary in this problem.

Given how closely the material from 1.1 blends into 1.2, it is also fine if a student uses a pivots argument when getting $h = 12$.

An alternate method is to note that the system will be inconsistent precisely when the two lines given by the equations fail to intersect, which is when they are parallel non-identical lines. Multiplying the first equation by -4 shows our lines are

$$8x - 12y = -24$$
$$8x - hy = 2.$$

From this we see the lines are parallel non-identical lines precisely when $h = 12$.