Name:______________________________ Recitation Section:__________

Math 1553 Quiz 1, Spring 2020 (10 points, 10 minutes)
Lecture C (11:15 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 $2x + 7y - z = 2$? 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.

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

We have y inside of a sine function.

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:

$$3x - 5y = -1$$
$$9x + hy = 3.$$

Solution.

The answer is $h = -15$.

The student can use augmented matrices if they desire, or write things out the long way. We eliminate the $9x$ term in the second equation by subtracting three times the first equation to the second.

$$\left(\begin{array}{cc|c} 3 & -5 & -1 \\ 9 & h & 3 \end{array}\right) \xrightarrow{R_2 = R_2 - 3R_1} \left(\begin{array}{cc|c} 3 & -5 & -1 \\ 0 & h+15 & 6 \end{array}\right)$$

The second line says $(h+15)y = 6$. If $h = -15$ then we will get $0 = 6$, making the system inconsistent. If $h \neq -15$ 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 $h = -15$.

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 3 shows our lines are

$$9x - 15y = -3$$
$$9x + hy = 3.$$

From this we see the lines are parallel non-identical lines precisely when $h = -15$.