

Math 1553 Worksheet: Lines and planes in \mathbb{R}^n , §1.1, §1.2

1. For each equation, determine whether the equation is linear or non-linear, and circle your answer.

a) $3x_1 + \sqrt{x_2} = 4$ Linear Not linear

b) $e^\pi x + \ln(13)y = \sqrt{2} - z$ Linear Not linear

2. Consider the following three planes, where we use (x, y, z) to denote points in \mathbb{R}^3 :

$$2x + 4y + 4z = 1$$

$$2x + 5y + 2z = -1$$

$$y + 3z = 8.$$

Find all points where the planes intersect. In other words, find all solutions to the system of three linear equations given above.

3. For each of the following, answer true or false. Justify your answer.

a) Every system of linear equations has at least one solution.

b) There is a system of linear equations that has exactly 5 solutions.

4. a) Which of the following matrices are in row echelon form? Which are in reduced row echelon form?

b) Which entries are the pivots? Which are the pivot columns?

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \end{pmatrix} \qquad \begin{pmatrix} 1 & 1 & 0 & 1 & 1 \\ 0 & 2 & 0 & 2 & 2 \\ 0 & 0 & 0 & 3 & 3 \\ 0 & 0 & 0 & 0 & 4 \end{pmatrix}$$