

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

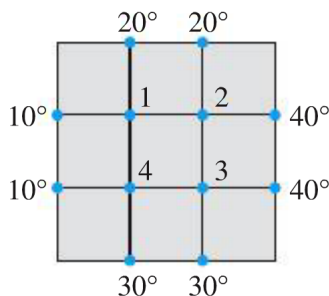
1. Which of the following equations are linear? Justify your answers.
 - a) $3x_1 + \sqrt{x_2} = 4$
 - b) $x_1 = x_2 - x_3 + 10x_4$.
 - c) $\pi x + \ln(13)y + z = \sqrt[3]{2}$
2. Find all values of h so that the lines $x + hy = -5$ and $2x - 8y = 6$ do *not* intersect.
3. Consider the following three planes in \mathbb{R}^3 :

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

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

$$y + 3z = 8.$$

Do all three of the planes intersect? If so, do they intersect at a single point, a line, or a plane?
4. 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.
 - c) If a , b , and c are real numbers, then the equation $ax + by = c$ in \mathbb{R}^3 describes a line.
5. The picture below represents the temperatures at four interior nodes of a mesh.



Let T_1, \dots, T_4 be the temperatures at nodes 1 through 4. Suppose that the temperature at each node is the average of the four nearest nodes. For example,

$$T_1 = \frac{10 + 20 + T_2 + T_4}{4}.$$

Write a system of four linear equations whose solution would give the temperatures T_1, \dots, T_4 . Next, write an augmented matrix that represents that system of equations.