Math 1553 Worksheet: Fundamentals, §1.1, and beginning §1.2

1. **a)** (Warm-up) Draw the set of all points in $\mathbf{R}^2$ that satisfy the equation $x - y = 0$, where we use (x, y) to denote points in $\mathbf{R}^2$.

b) Draw the set of all points in $\mathbf{R}^3$ that satisfy the equation $x - y = 0$, where we use (x, y, z) to denote points in $\mathbf{R}^3$. Geometrically, does this set form a line, a plane, or something else?

2. Richard Straker has eight light switches in order along a wall. He records which lights are on and which lights are off. To save time, he uses 0 to represent "off" and using 1 to represent "on" for each light.

a) Write an element of $\mathbf{R}^n$ (for some n) that represents the situation when all the lights are on. What is n?

b) Repeat part (a) when all lights are off.

3. Find all values of h so that the lines $x + hy = -5$ and $2x - 8y = 6$ do *not* intersect, and indicate what this means for the set of solutions to the linear system of equations

$$\begin{aligned} x + hy &= -5 \\ 2x - 8y &= 6. \end{aligned}$$

For all h so that the lines do not intersect, draw the line $x + hy = -5$ and the line $2x - 8y = 6$ to verify that they do not intersect.

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

$$\begin{aligned} 2x + 4y + 4z &= 1 \\ 2x + 5y + 2z &= -1 \\ y + 3z &= 8 \end{aligned}$$

Determine if all three of the planes intersect. If so, do they intersect at a single point, a line, or a plane?