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 $x - 2y = 0$, 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 $x - 2y = 0$, 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 seven 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 the last three lights are on, and the first four are off. What is n?

   b) Repeat part (a) when the first three lights are on and the rest 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

$$x + hy = -5$$
$$2x - 8y = 6.$$

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 $\mathbf{R}^3$:

$$2x + 4y + 4z = 1$$
$$2x + 5y + 2z = -1$$
$$y + 3z = 8$$

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