Math 1553 Worksheet: Fundamentals and §1.1

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. **a)** (Warm-up) In how many ways can two lines in the xy-plane intersect? Draw a quick picture for each case.

b) Is it possible for two planes in $\mathbf{R}^3$ to intersect in a line? If so, draw an example. Can you write a system of two equations that represents this?

c) Is it possible for the intersection of two planes in $\mathbf{R}^3$ to consist of exactly one point? If so, draw an example. Can you write a system of two equations that represents this?

d) Is it possible for the intersection of three planes in $\mathbf{R}^3$ to be exactly one point? If so, draw an example. Can you write a system of three equations that represents this?

4. For each equation, determine whether the equation is linear or non-linear. Circle your answer. If the equation is non-linear, briefly justify why it is non-linear.

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

b) $x^2 + y = z$ Linear Not linear

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