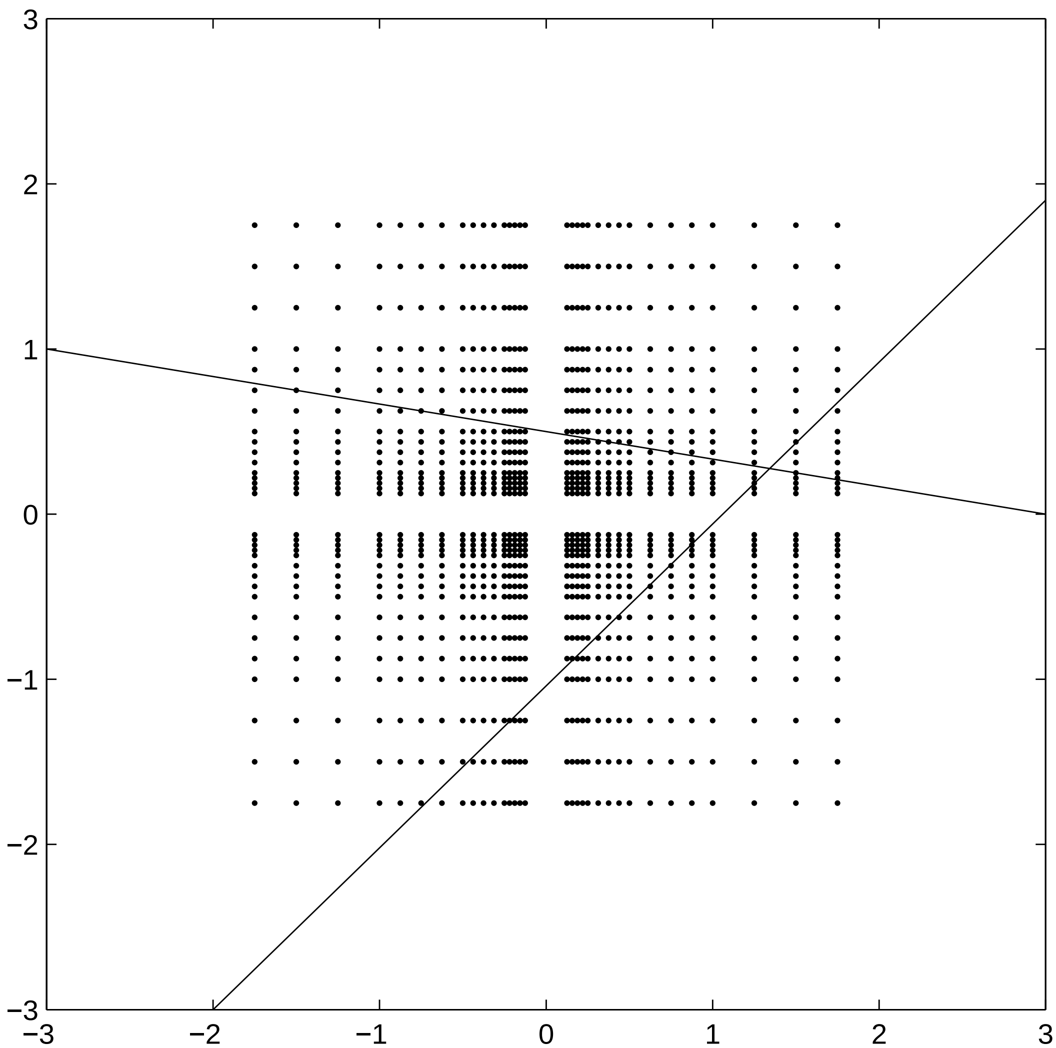
Linear Algebra in Floating Point

Here is the xy-plane as represented by a 5-bit floating point system. This picture is an extreme caricature: in most scientific computation applications we use 4 or 8 bytes of storage for each of our real numbers, not 5 bits. This picture exaggerates the gap near 0 (or $(0, 0)$) and has a very small range from biggest to smallest, but in the actual systems there *is* a gap near zero, and there *is* a finite range. If we used 4-byte storage, there would be about 4 billion dots in each row, but it would look just like this except the gap at the x and y axes wouldn't be visible, and the scale would be different.



Now suppose you are given a point $x = (x_0, y_0)$ and are to anwer the question "is x on the line L?". Think about how you might write a program to answer that question.

Solving $Ax = b$, where A is a 2×2 nonsingular matrix, is equivalent to finding the intersection of two lines in $\mathbb{R}^2$. Much of our course is about making sense of this in $\mathbb{R}^n$.