Homework 6
Coordinate Functions

1. Suppose our metric is the Euclidean metric. Find a coordinate function for the line $y = -2x + 3$ that maps the $y$-intercept $(0, 3)$ onto the real number 0.

2. Suppose that like the previous problem, I want a coordinate function for the line $y = -2x + 3$ that maps $(0, 3)$ onto the real number 0, but I want to reverse the direction of the way that the points on the line map to the real numbers. For example, if a point mapped onto -1 before, now I want it to map onto 1. What coordinate function would I use?

3. Find a coordinate function for the line $y = -2x + 3$ that maps $(4, -5)$ onto the real number -7.

4. Now suppose that I took the coordinate function from the first problem and added a real number $r$ to it. So for example, if the coordinate function was $f : (x, y) \mapsto x + 2$, the new function would be $g(x) : (x, y) \mapsto x + 2 + r$.
   a. Would the new function be a coordinate function? If so, prove it. If not, give a reason, preferably a counter example, that shows it is not.
   b. How does the new function change the way points are mapped to the real numbers? Or in other words, how does the new function change the “ruler” that we had imposed on the line?

5. Suppose now that we use the Taxicab metric. Find a coordinate function for the line $y = -2x + 3$ that maps the $y$-intercept $(0, 3)$ onto the real number 0.

6. Suppose now that I take the coordinate function from the previous problem, multiply it by -1 and add 6 to it.
   a. Would the new function be a coordinate function? If so, prove it. If not, give a reason, preferably a counter example, that shows it is not.
   b. How does the new function change the way points are mapped to the real numbers? Or in other words, how does the new function change the “ruler” that we had imposed on the line?

7. Now suppose that we use the square metric that was introduced in Problem 8 on p. 45 in your book. Find the coordinate function for the line $y = -2x + 3$ that maps the $y$-intercept $(0, 3)$ onto 1.

8. Suppose that we are using the square metric. If now instead of considering a specific line, let’s consider the line $y = nx + b$. Find the formula for the coordinate function for this line.

9. Given a metric for the Euclidean plane and a specific line, how many coordinate functions are there for that line? Justify your answer.