

# Extra credit problems

Math 427

0. Find a mistake or misprint in the book.
1. Describe all the motions of the Manhattan plane.
2. Construct a metric space  $\mathcal{X}$  and a distance preserving map  $f: \mathcal{X} \rightarrow \mathcal{X}$  which is not a motion of  $\mathcal{X}$ .
3. Note that the following quantity

$$\tilde{\angle}ABC = \begin{cases} \pi & \text{if } \angle ABC = \pi \\ -\angle ABC & \text{if } \angle ABC < \pi \end{cases}$$

can serve as the angle measure; that is, the axioms hold if one changes everywhere  $\angle$  to  $\tilde{\angle}$ .

- (a). Show that  $\angle$  and  $\tilde{\angle}$  are the only possible angle measures on the plane.
- (b). Show that without Axiom IIc, this is not longer true.