

## MATHEMATICS 3100-1. Homework # 11.

April 2

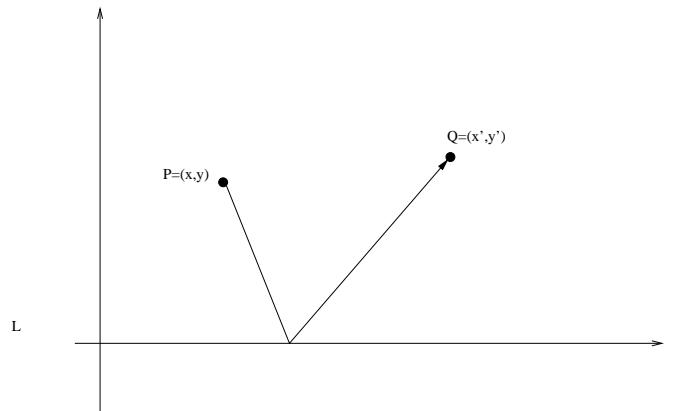
1. Suppose that  $m$  is a motion of the plane  $\mathbb{R}^2$ . Show that  $m$  sends straight lines to straight lines. (Recall that a straight line is the solution set of a linear equation  $ax + by + c = 0$ , where  $(a, b) \neq (0, 0)$ .)

Hint: It suffices to check the assertion only for the basic motions: translations, rotations about the origin and the vertical flip. See the handout "Triangle inequality and lines in the plane" (Class' Homepage) for the case of translations. Then consider rotations and the flip.

2. Consider points  $P = (x, y), Q = (x', y')$  in the plane, so that  $y > 0, y' > 0$ . Suppose that a fly sits at the point  $P$  and it wants to *fly* to  $Q$  by going first to the  $x$ -axis  $L$  (along a straight line), then bounce off the line  $L$  and go straight to the point  $Q$ . See Figure below.

Question: What is the shortest distance for the fly's travel?

(Hint: Use the vertical flip in  $\mathbb{R}^2$ .)



3. Find equation of a straight line through the points  $(1, 1)$  and  $(2, -1)$ . Hint: Find  $m$  and  $b$  in the line equation  $y = mx + b$  by solving a system of two linear equations.