1. Problem II.18, page 43. See Figure II.16. Note that the plane \( P \) contains the origin.

2. An affine transform \( A \) in \( \mathbb{R}^2 \) is defined as \( A = R_{-\pi} \circ T_{\langle 0,2 \rangle} \circ R_{\pi} \circ S_{1,1} \), where \( S_{a,b} \) denotes a scaling transformation. Draw, on righthand side below, how the “F” is transformed by \( A \). Be sure to label enough points to make your answer clear.

3. Express the transformation \( A \) from problem 2 as a 4 \( \times \) 4 matrix acting on homogeneous coordinates.

4. A light source is placed at \( \langle -1, 0, 0 \rangle \) and it casts shadows onto the plane \( P \) defined by \( x = 5 \). The plane \( P \) is parallel to the \( yz \)-plane and is like an infinite wall. For \( \langle x, y, z \rangle \) is a point in \( \mathbb{R}^3 \) with \(-1 < x \leq 5\), define \( A(\langle x, y, z \rangle) \) to be the position of the shadow of the point on the plane \( P \). For example, \( A(\langle 2, 3, 1 \rangle) = \langle 5, 6, 2 \rangle \) and \( A(\langle 3, 4, 2 \rangle) = \langle 5, 6, 3 \rangle \).

   a. Working in ordinary coordinates (not homogeneous) give the formula expressing the mapping \( A(\langle x, y, z \rangle) = \langle x', y', z' \rangle \). That is, give formulas for \( x', y', z' \) in terms of \( x, y, z \).

   b. Give a 4 \( \times \) 4-matrix that represents the transformation \( A \) over homogeneous coordinates.