

## Progress Report: Matrices and Transformations

Group: \_\_\_\_\_

**1.** Using the results above, find the matrices that would be associated with a rotation  $M_{30}$  of 30 degrees and a reflection about  $l$ , where  $l$  makes an angle of 30 degrees with the  $x$ -axis. Use the matrices to find the image of  $P = (2, 5)$ ,  $Q = (-1, 3)$  and  $S = (-2, 3)$  under  $M_{30}$  and  $R_l$ .

**2.** Use the reflection and rotation feature of GSP to confirm your answers to question 1.

**3.** Using the definition of the Euclidean distance function, verify that reflections are distance preserving. (This is just a bit of algebra, but it is worth doing.)

**4.** Give a short proof, with no algebra, that the composition of two isometries is an isometry.

5. Using the results above, show that if  $l$  and  $m$  are two lines through the origin, then  $R_m \circ R_l$  is a rotation. Do this by showing that the product of two matrices of the form  $\begin{bmatrix} a & b \\ b & -a \end{bmatrix}$  ( $a^2 + b^2 = 1$ ) is a matrix of the form  $\begin{bmatrix} c & -d \\ d & c \end{bmatrix}$  ( $c^2 + d^2 = 1$ ).

6. Group Process: You are (finally) in a new group! What practices did you find beneficial in your old group and will try to bring to this group?