

## Mathematics 308—Second homework—due Wednesday, October 2

1. Let  $T$  be a shear along the axis  $\theta = 33^\circ$  with displacement parameter  $a = 2$ . What is the matrix of  $T$ ?
2. Write a PostScript procedure that shears your current coordinate system. It should have two parameters  $a$  and  $\theta$ , so that `1 45 shear` shears 1 unit along the axis  $\theta = 45^\circ$ .

3. The matrix

$$\begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix}$$

is a scale change. By what factors and along what axes?

4. Write a PostScript procedure with three parameters  $a$ ,  $b$ ,  $\theta$  which scales by  $a$  along the axis at angle  $\theta$ ,  $b$  in the direction perpendicular to that.
5. Find the  $3 \times 3$  matrix representing the affine transformation taking  $(1, 1)$ ,  $(-1, 1)$ , and  $(-1, 0)$  to  $(1, 2)$ ,  $(2, 3)$ , and  $(0, 1)$  respectively. *Hint: Move the first three points to  $(0, 0)$ ,  $(1, 0)$ ,  $(0, 1)$  first.*
6. Write a PostScript procedure which draws a regular polygon of  $N$  sides with radius  $r$ , centred at the origin, and with one radius along the positive  $x$  axis.