

Q2 Shearing wot x

(a)  $Shx = 2$

(b)  $Shy = 3$

(c)  $Shx = 2, Shy = 3$

(a) Shearing in x only

$$\begin{bmatrix} A' & B' & C' \\ x_1' & x_2' & x_3' \\ y_1' & y_2' & y_3' \\ 1 & 1 & 1 \end{bmatrix} = \begin{bmatrix} 1 & Shx & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ 1 \end{bmatrix}$$

2

(b)

$$= \begin{bmatrix} 1 & 0 & 0 \\ Shy & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ 1 \end{bmatrix}$$

3

Shear in both  $x, y$ .

(c) ~~$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 1 & \sin \alpha & 0 \\ 0 & \cos \alpha & 0 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$~~

$$\begin{bmatrix} x' \\ y' \\ z' \end{bmatrix} = \begin{bmatrix} 1 & \sin \alpha & 0 \\ \sin \alpha & \cos \alpha & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

Diagram showing the transformation matrix for shear in both  $x$  and  $y$  directions. The matrix is a 3x3 matrix with elements  $1, \sin \alpha, 0$  in the first row,  $\sin \alpha, \cos \alpha, 0$  in the second row, and  $0, 0, 1$  in the third row. The columns are labeled  $x, y, z$  and the rows are labeled  $x', y', z'$ . Arrows point from the labels  $x, y, z$  to the corresponding columns. The elements  $\sin \alpha$  and  $\cos \alpha$  are circled, and the element  $1$  in the second row, second column is also circled.