

**Shears - Exercises** (1 page; 4/6/19)

(1) Consider the matrix  $\begin{pmatrix} a & c \\ b & d \end{pmatrix}$ , which represents a shear. Show that it is not possible for all of the elements of the matrix to be positive.

(2) If the  $2 \times 2$  matrix  $M$  represents a shear, what can be said about  $M^{-1}$ ?

(3) Find the invariant lines of the shear represented by the matrix  $\begin{pmatrix} 4 & -3 \\ 3 & -2 \end{pmatrix}$

(4) For the shear  $\begin{pmatrix} -1 & 1 \\ -4 & 3 \end{pmatrix}$ , find the shear factor, and show that the point  $\begin{pmatrix} 2 \\ 5 \end{pmatrix}$  is displaced by the expected amount in the direction of the line of shear.

(5) Show that  $\frac{(a-1)^2+c^2}{c} = -\frac{b^2+(1-d)^2}{b}$  for the shear  $\begin{pmatrix} a & c \\ b & d \end{pmatrix}$ .

(6) Find the invariant lines of the shear represented by the matrix  $\begin{pmatrix} 7 & -4 \\ 9 & -5 \end{pmatrix}$