

Shears - Exercises (1 page; 22/2/20)

Key to difficulty:

* easier

** moderate

*** harder

(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 2×2 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 $\begin{pmatrix} 7 & -4 \\ 9 & -5 \end{pmatrix}$