

CS3388B, Winter 2023

Problem Set 2

Due: January 20, 2023

Exercise 1.

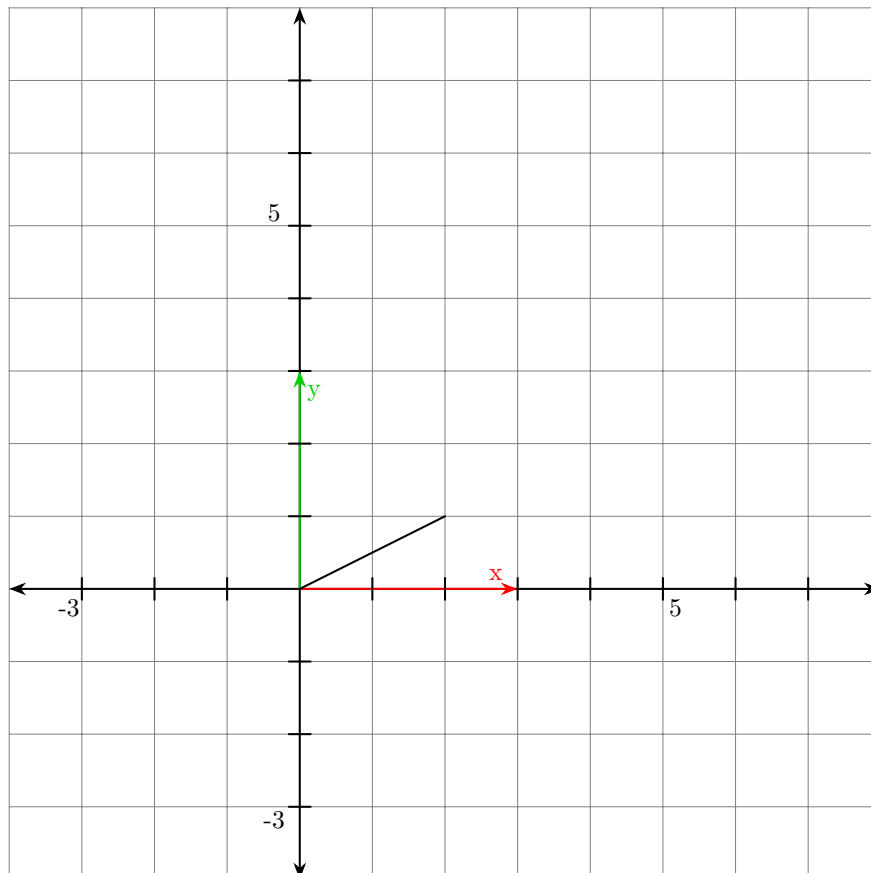
Consider a window with width 1000px and height 800px with a viewport whose opposite corners, in pixels, are (200, 100) and (800, 700).

Give the viewport matrix which transforms normalized device coordinates to this viewport.

Exercise 2. Consider the following affine transforms:

$$T = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & 3 \\ 0 & 0 & 1 \end{bmatrix} \quad R = \begin{bmatrix} \cos(30) & -\sin(30) & 0 \\ \sin(30) & \cos(30) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Let $M_1 = TR$ and $M_2 = RT$ be two transformation matrices. Consider the line segment defined by $v_1 = (0,0)$ and $v_2 = (2,1)$. Draw the line segment when transformed by M_1 and when transformed by M_2 . Describe, in words, what is the difference between the affine transforms M_1 and M_2 ? Why is the result different?



Exercise 3.

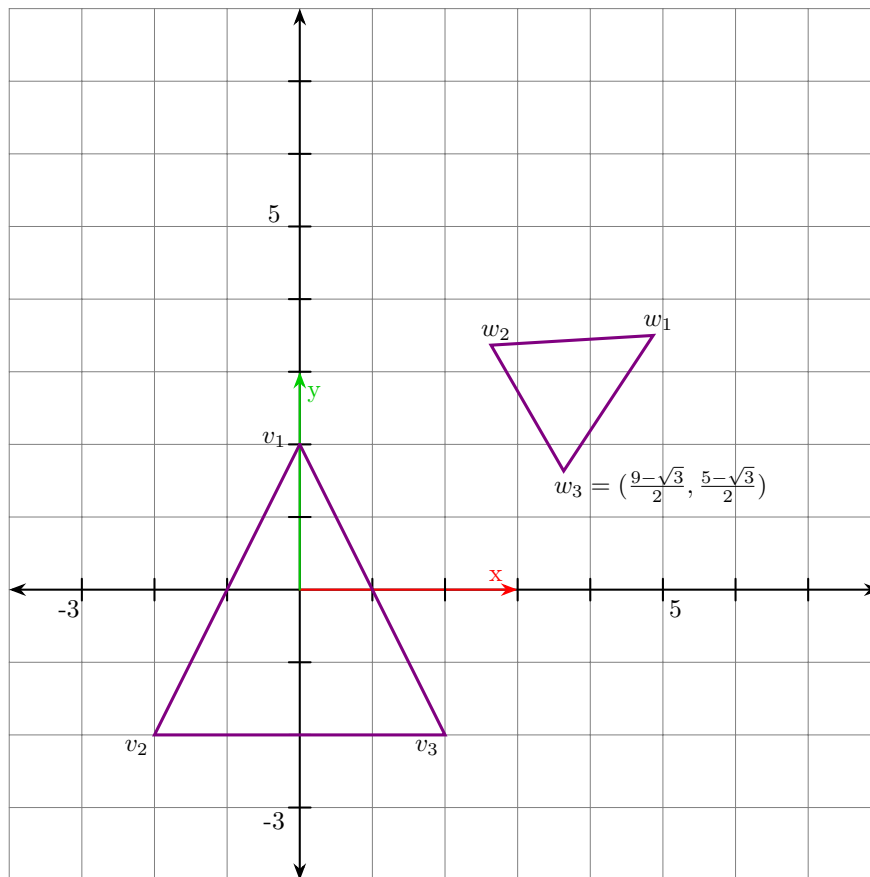
Consider the shear matrix

$$S = \begin{bmatrix} 1 & m \\ 0 & 1 \end{bmatrix}.$$

Find the inverse of S in homogeneous coordinates and show that $SS^{-1} = I_3$, the 3x3 identity matrix.

Exercise 4.

The below triangle (v_1, v_2, v_3) has been affinely transformed to (w_1, w_2, w_3) by a combination of a scaling, a translation, and a rotation. Let those individual transformations be described by the matrices S, T, R , respectively.



Using homogeneous coordinates, find the matrices S, T, R . Then find (through matrix-matrix and matrix-vector multiplication) the coordinates of w_1 and w_2 . What is the correct order of matrix multiplications to get the correct result?