# CPSC 314 Homework 2

**NOTE:** These homework problems and the ones coming in future weeks are not graded. **However**, I strongly encourage you to take them seriously as a preparation for Quiz 1, and the other exams!

This set of homework problems deals with perspective transformations, as well as transformation hierarchies. The solutions will be discussed in the week of January 26-30.

## Problem 1: Perspective Transformation in 2D

a) In class, we discussed that you need to specify the mapping of 5 points in general position to uniquely describe a 3D perspective transformation. How many points are required if we restrict ourselves to 2D?

b) Derive the $3 \times 3$ homogeneous matrix that maps the asymmetric view frustum drawn below into the square with corners at $(-1, -1)^T \ldots (1, 1)^T$.
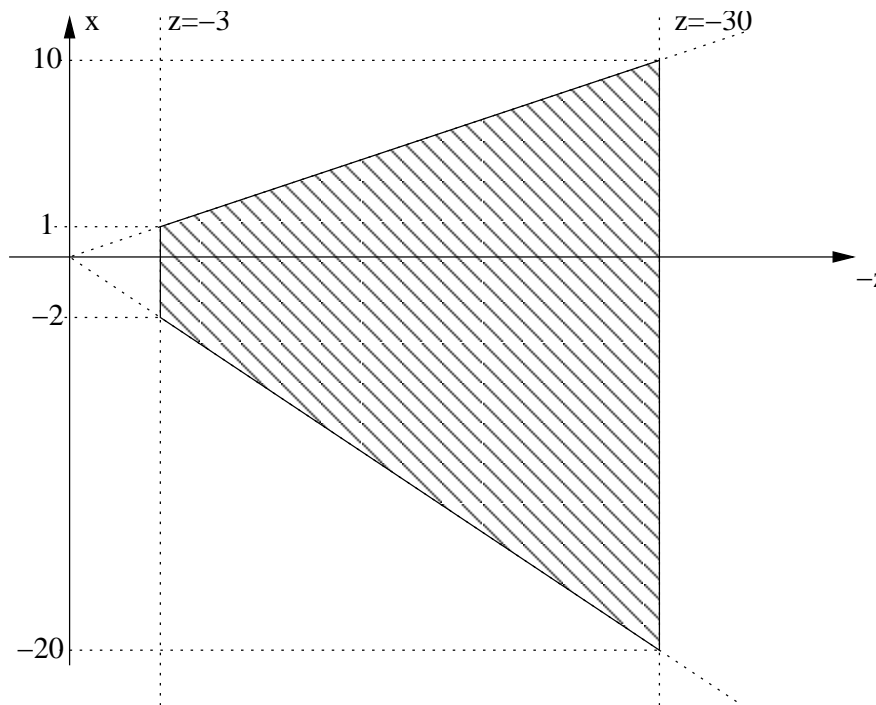


## Problem 2: Hierarchical Transformations

Give an appropriate sequence of the following commands for drawing the scene depicted in the figure below. Assume that the current transformation matrix is initialized to the identity.

Commands (all transformation matrices are multiplied to current transformation matrix from the right):

- `drawSquare()`: draw a 1×1 square, bottom left corner at origin

- `translate( x, y )`: translation by x, y

- `scale( x, y )`: scaling in x and y direction

- `rotateZ( theta )`: rotation around z axis (i.e. in x-y plane)

- `pushMatrix()`: duplicates top entry of matrix stack

- `popMatrix()`: deletes top entry of matrix stack