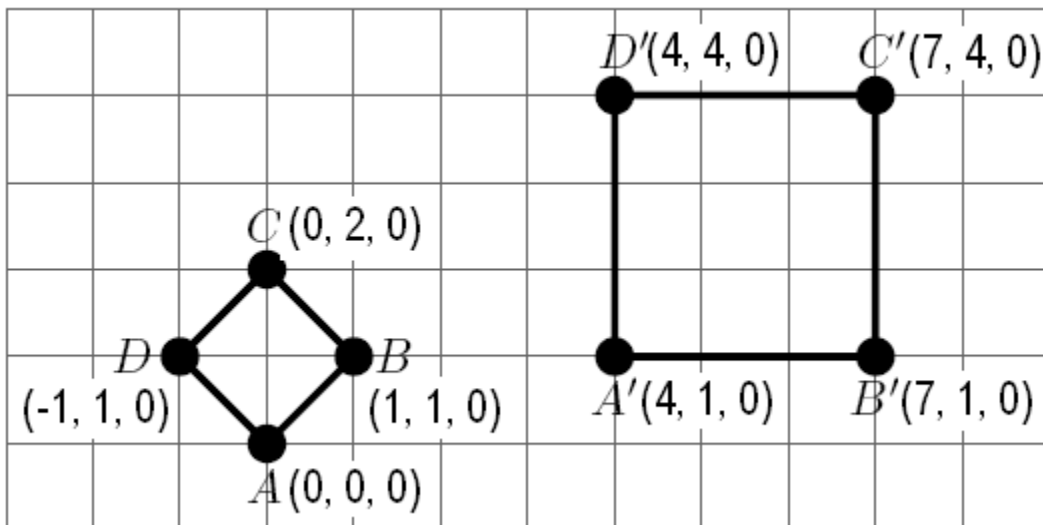


Self-assessment: Chapter 4

1. Do textbook exercises 4.1, 4.19 and 4.25.
2. Show that the following does not commute: A rotation and a translation
Under which conditions will these two transformations commute?
3. In this chapter many "frames" (coordinate systems with origin) are mentioned. Which different frames may be used on the way from modeling to rasterisation? Describe what each frame is for, and describe briefly the transformation to the next frame in each case.
4. Consider a triangular prism with vertices a, b, c, d, e and f at $(0, 0, 0), (1, 0, 0), (0, 0, 1), (0, 2, 0), (1, 2, 0)$ and $(0, 2, 1)$, respectively.

Compute the coordinates of the vertices $b(1, 0, 0)$ and $f(0, 2, 1)$ that result after each application of the following sequence of transformations of the given triangular prism:

- 4.1 Perform scaling by a factor of 1.5 along the x -axis.
 - 4.2 Then perform a clockwise rotation by 45° about the y -axis.
 - 4.3 Then Perform 4 unit translation along the z axis.
5. Consider the diagram below and answer the question that follows:



Determine the transformation matrix which will transform the square ABCD to the square A'B'C'D'. Show all workings

6. What is the 4x4 homogeneous matrix for a 3D rotation by 90 degrees about the X axis, followed by this translation: $x'=x-1$, $y'=y+1$, $z'=z+2$.
7. Consider the following 4x4 matrices:

$$\begin{array}{l}
 A \begin{bmatrix} \sqrt{2} & -\sqrt{2} & 0 & 0 \\ \sqrt{2} & \sqrt{2} & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 2 \end{bmatrix} \quad
 B \begin{bmatrix} 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad
 C \begin{bmatrix} 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad
 D \begin{bmatrix} 3 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 3 \end{bmatrix} \quad
 E \begin{bmatrix} 3 & 0 & 0 & 0 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 3 \end{bmatrix} \quad
 F \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 3 \end{bmatrix}
 \end{array}$$

Which of matrices reflect the following (write down the correct letter):

- 7.1 Identity matrix (no effect)
- 7.2 Uniform scaling
- 7.3 Non-uniform scaling
- 7.4 Reflection
- 7.5 Rotation about z
- 7.6 Rotation

- 2.2.1 Identity matrix (no effect) D
- 2.2.2 Uniform scaling F
- 2.2.3 Non-uniform scaling E
- 2.2.4 Reflection C
- 2.2.5 Rotation about z A
- 2.2.6 Rotation B