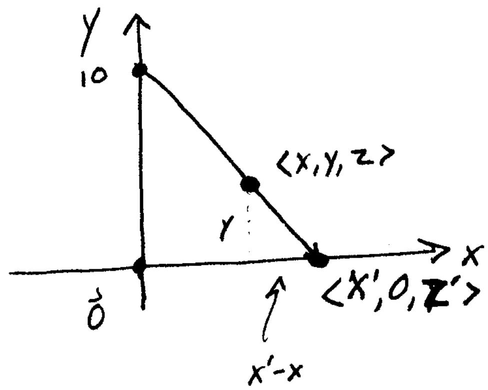
Homework #2 – ANSWERS – CSE 167 – Intro to Computer Graphics, – Fall 2003

1.

(a)
$$\begin{pmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 2 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

(b)
$$\begin{pmatrix} \sqrt{3}/2 & 0 & 1/2 & 0 \\ 0 & 1 & 0 & 0 \\ -1/2 & 0 & \sqrt{3}/2 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

2 $A: \langle x, y, z\rangle \mapsto \langle x', y', z'\rangle$
as shown in the figure, with $y' = 0$



By similar triangles,

$$\frac{x'-x}{y} = \frac{x'}{10}$$

Solving for x' gives: $x'\left(\frac{1}{y} - \frac{1}{10}\right) = \frac{x}{y}$

So $$x' = \frac{x}{y}\cdot\frac{y\cdot 10}{10-y} = \frac{10x}{10-y}$$

Similar reasoning gives $z' = \frac{10\cdot x}{10-y}$.

So $A: \langle x, y, z\rangle \mapsto \left\langle \frac{10x}{10-y}, 0\ \frac{10z}{10-y}, 1\right\rangle \equiv \langle 10x, 0, 10z, 10-y\rangle$

or in homogeneous coordinates:

$$A: \langle x, y, z, u\rangle \equiv \langle x/u, y/u, z/u, 1\rangle \mapsto \langle 10x/u, 0, 10z/u, 10 - y/u\rangle$$
$$\equiv \langle 10x, 0, 10z, 10u - y\rangle$$

Thus $A: \langle x, y, z, u\rangle \mapsto \langle 10x, 0, 10z, 10u - y\rangle$ and A can be represented

by
$$\begin{pmatrix} 10 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 10 & 0 \\ 0 & -1 & 0 & 10 \end{pmatrix}.$$

(3–8): on next pages, <u>not</u> available online.