

Name:

PID:

1. A light source is placed at  $\langle -9, 0, 0 \rangle$  and it casts shadows onto the plane  $P$  defined by  $x = 3$ . The  $x = 3$  plane is parallel to the  $yz$ -plane and acts like an infinite wall.

When  $\langle x, y, z \rangle$  is a point in  $\mathbb{R}^3$  with  $-9 < x \leq 3$ , define  $A(\langle x, y, z \rangle)$  to be the position of the shadow of the point on the  $yz$ -plane. For example,  $A(\langle -3, 2, 1 \rangle) = \langle 3, 4, 2 \rangle$ , and  $A(\langle -6, 2, 1 \rangle) = \langle 3, 8, 4 \rangle$ .

(a) Working in ordinary coordinates (not homogeneous) give the formula expressing the mapping  $A(\langle x, y, z \rangle) = \langle x', y', z' \rangle$ . That is, give formulas for  $x', y', z'$  in terms of  $x, y, z$ .

(b) Give a  $4 \times 4$ -matrix that represents the transformation  $A$  over homogeneous coordinates.