

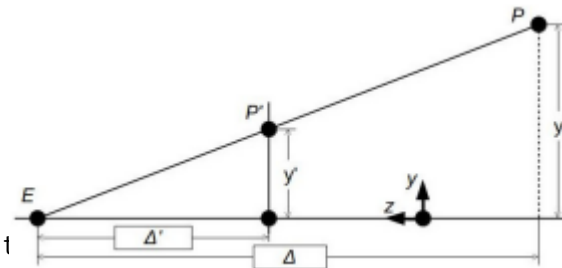
1. Let  $T$  be the triangle with vertices  $\mathbf{P} = (3, 8, 7)$ ,  $\mathbf{Q} = (4, 1, 3)$ , and  $\mathbf{R} = (3, 7, 7)$ , with the given order.
  - a. Find an orientation vector for  $T$ .
  - b. Is  $T$  visible to a viewer located at the point  $\mathbf{E} = (0, 4, 4)$ ?
  - c. Suppose that a single light source shines light parallel to the vector  $\mathbf{L} = \langle 2, 4, 2 \rangle$ . Moreover,  $T$  has **color (112, 62, 215)** at normal incidence. Using the diffuse shading model discussed in class, what color does  $T$  appear to be? We are using an integer color model with 8-bit components

2. Let  $T$  be the triangle with vertices  $\mathbf{P} = (9, 6, 4)$ ,  $\mathbf{Q} = (3, 5, 2)$ , and  $\mathbf{R} = (6, 3, 3)$ , with the given order.
  - a. Find an orientation vector for  $T$
  - b. Is  $T$  visible to a viewer located at the point  $\mathbf{E} = (4, 1, -2)$ ?
  - c. Suppose that a single light source shines light parallel to the vector  $\mathbf{L} = \langle 4, 0, 7 \rangle$ . Moreover,  $T$  has **color (124, 89, 127)** at normal incidence. Using the diffuse shading model discussed in class, what color does  $T$  appear to be? We are using an integer color model with 8-bit components

3. Explain why surface receives the maximum amount of light when the light direction is parallel to the surface normal.

4. Suppose that the center of projection is the point  $E = (0, 0, 15)$  and the plane of projection is  $z = 10$ .

- a. Find the values of  $\Delta$  and  $\Delta'$ , the distances indicated in the diagram below. Here  $P = (x, y, z)$  is a point, and  $P' = (x', y', z')$  is its perspective projection.

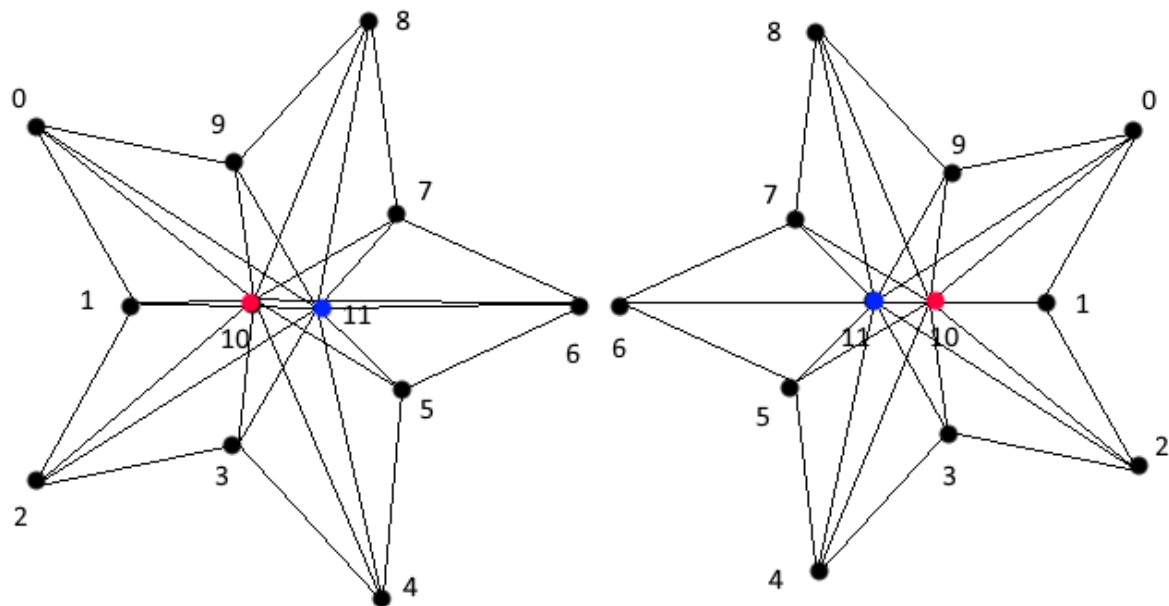


- b. Find a formula for  $P' = (x', y', z')$  in terms of  $P = (x, y, z)$ .

- c. Find a  $4 \times 4$  matrix that represents perspective projection in this case.

- d. Use this matrix to compute the perspective projection of the point  $P = (2, 2, 4)$ .

5.



We wish to construct a 3D triangular mesh for the star. The vertex array and face list are indicated by the diagram (vertex[10] and vertex[11] are the center of the polygon and they are separated by certain distance.)

- a. What is the total number of vertices for polygon above?
- b. What is the total number of faces for polygon above?
- c. What is the total number of edges for polygon above?