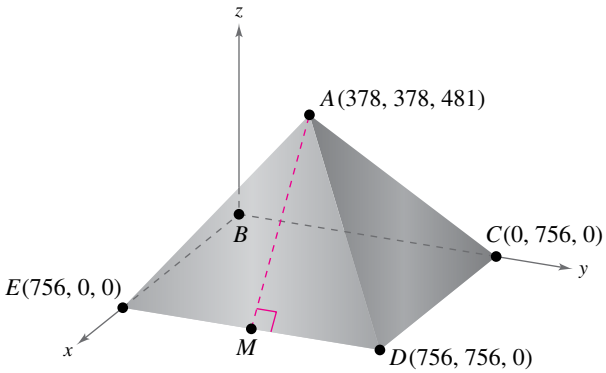
Collaborative Project – Analytic Geometry in Three Dimensions

The Great Pyramid of Giza was built around 2560 BC and stood as the tallest man-made structure in the world for over 3800 years. The diagram shows the original dimensions of the square pyramid before years of erosion. The units of the coordinate system are feet.



1. Find the lengths (a) of the edges of the base of the pyramid and (b) the edges of the pyramid that extend from the corners of the base to the apex (tip) of the pyramid.

2. The slant height of a pyramid is the shortest distance from the apex to the edge of a base. Find the midpoint M of $\overline{DE}$ and use it to find the slant height $\overline{AM}$.

3. Write vector representations of the slant height and line segment between M and the midpoint of the opposite side of the base. Use the intersection of the two line segments as the initial point of the vectors. Find the angle between these two vectors (the slope of the pyramid walls).

4. Repeat the process in Exercise 4 to find the angle between the edge of the pyramid $\overline{AD}$ and the diagonal of the base $\overline{BD}$ that the edge intersects.

5. Write an equation for the plane that contains the base of the pyramid.

6. Write an equation for the plane that passes through points A, B, and E.

7. Find the center of the base and write parametric equations of the line going through the center and the apex of the pyramid.

8. Write parametric and symmetric equations of the line that passes through points A and E.

9. Use vector operations to find the lateral surface area of the pyramid. Describe the method you used.