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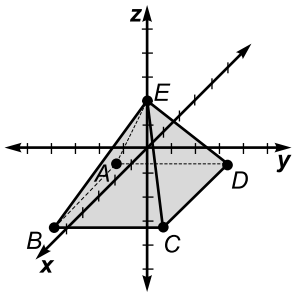
Study Guide

Transformation Matrices in Three-Dimensional Space

Example 1 **Find the coordinates of the vertices of the pyramid and represent them as a vertex matrix.**

$A(-2, -2, -2)$
$B(2, -2, -2)$
$C(2, 2, -2)$
$D(-2, 2, -2)$
$E(0, 0, 2)$



The vertex matrix for the pyramid is $\begin{array}{c} \\ x \\ y \\ z \end{array}\begin{array}{c} \begin{array}{ccccc} A & B & C & D & E \end{array} \\ \begin{bmatrix} -2 & 2 & 2 & -2 & 0 \\ -2 & -2 & 2 & 2 & 0 \\ -2 & -2 & -2 & -2 & 2 \end{bmatrix} \end{array}$.

Example 2 **Let M represent the vertex matrix of the pyramid in Example 1.**

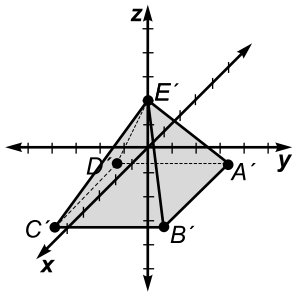
a. Find TM if $T = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$.

b. Graph the resulting image and describe the transformation represented by matrix T.

a. First find TM.

$$TM = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} -2 & 2 & 2 & -2 & 0 \\ -2 & -2 & 2 & 2 & 0 \\ -2 & -2 & -2 & -2 & 2 \end{bmatrix} = \begin{array}{c} \begin{array}{ccccc} A' & B' & C' & D' & E' \end{array} \\ \begin{bmatrix} -2 & 2 & 2 & -2 & 0 \\ 2 & 2 & -2 & -2 & 0 \\ -2 & -2 & -2 & -2 & 2 \end{bmatrix} \end{array}$$

b. Then graph the points represented by the resulting matrix.



The transformation matrix reflects the image of the pyramid over the xz-plane.