

17 (a) The distance between (3, 4) and the origin is  $d = \sqrt{(3-0)^2 + (4-0)^2} = \sqrt{25} = 5$ .

$$(b) AX = \begin{bmatrix} 3 & 0 & 0 \\ 0 & 3 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 4 \\ 1 \end{bmatrix} = \begin{bmatrix} 9 \\ 12 \\ 1 \end{bmatrix} = Y. \text{ The point represented by } Y \text{ is } (9, 12).$$

The distance from (9, 12) to the origin is  $d = \sqrt{(9-0)^2 + (12-0)^2} = \sqrt{225} = 15$ . This is exactly triple the distance of (3, 4). The matrix  $A$  increases the distance between the point and the origin by a factor of 3.

$$(c) A^{-1}Y = \begin{bmatrix} \frac{1}{3} & 0 & 0 \\ 0 & \frac{1}{3} & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 9 \\ 12 \\ 1 \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \\ 1 \end{bmatrix} = X. \text{ } A^{-1} \text{ reduces the distance to } \frac{1}{3} \text{ of the}$$

original distance between the point and the origin.