8a) T is linear since

$$T((x_1,y_1)+(x_2,y_2)) = (2(x_1+x_2),\ y_1+y_2)$$
$$= (2x_1, y_1) + (2x_2, y_2)$$
$$= T(x_1,y_1) + T(x_2,y_2)$$

and $T(k(x,y)) = T(kx,ky) = (2kx, ky) = k(2x,y) = kT(x,y)$

d. T is linear because

$$T(k(x,y)) = T(kx,ky) = (kx,0) = k(x,0) = kT(x,y)$$

and $T((x_1,y_1)+(x_2,y_2)) = T(x_1+x_2, y_1+y_2) = (x_1+x_2, 0)$

$$= (x_1,0) + (x_2,0) = T(x_1,y_1) + T(x_2,y_2)$$

14.a) $e_1 = (1,0,0) \to (1,0,0) \Rightarrow (1/5,0,0) = \frac{1}{5}e_1$

$e_2 = (0,1,0) \to (0,-1,0) \Rightarrow (0,-\frac{1}{5},0) = -\frac{1}{5}e_2$

$e_3 = (0,0,1) \Rightarrow (0,0,1) \Rightarrow (0,0,1/5) = 1/5\, e_3$

$$[T] = \begin{bmatrix} 1/5 & 0 & 0 \\ 0 & -1/5 & 0 \\ 0 & 0 & 1/5 \end{bmatrix}$$

b) $e_1 = (1,0,0) \to (1,0,0) \Rightarrow (1,0,0) = e_1$

$e_2 = (0,1,0) \Rightarrow (0,0,0) \Rightarrow (0,0,0) = 0e_2$

$e_3 = (0,0,1) \Rightarrow (0,0,1) \Rightarrow (0,0,0) = 0e_3$

$$[T] = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

c) $e_1 \to \begin{bmatrix} -1 \\ 0 \\ 0 \end{bmatrix}$ ; $e_2 \to \begin{bmatrix} 0 \\ -1 \\ 0 \end{bmatrix}$ ; $e_3 \to \begin{bmatrix} 0 \\ 0 \\ -1 \end{bmatrix}$

$$[T] = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$$