

1.

a. No

b. Yes

$$\text{i. } \begin{pmatrix} 23 & 34 \\ 31 & 46 \\ 27 & 36 \end{pmatrix}$$

c. Yes

$$\text{i. } \begin{pmatrix} 17 & 23 & 18 \\ 39 & 53 & 36 \end{pmatrix}$$

d. Yes

$$\text{i. } \begin{pmatrix} 23 & 31 & 27 \\ 34 & 46 & 36 \end{pmatrix}$$

e. Yes

$$\text{i. } \begin{pmatrix} 22 \\ 52 \end{pmatrix}$$

f. Yes

$$\text{i. } \begin{pmatrix} 82 \\ 112 \\ 63 \end{pmatrix}$$

g. Yes

$$\text{i. } (29 \quad 44)$$

h. Yes

$$\text{i. } (540)$$

2.

$$\text{a. } \begin{pmatrix} 5 & 11 \\ 10 & 20 \end{pmatrix}$$

$$\text{b. } \begin{pmatrix} 5a \\ ab - 8 \end{pmatrix}$$

$$\text{c. } \begin{pmatrix} 8 & 31 \\ 9 & -8 \end{pmatrix}$$

$$\text{d. } (x_1 \quad x_2) \begin{pmatrix} x_1 - x_2 \\ x_2 - x_1 \end{pmatrix} = (x_1(x_1 - x_2) + x_2(x_2 - x_1)) = (x_1^2 - 2x_1x_2 + x_2^2)$$

$$3. \quad x = R(310^\circ)T(40\text{cm}, 0)R(45^\circ)T(20\text{cm}, 0) \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

$$\begin{aligned} \text{a. } & \begin{pmatrix} \cos(310) & -\sin(310) & 0 \\ \sin(310) & \cos(310) & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 40 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \cos(45) & -\sin(45) & 0 \\ \sin(45) & \cos(45) & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 20 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix} \\ & = \begin{pmatrix} 45.6 \\ -32.4 \\ 1 \end{pmatrix} \end{aligned}$$

4.

$$\begin{aligned}
 \text{a. } & \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \cos(40) & -\sin(40) & 0 \\ \sin(40) & \cos(40) & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ 1 \end{pmatrix} \\
 \text{b. } & \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \cos(40) & -\sin(40) & 0 \\ \sin(40) & \cos(40) & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 2 \\ 0 \\ 1 \end{pmatrix} = \begin{pmatrix} 1.77 \\ 0.64 \\ 1 \end{pmatrix} \\
 \text{c. } & \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \cos(40) & -\sin(40) & 0 \\ \sin(40) & \cos(40) & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 1.12 \\ 1.41 \\ 1 \end{pmatrix} \\
 \text{d. } & \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \cos(40) & -\sin(40) & 0 \\ \sin(40) & \cos(40) & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} = \begin{pmatrix} 0.36 \\ 0.77 \\ 1 \end{pmatrix}
 \end{aligned}$$