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HW3

Problem 3.

a. focal lengths: $f_x = 1072$, $f_y = 1072$
image center: $\theta_x = 500$, $\theta_y = 390$

b. The camera is rotated by 45° and translated by $-C$ with respect to the world coordinates.

Notice, $\sin 45° = \cos 45° = 0.7071$.

$$R = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos 45° & -\sin 45° \\ 0 & \sin 45° & \cos 45° \end{bmatrix}$$, which is the matrix of rotation by 45° around the x axis.

c. $$R_{new} = R_{10°} \times R = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos 10° & -\sin 10° \\ 0 & \sin 10° & \cos 10° \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.7071 & -0.7071 \\ 0 & 0.7071 & 0.7071 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.5736 & -0.8191 \\ 0 & 0.8191 & 0.5736 \end{bmatrix}$$ (using MATLAB)

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos 55° & -\sin 55° \\ 0 & \sin 55° & \cos 55° \end{bmatrix}$$, which is the matrix of rotation by 55°.
(As we expect: $55 = 45 + 10$)

d. $$C_{New} = C + \begin{bmatrix} 10 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 35 \\ 30 \\ 0 \end{bmatrix}$$

Translation by 10 units along the x axis is achieved by adding the vector $[10 \ 0 \ 0]^T$ to our current C. ■