3D CONCURRENT FORCE SYSTEMS

Friday, December 02, 2011
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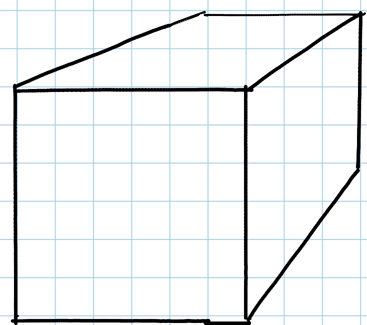
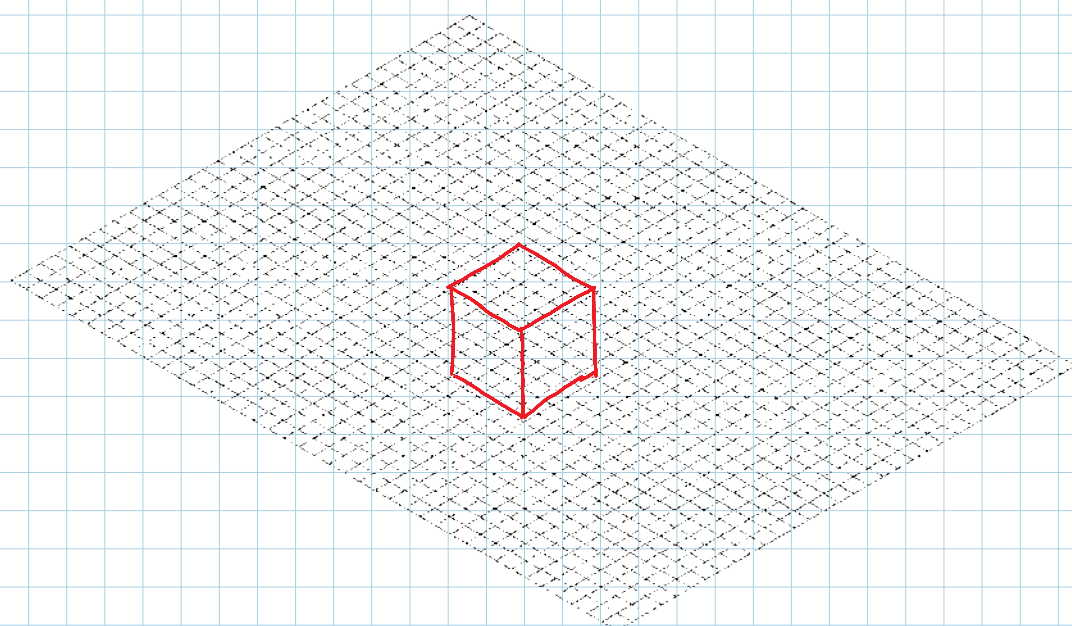
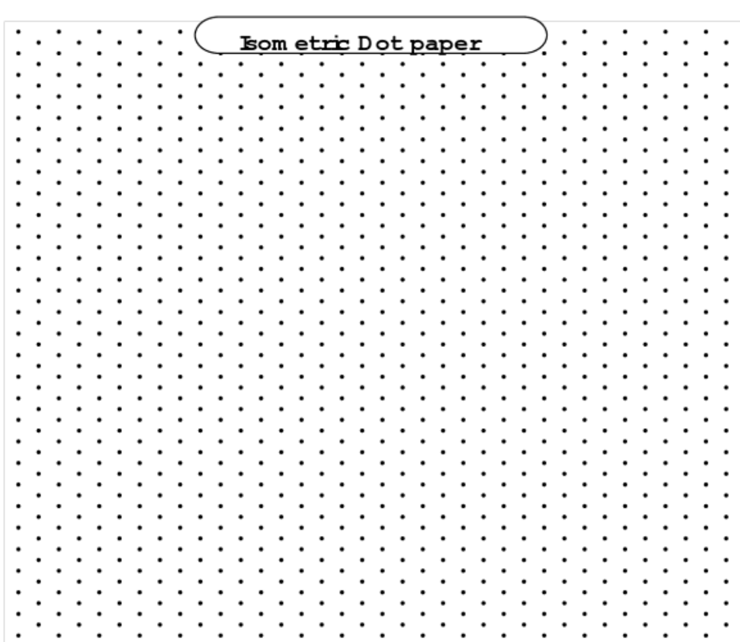
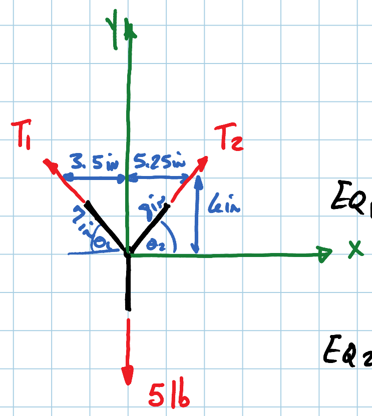
VANISHING POINT









$\cos\theta_1$

$$\Sigma F_x = 0 = -T_1 \cdot \left(\frac{3.5in}{7in}\right) + T_2 \cdot \left(\frac{5.25in}{8in}\right)$$

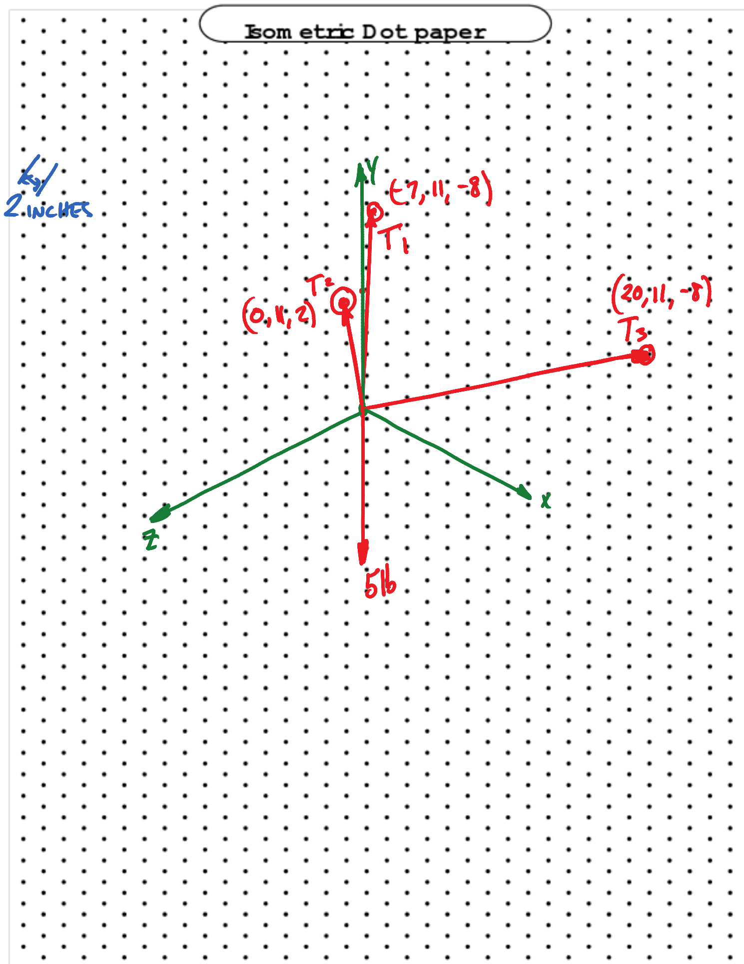
$EQ_1 \rightarrow \quad 0 = -T_1 \cdot (0.5) + T_2(0.656)$

$$\Sigma F_y = 0 = T_1 \cdot \left(\frac{6in}{7in}\right) + T_2 \cdot \left(\frac{6in}{8in}\right) - 5lb$$

$EQ_2 \rightarrow \quad 5lb = T_1 \cdot (0.857) + T_2(0.75)$

$T_1 = 3.5\ lb$

$T_2 = 2.7\ lb$



x, y, z

$T_1(-7, 11, -8)$

$T_2(0, 11, 2)$

$T_3(20, 11, -8)$

$$L_{T_1} = \sqrt{(-7_{in})^2 + (11_{in})^2 + (-8_{in})^2}$$

$$= 15.3_{in}$$

$$L_{T_2} = \sqrt{(0_{in})^2 + (11_{in})^2 + (2_{in})^2}$$

$$= 11.2_{in}$$

$$L_{T_3} = \sqrt{(20_{in})^2 + (11_{in})^2 + (-8_{in})^2}$$

$$= 24.2_{in}$$

$$\cos\theta_{x_1} = \frac{adj}{hyp} \therefore \theta_{x_1} = \cos^{-1}\frac{adj}{hyp} = \theta_{x_1} = \cos^{-1}\left(\frac{X_1}{L_1}\right)$$

$$\theta_{x_1} = \cos^{-1}\frac{X_1}{L_1} \qquad \theta_{x_2} = \frac{X_2}{L_2} \qquad \theta_{x_3} = \frac{X_3}{L_3}$$

$$\theta_{y_1} = \cos^{-1}\frac{Y_1}{L_1} \qquad \theta_{y_2} = \frac{Y_2}{L_2} \qquad \theta_{y_3} = \frac{Y_3}{L_3}$$

$$\theta_{z_1} = \cos^{-1}\frac{Z_1}{L_1} \qquad \theta_{z_2} = \frac{Z_2}{L_2} \qquad \theta_{z_3} = \frac{Z_3}{L_3}$$

$$\Sigma F_x = 0 = T_1 \cdot \cos\theta_{x_1} + T_2\cos\theta_{x_2} + T_3 \cdot \cos\theta_{x_3}$$

$$0 = T_1 \cdot \cos\left(\cos^{-1}\frac{X_1}{L_1}\right) + T_2 \cdot \cos\left(\cos^{-1}\frac{X_2}{L_2}\right) + T_3 \cdot \cos\left(\cos^{-1}\frac{X_3}{L_3}\right)$$

$$0 = T_1 \cdot \left(\frac{X_1}{L_1}\right) + T_2\left(\frac{X_2}{L_2}\right) + T_3\left(\frac{X_3}{L_3}\right)$$

$$\Sigma F_y = 0 = T_1 \cdot \left(\frac{Y_1}{L_1}\right) + T_2\left(\frac{Y_2}{L_2}\right) + T_3\left(\frac{Y_3}{L_3}\right) - 5lb$$

$$5\,lb = T_1 \cdot \left(\frac{Y_1}{L_1}\right) + T_2\left(\frac{Y_2}{L_2}\right) + T_3\left(\frac{Y_3}{L_3}\right)$$

$$\Sigma F_z = 0 = T_1 \cdot \left(\frac{Z_1}{L_1}\right) + T_2\left(\frac{Z_2}{L_2}\right) + T_3\left(\frac{Z_3}{L_3}\right)$$

$$\Sigma F_z = 0 = T_1\left(\frac{z_1}{L_1}\right) + T_2\left(\frac{z_2}{L_2}\right) + T_3\left(\frac{z_3}{L_3}\right)$$

$$\overset{B}{\begin{bmatrix} 0 \\ 5lb \\ 0 \end{bmatrix}} \quad \overset{A}{\begin{bmatrix} \frac{x_1}{L_1} & \frac{x_2}{L_2} & \frac{x_3}{L_3} \\ \frac{y_1}{L_1} & \frac{y_2}{L_2} & \frac{y_3}{L_3} \\ \frac{z_1}{L_1} & \frac{z_2}{L_2} & \frac{z_3}{L_3} \end{bmatrix}}$$

TO SOLVE:

$$A^{-1} \cdot B = \begin{bmatrix} T_1 \\ T_2 \\ T_3 \end{bmatrix}$$