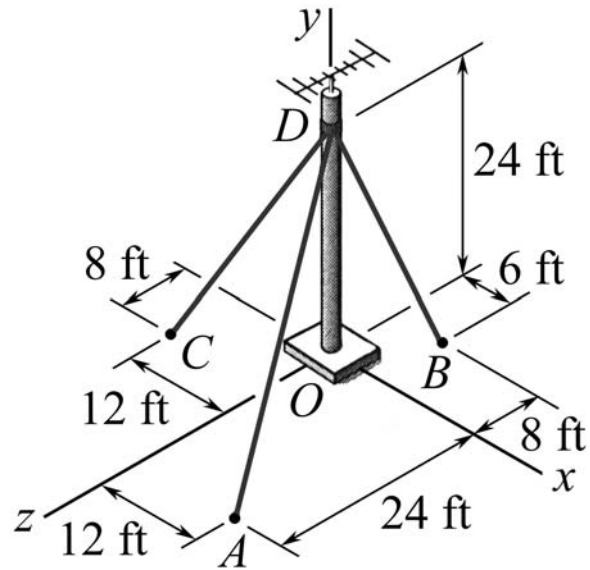


Quiz #2 The pole for an antenna is held by three guy wires as shown. If the resultant force exerted by these wires on the pole at D is $\mathbf{R} = -252\mathbf{j}$ lb, determine the tension in each wire.



$A(12, 0, 24)$ ft, $B(6, 0, -8)$ ft, $C(-12, 0, 8)$ ft, $D(0, 24, 0)$ ft

$$\overline{DA} = 12\mathbf{i} - 24\mathbf{j} + 24\mathbf{k}, \quad \overline{DA} = 36, \quad \lambda_{DA} = \frac{1}{3}(\mathbf{i} - 2\mathbf{j} + 2\mathbf{k})$$

$$\overline{DB} = 6\mathbf{i} - 24\mathbf{j} - 8\mathbf{k}, \quad \overline{DB} = 26, \quad \lambda_{DB} = \frac{1}{13}(3\mathbf{i} - 12\mathbf{j} - 4\mathbf{k})$$

$$\overline{DC} = -12\mathbf{i} - 24\mathbf{j} + 8\mathbf{k}, \quad \overline{DC} = 28, \quad \lambda_{DC} = \frac{1}{7}(-3\mathbf{i} - 6\mathbf{j} + 2\mathbf{k})$$

$$\mathbf{F}_{DA} = \frac{F_{DA}}{3}(\mathbf{i} - 2\mathbf{j} + 2\mathbf{k}) \quad \textcircled{2} \quad \mathbf{F}_{DB} = \frac{F_{DB}}{13}(3\mathbf{i} - 12\mathbf{j} - 4\mathbf{k}) \quad \textcircled{2}$$

$$\mathbf{F}_{DC} = \frac{F_{DC}}{7}(-3\mathbf{i} - 6\mathbf{j} + 2\mathbf{k}) \quad \textcircled{2}$$

Since $\mathbf{F}_{DA} + \mathbf{F}_{DB} + \mathbf{F}_{DC} = -252\mathbf{j}$, $\textcircled{1}$ we write

$$\mathbf{i}: \frac{1}{3}F_{DA} + \frac{3}{13}F_{DB} - \frac{3}{7}F_{DC} = 0 \quad | \quad -\frac{6}{13}F_{DB} - \frac{12}{7}F_{DC} = -252$$

$$\mathbf{j}: -\frac{2}{3}F_{DA} - \frac{12}{13}F_{DB} - \frac{6}{7}F_{DC} = -252 \quad | \quad -\frac{16}{13}F_{DB} - \frac{4}{7}F_{DC} = -252$$

$$\mathbf{k}: \frac{2}{3}F_{DA} - \frac{4}{13}F_{DB} + \frac{2}{7}F_{DC} = 0 \quad | \quad \frac{42}{13}F_{DB} = 504$$

Thus, we obtain

$$F_{DA} = 27 \text{ lb} \quad F_{DB} = 156 \text{ lb} \quad F_{DC} = 105 \text{ lb} \quad \textcircled{3}$$