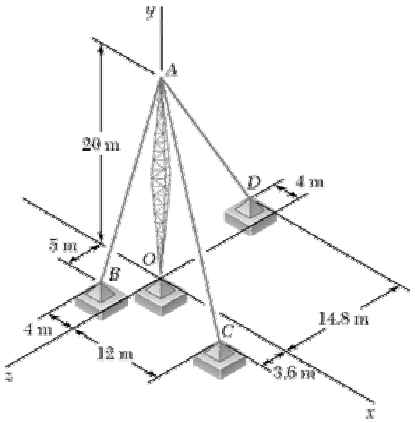
PROBLEM 2.87



A transmission tower is held by three guy wires anchored by bolts at *B*, *C*, and *D*. If the tension in wire *AB* is 2100 N, determine the components of the force exerted by the wire on the bolt at *B*.

SOLUTION

$$\overrightarrow{BA} = (4\text{ m})\mathbf{i} + (20\text{ m})\mathbf{j} - (5\text{ m})\mathbf{k}$$

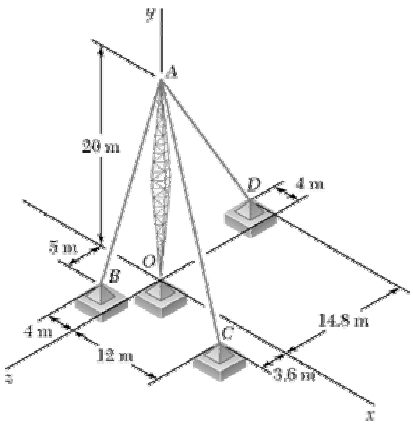
$$BA = \sqrt{(4\text{ m})^2 + (20\text{ m})^2 + (-5\text{ m})^2} = 21\text{ m}$$

$$\mathbf{F} = F\boldsymbol{\lambda}_{BA} = F\frac{\overrightarrow{BA}}{BA} = \frac{2100\text{ N}}{21\text{ m}}\left[(4\text{ m})\mathbf{i} + (20\text{ m})\mathbf{j} - (5\text{ m})\mathbf{k}\right]$$

$$\mathbf{F} = (400\text{ N})\mathbf{i} + (2000\text{ N})\mathbf{j} - (500\text{ N})\mathbf{k}$$

$F_x = +400$ N, $F_y = +2000$ N, $F_z = -500$ N ◀

PROBLEM 2.88



A transmission tower is held by three guy wires anchored by bolts at *B*, *C*, and *D*. If the tension in wire *AD* is 1260 N, determine the components of the force exerted by the wire on the bolt at *D*.

SOLUTION

$$\overrightarrow{DA} = (4\text{ m})\mathbf{i} + (20\text{ m})\mathbf{j} + (14.8\text{ m})\mathbf{k}$$

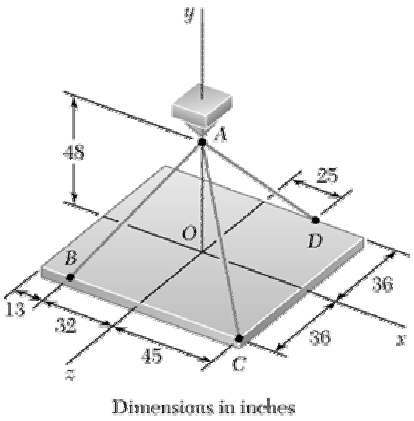
$$DA = \sqrt{(4\text{ m})^2 + (20\text{ m})^2 + (14.8\text{ m})^2} = 25.2\text{ m}$$

$$\mathbf{F} = F\boldsymbol{\lambda}_{DA} = F\frac{\overrightarrow{DA}}{DA} = \frac{1260\text{ N}}{25.2\text{ m}}\left[(4\text{ m})\mathbf{i} + (20\text{ m})\mathbf{j} + (14.8\text{ m})\mathbf{k}\right]$$

$$\mathbf{F} = (200\text{ N})\mathbf{i} + (1000\text{ N})\mathbf{j} + (740\text{ N})\mathbf{k}$$

$F_x = +200$ N, $F_y = +1000$ N, $F_z = +740$ N ◀

PROBLEM 2.89



Dimensions in inches

A rectangular plate is supported by three cables as shown. Knowing that the tension in cable *AB* is 204 lb, determine the components of the force exerted on the plate at *B*.

SOLUTION

$$\overrightarrow{BA} = (32 \text{ in.})\mathbf{i} + (48 \text{ in.})\mathbf{j} - (36 \text{ in.})\mathbf{k}$$

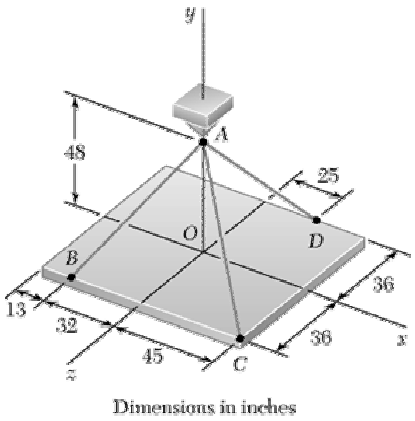
$$BA = \sqrt{(32 \text{ in.})^2 + (48 \text{ in.})^2 + (-36 \text{ in.})^2} = 68 \text{ in.}$$

$$\mathbf{F} = F\boldsymbol{\lambda}_{BA} = F\frac{\overrightarrow{BA}}{BA} = \frac{204 \text{ lb}}{68 \text{ in.}}\left[(32 \text{ in.})\mathbf{i} + (48 \text{ in.})\mathbf{j} - (36 \text{ in.})\mathbf{k}\right]$$

$$\mathbf{F} = (96 \text{ lb})\mathbf{i} + (144 \text{ lb})\mathbf{j} - (108 \text{ lb})\mathbf{k}$$

$F_x = +96.0$ lb, $F_y = +144.0$ lb, $F_z = -108.0$ lb ◀

PROBLEM 2.90



Dimensions in inches

A rectangular plate is supported by three cables as shown. Knowing that the tension in cable *AD* is 195 lb, determine the components of the force exerted on the plate at *D*.

SOLUTION

$$\overrightarrow{DA} = -(25 \text{ in.})\mathbf{i} + (48 \text{ in.})\mathbf{j} + (36 \text{ in.})\mathbf{k}$$

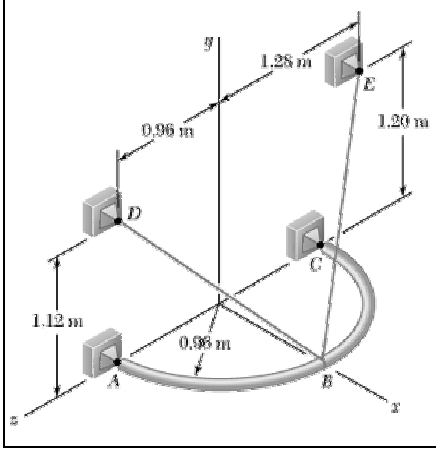
$$DA = \sqrt{(-25 \text{ in.})^2 + (48 \text{ in.})^2 + (36 \text{ in.})^2} = 65 \text{ in.}$$

$$\mathbf{F} = F\boldsymbol{\lambda}_{DA} = F\frac{\overrightarrow{DA}}{DA} = \frac{195 \text{ lb}}{65 \text{ in.}}\left[(-25 \text{ in.})\mathbf{i} + (48 \text{ in.})\mathbf{j} + (36 \text{ in.})\mathbf{k}\right]$$

$$\mathbf{F} = -(75 \text{ lb})\mathbf{i} + (144 \text{ lb})\mathbf{j} + (108 \text{ lb})\mathbf{k}$$

$F_x = -75.0$ lb, $F_y = +144.0$ lb, $F_z = +108.0$ lb ◀

PROBLEM 2.91



A steel rod is bent into a semicircular ring of radius 0.96 m and is supported in part by cables *BD* and *BE* which are attached to the ring at *B*. Knowing that the tension in cable *BD* is 220 N, determine the components of this force exerted by the cable on the support at *D*.

SOLUTION

$$\overrightarrow{DB} = (0.96\text{ m})\mathbf{i} - (1.12\text{ m})\mathbf{j} - (0.96\text{ m})\mathbf{k}$$

$$DB = \sqrt{(0.96\text{ m})^2 + (-1.12\text{ m})^2 + (-0.96\text{ m})^2} = 1.76\text{ m}$$

$$\mathbf{T}_{DB} = T\boldsymbol{\lambda}_{DB} = T\frac{\overrightarrow{DB}}{DB} = \frac{220\text{ N}}{1.76\text{ m}}\left[(0.96\text{ m})\mathbf{i} - (1.12\text{ m})\mathbf{j} - (0.96\text{ m})\mathbf{k}\right]$$

$$\mathbf{T}_{DB} = (120\text{ N})\mathbf{i} - (140\text{ N})\mathbf{j} - (120\text{ N})\mathbf{k}$$

$$(T_{DB})_x = +120.0\text{ N},\ (T_{DB})_y = -140.0\text{ N},\ (T_{DB})_z = -120.0\text{ N} \blacktriangleleft$$