

## The Equilibrium Problem

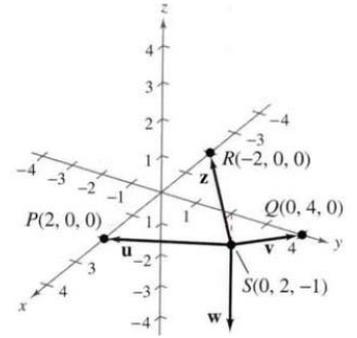
A weight of 480 pounds is supported by three ropes. As shown in the figure, the weight is located at  $S(0, 2, -1)$ . The ropes are tied to the points  $P(2, 0, 0)$ ,  $Q(0, 4, 0)$ , and  $R(-2, 0, 0)$ . Find the force (or tension) on each rope.

The force vectors corresponding to the ropes are as follows:

$$\mathbf{u} = \|\mathbf{u}\| \frac{\overrightarrow{SP}}{\|\overrightarrow{SP}\|} \quad \mathbf{v} = \|\mathbf{v}\| \frac{\overrightarrow{SQ}}{\|\overrightarrow{SQ}\|} \quad \mathbf{z} = \|\mathbf{z}\| \frac{\overrightarrow{SR}}{\|\overrightarrow{SR}\|}$$

For the system to be in equilibrium, it must be true that

$$\mathbf{u} + \mathbf{v} + \mathbf{z} + \mathbf{w} = \mathbf{0} \quad \text{or} \quad \mathbf{u} + \mathbf{v} + \mathbf{z} = -\mathbf{w}$$



Ex. 1 Find the tension in each supporting cable if the weight of the crate is 500 Newtons.

