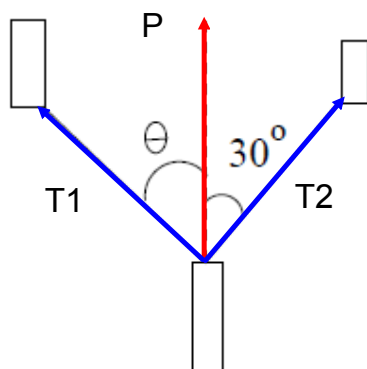


2) Two tug boats are towing a large ship into port. The larger tug exerts a force of 5000 pounds on its cable, and the smaller tug exerts a force of 3500 pounds on its cable. If the ship is to travel in a straight line, find the angle θ that the larger tug must make if the smaller tug makes an angle of 30° .



T_1 and T_2 are the vectors that represent the tensions on the cables from the tug boats. P is the resultant vector representing the path of the ship.

$$|T_1| = 5000 \quad |T_2| = 3500$$

The vector representation of T_1 , T_2 , and P are

$$P = \langle 0, x \rangle$$

$$T_1 = \langle -5000 \sin \theta, 5000 \cos \theta \rangle$$

$$T_2 = \langle 3500 \sin 30, 3500 \cos 30 \rangle$$

$$= \langle 1750, 1750\sqrt{3} \rangle$$

We know by the picture and the fact the ship travels in a straight line that

$$T_1 + T_2 = P$$

This give the following equation (using the x-components).

$$-5000 \sin \theta + 1750 = 0$$

$$1750 = 5000 \sin \theta$$

$$\sin \theta = \frac{1750}{5000}$$

$$\theta = 20.49^\circ$$