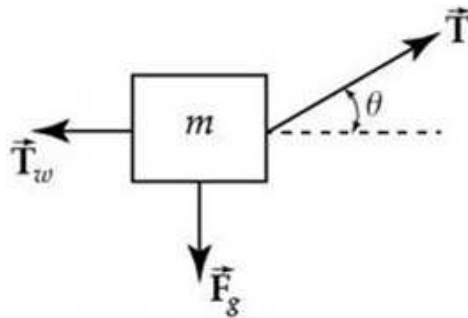


Read the problem carefully at least once.

Be sure to notice quantities that are known and those we're being asked to find. In this case, the known quantities are the block's mass and the magnitude of tension T . The unknown quantities we're asked to find are the magnitude of tension in the horizontal cord and the angle θ .

Draw a picture of the system, identify the object of interest, and indicate forces with arrows.

The figure below shows a picture of the block (our object of interest). The forces are indicated with arrows.

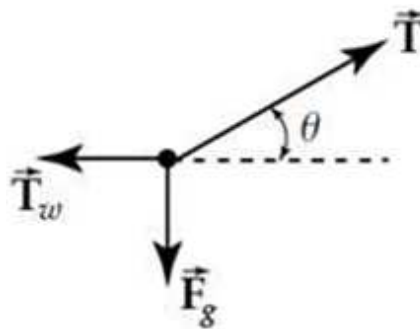


Label each force in the picture.

The unknown tension force holding the block to the wall is labeled \vec{T}_w and the gravity and other tension force are labeled \vec{F}_g and \vec{T} , respectively.

Draw a free-body diagram of the object of interest.

The correct FBD is shown below. Note that each force and the angle θ are indicated. Because the angle will be used to determine the components of the tension force, it is important to include it on the FBD.



Apply Newton's second law.

Applying Newton's second law means that we should first take and write out each component. We'll take the positive x -direction to be to the right and the positive y -direction to be straight up.

The y -component of Newton's second law is $\sum F_y = ma_y$. The term $\sum F_y$ represents the sum of all the y -components of all forces shown on our FBD. Making this substitution, with $a_y = 0$ for an object in equilibrium, gives

$$\sum F_y = T \sin \theta - F_g = 0.$$

The gravity force acting on the block has magnitude $F_g = mg$ so that

$$T \sin \theta - mg = 0.$$

Rearranging and substituting the known values gives

$$\sin \theta = \frac{mg}{T} = \frac{(5.30 \text{ kg})(9.80 \text{ m/s}^2)}{72.0 \text{ N}} = 0.721.$$

Solving for θ , we have

$$\theta = \sin^{-1}(0.721) = 46.2^\circ.$$

To determine T_w , we'll use the x -component of Newton's second law. The x -component of Newton's second law for an object in equilibrium is $\sum F_x = 0$. The term $\sum F_x = 0$ represents the sum of all the x -components of all the forces shown on our FBD. Adding up the x -components shown in the FBD gives

$$\sum F_x = T \cos \theta - T_w = 0.$$

Solve for the desired unknown quantity, and substitute the numbers.

Our remaining unknown quantity is the tension T_w in the cord holding the block to the wall.

Solving for it gives

$$\begin{aligned} T_w &= T \cos \theta \\ &= (72.0 \text{ N})(\cos 46.2^\circ) = 49.9 \text{ N}. \end{aligned}$$