27. The bar is in equilibrium, so the forces and the torques acting on it each sum to zero. Let T_l be the tension force of the left-hand cord, T_r be the tension force of the right-hand cord, and m be the mass of the bar. The equations for equilibrium are:

$$\begin{aligned} \text{vertical force components} \qquad & T_l \cos\theta + T_r \cos\phi - mg = 0 \\ \text{horizontal force components} \qquad & -T_l \sin\theta + T_r \sin\phi = 0 \\ \text{torques} \qquad & mgx - T_r L \cos\phi = 0 \; . \end{aligned}$$

The origin was chosen to be at the left end of the bar for purposes of calculating the torque.

The unknown quantities are T_l, T_r, and x. We want to eliminate T_l and T_r, then solve for x. The second equation yields $T_l = T_r \sin\phi / \sin\theta$ and when this is substituted into the first and solved for T_r the result is $T_r = mg \sin\theta / (\sin\phi \cos\theta + \cos\phi \sin\theta)$. This expression is substituted into the third equation and the result is solved for x:

$$x = L \frac{\sin\theta \cos\phi}{\sin\phi \cos\theta + \cos\phi \sin\theta} = L \frac{\sin\theta \cos\phi}{\sin(\theta + \phi)} \; .$$

The last form was obtained using the trigonometric identity $\sin(A + B) = \sin A \cos B + \cos A \sin B$. For the special case of this problem $\theta + \phi = 90°$ and $\sin(\theta + \phi) = 1$. Thus,

$$x = L \, \sin\theta \, \cos\phi = (6.10\,\text{m}) \sin 36.9° \cos 53.1° = 2.20 \text{ m} \; .$$