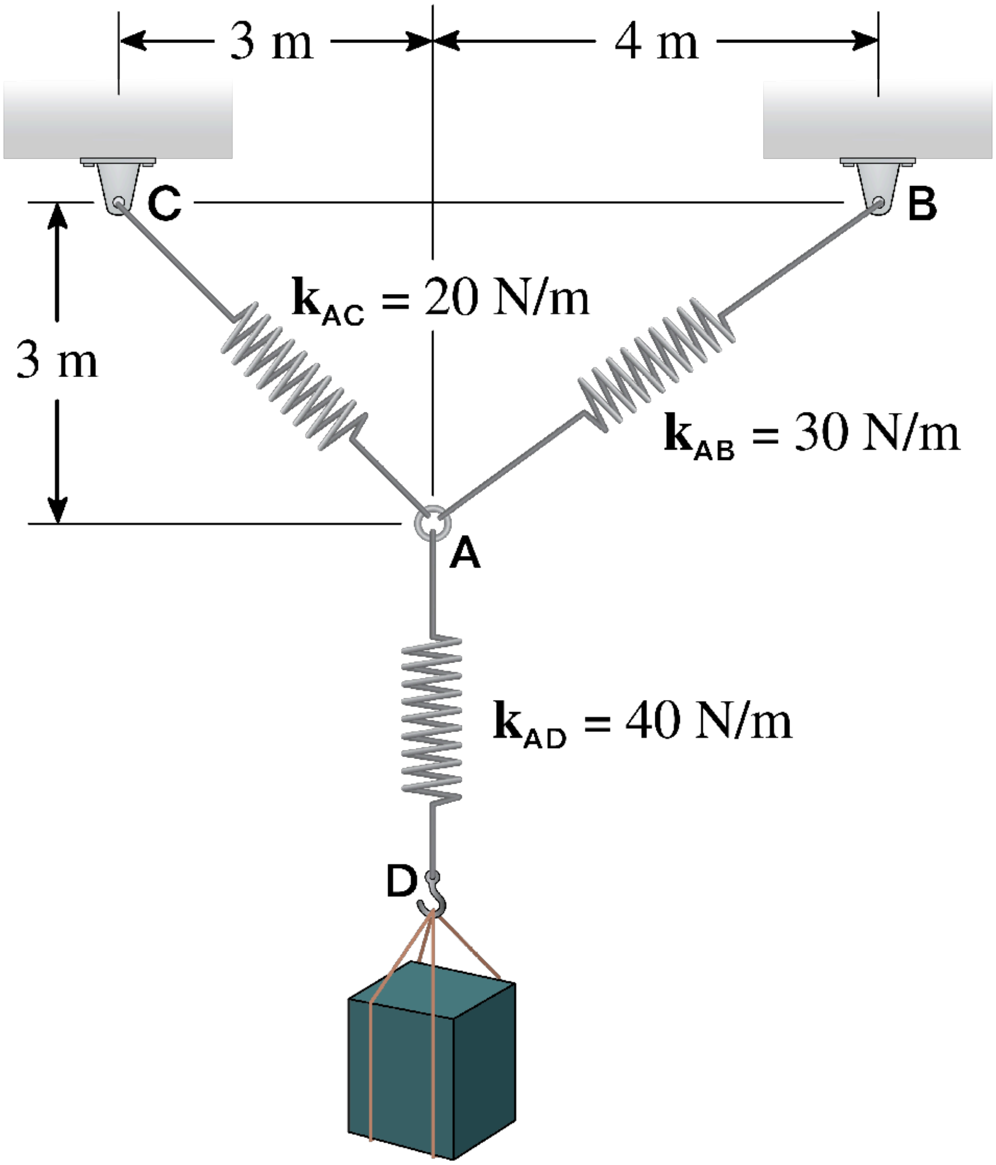




In the 2D system above, the springs are stretched and are in static equilibrium. If the unstretched length of spring $AB$ is $x_{AB\,0}\,\mathrm{m}$, find the mass of the block at D. Assume the spring $AB$ includes the uncoiled length between $A$ and $B$.

What is the stretch in spring $AB$?

$|AB| = \sqrt{3^2 + 4^2} = 5\,\mathrm{m}$

$|AC| = \sqrt{3^2 + 3^2} = 3\sqrt{2}\,\mathrm{m}$

If $x_{AB\,f} = |AB| = 5\,\mathrm{m}$,

$\Delta x_{AB} = x_{AB\,f} - x_{AB\,0} = (5 - x_{AB\,0})$ m

Determine the force exerted by the $AB$ spring.

$T_{AB} = (30 * \Delta x_{AB})$ N

Finally, find the mass of the block at D.

$$\Sigma F_x = 0 \rightarrow \frac{d_3}{|AB|} T_{AB} - \frac{d_2}{|AC|} T_{AC} \rightarrow T_{AB} = \frac{d_2 |AB|}{d_3 |AC|} T_{AC} = \frac{15}{12\sqrt{2}} T_{AC} \rightarrow T_{AB} = \frac{5}{4\sqrt{2}} T_{AC}$$

or $T_{AC} = \frac{4\sqrt{2}}{5} T_{AB}$

$$\Sigma F_y = 0 \rightarrow \frac{d_1}{|AB|} T_{AB} + \frac{d_1}{|AC|} T_{AC} - T_{AD} = 0$$

$$\rightarrow T_{AD} = \frac{d_1(d_2 + d_3)}{d_3 |AC|} T_{AC} = \frac{21}{12\sqrt{2}} T_{AC} = \frac{7}{5} T_{AB}$$

$T_{AD} = m_D * g$

$$\rightarrow m_D = \frac{42}{g} (5 - x_{AB\,0}) \text{ kg}$$