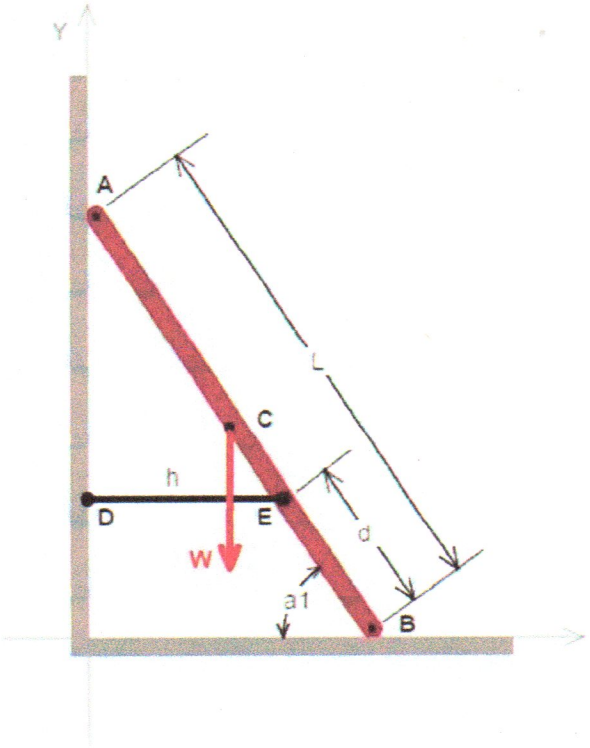
SOLUTION

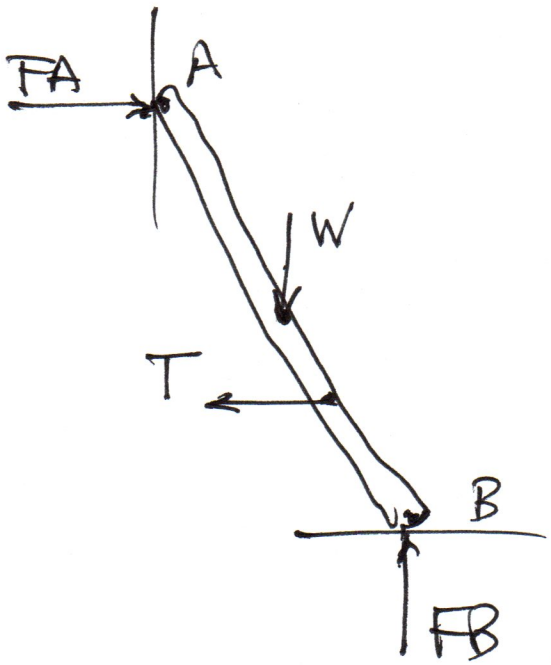
ip4STATICS Problem U04_P08

A ladder is tethered to the wall by cable DE, which is horizontal at equilibrium. The cable length is h. Both the wall and the floor are frictionless with respect to the ladder. The ladder's weight acts at its center.

Instance variables: force W in lbs, lengths L, d and h in ft.



FBD



(1) What is the angle a1 between the ladder and the floor, in deg?

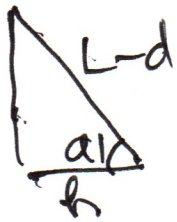
(2) What is the reaction force FA at A? (Enter 'mag,deg')

(3) What is the reaction force FB at B? (Enter 'mag,deg')

(4) What is the force FE from the cable on the ladder? (Enter 'mag,deg')

Geometry

(1)



$\cos(a1) = h/(L-d)$

so $a1 = \cos^{-1}(h/L-d)$

$\Sigma FX=0: \quad FA - T = 0.$

$\Sigma Fy=0: \quad FB - W = 0.$

$\Sigma M_B=0: \quad FA \cdot L\sin(a1) - \frac{WL}{2}\cdot\cos(a1) - Td\sin(a1) = 0$

(2) $FA = \dfrac{W \cdot L}{2\,(L-d)\tan(a1)}$

(3) $FB = W$

(4) $FE = T = FA$.