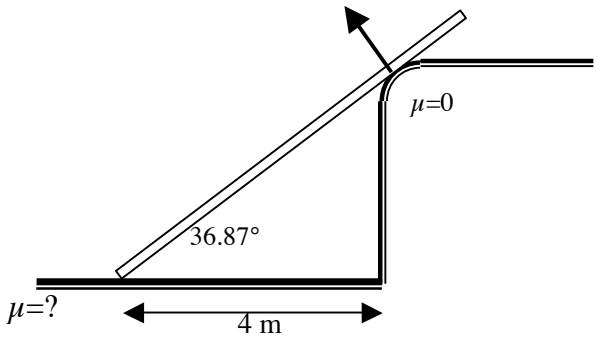
W4.07H

STATIC EQUILIBRIUM – Ladders [Hard]

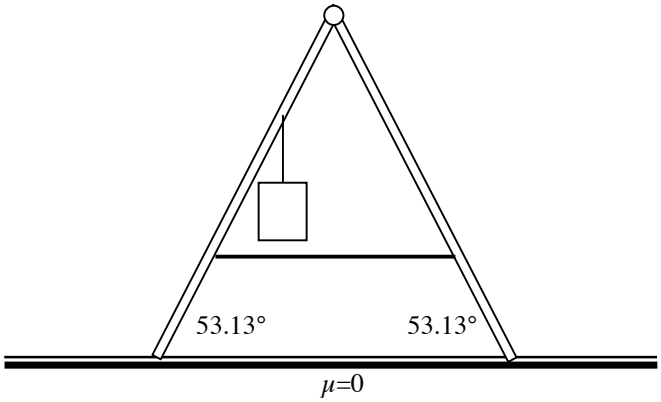
$\Sigma F = 0$ & $\Sigma \boldsymbol{\tau} = 0$

Note: all walls are frictionless (μ=0) and all floors are rough ($\mu \neq 0$), unless otherwise indicated.

[5] A 6-meter long ladder leans against a frictionless curved edge that only has the ability to push perpendicularly on the ladder as shown. If the ladder weighs 100 N, what is the minimum coefficient of friction between the floor and the ladder in order for the ladder to remain stable?



[6] Two ladders, each 15 meters long and 200 N, are hinged at the top as shown. A rope, tied 5 meters up from the foot of each ladder, prevents the ladders from "doing the splits". A 1,000 N box is suspended 10 meters up the left-hand ladder. Find the normal force acting on the base of each ladder **and** the tension in the rope.



W4.07H

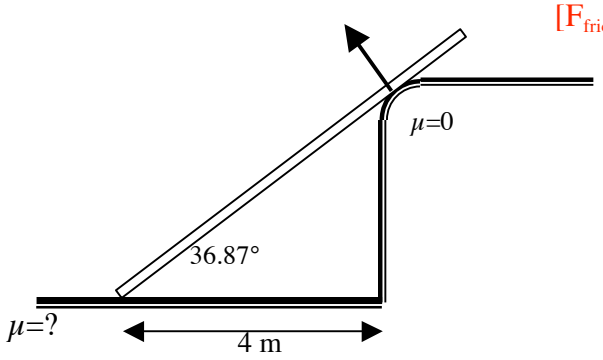
STATIC EQUILIBRIUM – Ladders [Hard] – KEY

$\Sigma F = 0$ & $\Sigma \tau = 0$

Note: all walls are frictionless (μ=0) and all floors are rough ($\mu \neq 0$), unless otherwise indicated.

[5] A 6-meter long ladder leans against a frictionless curved edge that only has the ability to push perpendicularly on the ladder as shown. If the ladder weighs 100 N, what is the minimum coefficient of friction between the floor and the ladder in order for the ladder to remain stable?

$[F_{edge} = 48\ N, F_{edgeX} = 28.8\ N, F_{edgeY} = 38.4\ N]$
$[F_{friction} = 28.8\ N, F_{normal} = 61.6\ N]$
$\mu = 0.467$



[6] Two ladders, each 15 meters long and 200 N, are hinged at the top as shown. A rope, tied 5 meters up from the foot of each ladder, prevents the ladders from "doing the splits". A 1,000 N box is suspended 10 meters up the left-hand ladder. Find the normal force acting on the base of each ladder **and** the tension in the rope.

$F_{supportLEFT} = 866.66\ N, F_{supportRIGHT} = 533.333\ N$
$T = 487.5\ N$