Question #60869, Physics / Classical Mechanics | for completion

a 60m ladder weighing 100N rests against a wall at a point 48 degree north above the ground. the center of gravity of the ladder is 1/3 the way up. a 160N man climbs halfway up the ladder assuming that the wall is friction less. find the reaction on the wall and the frictional force.

L=60 m

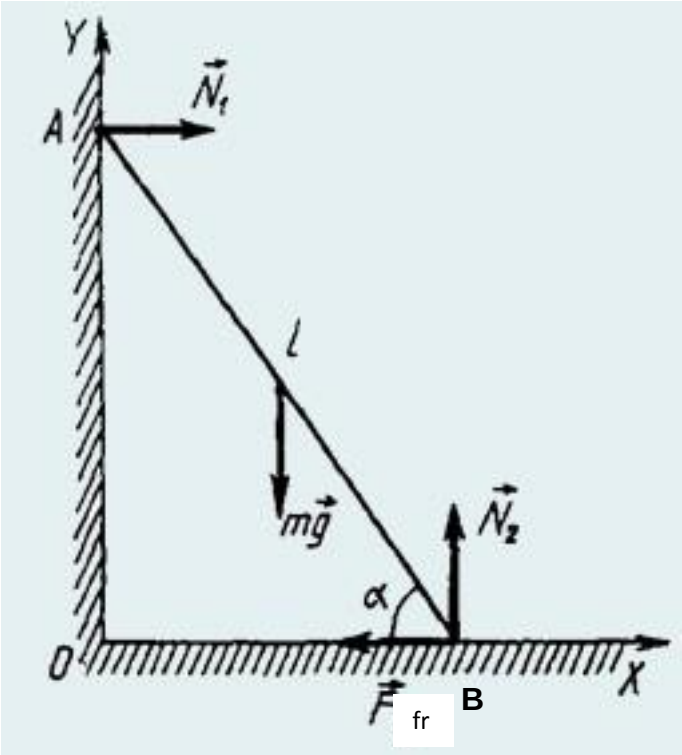
F_l = 100N

α= 48^0

F_m = 160 N

N_a - ? $F_{fr}-?$

Solution:



On the basis of the vanishing of the sum of the moments of all forces about the axis passing through the point B, we form the equation:

$$N_A L sin\alpha - F_m \frac{L}{2} cos\alpha - F_l \frac{L}{3} cos\alpha = 0$$

$$N_A L sin\alpha = L cos\alpha \left(\frac{F_m}{2} - \frac{F_l}{3}\right)$$

$$N_A = tg\alpha \left(\frac{F_m}{2} - \frac{F_l}{3}\right)$$

$N_A = tg48^0 \left(\frac{160N}{2} - \frac{100N}{3}\right) \approx 51{,}83N$ - the reaction force of the wall

As the ladder is fixed, then the equality of forces:

$N_A = F_{fr} = 51{,}83\ N$ – the frictional force

Answer the questions:

$N_A = 51{,}83N.$

$N_A = F_{fr} = 51{,}83\ N$