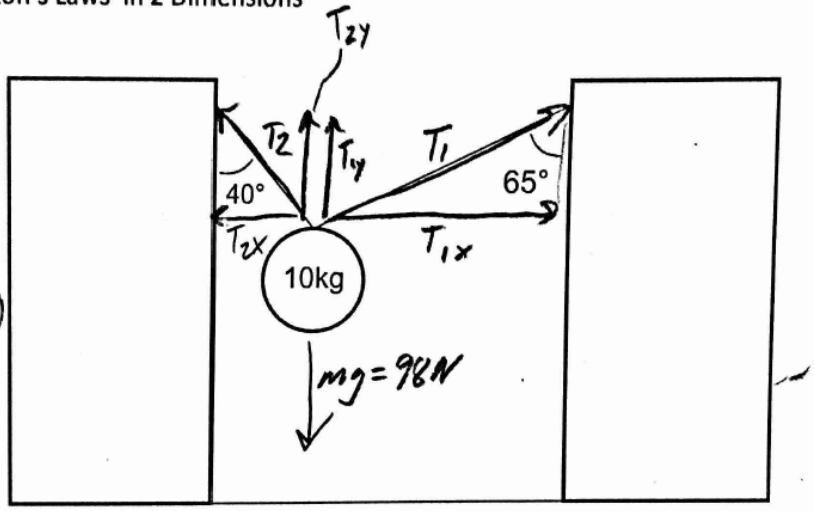
Physics 200

Name: Key

Masses Hanging and Dragged at Angles – Newton's Laws in 2 Dimensions

2. The 10kg mass is in static equilibrium. Find the tensions in the two segments of rope.



$\Sigma F_y = 0 = T_{1y} + T_{2y} - 98N$

$\Sigma F_x = 0 = T_{1x} - T_{2x} \Rightarrow T_{1x} = T_{2x}$

$\sin 65°(T_1) = \sin 40°(T_2)$

$0.906\,T_1 = 0.643\,T_2$

$T_1 = 0.71\,T_2$

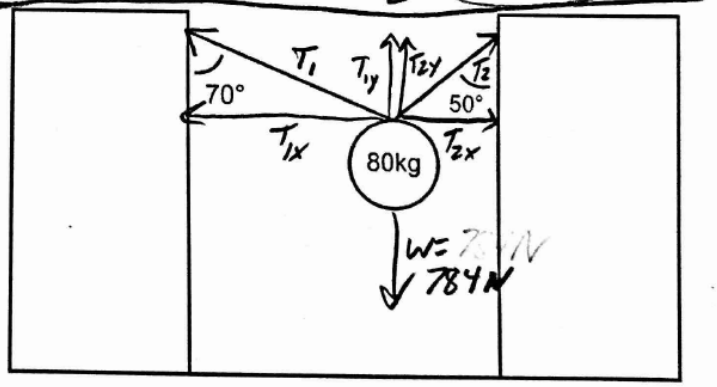
$0 = \cos 65° T_1 + \cos 40° T_2 - 98N$

$0 = 0.423T_1 + 0.766T_2 - 98N = 0.423(0.71T_2) + 0.766T_2 - 98N$

$0 = 0.766T_2 + 0.3T_2 - 98N$

$T_2 = 91.5N \Rightarrow T_1 = 0.71\,T_2 = 65N$

1. The 80kg mass is in static equilibrium. Find the tensions in the two segments of rope.



$\Sigma F_x = 0 = T_{2x} - T_{1x} \Rightarrow T_{1x} = T_{2x}$

$\Sigma F_y = 0 = T_{1y} + T_{2y} - 784N$

$T_{1x} = \sin 70°(T_1)$ $T_{2x} = \sin 50°(T_2)$

0.94 0.766

$0.94\,T_1 = 0.766\,T_2$

$T_1 = 0.815\,T_2$

$\cos 70°(T_1) + \cos 50°(T_2) - 784N = 0$

$0.342(0.815T_2) + 0.643(T_2) - 784N = 0$

$0.279\,T_2 + 0.643\,T_2 = 784N$

$T_2 = 850N$ $T_1 = 693N$

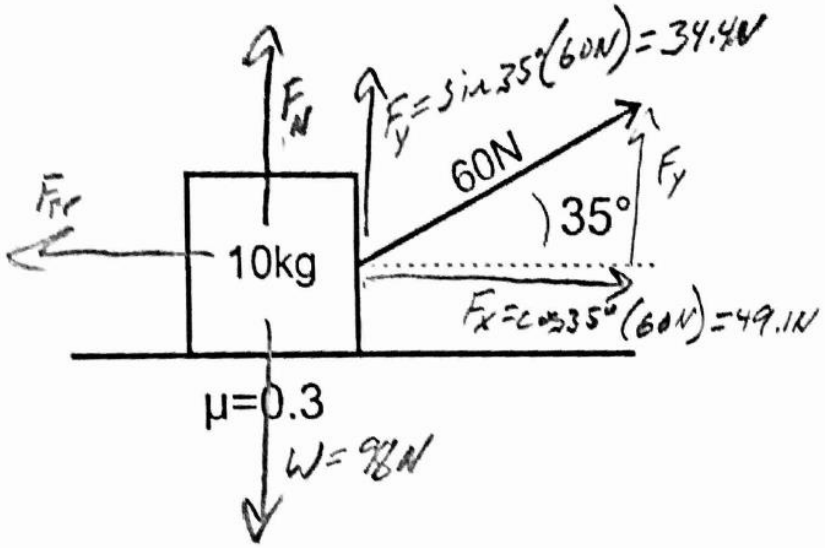
234

539

642

642

3. Find the acceleration of the 10 kg mass.



$\Sigma F_y = F_y + F_N - w = 0$

$0 = 34.4N + F_N - 98N$

$F_N = 63.6N$

$\Sigma F_x = F_x - F_{fr}$

$= 49.1N - \mu F_N$

$= 49.1N - (0.3)(63.6N)$

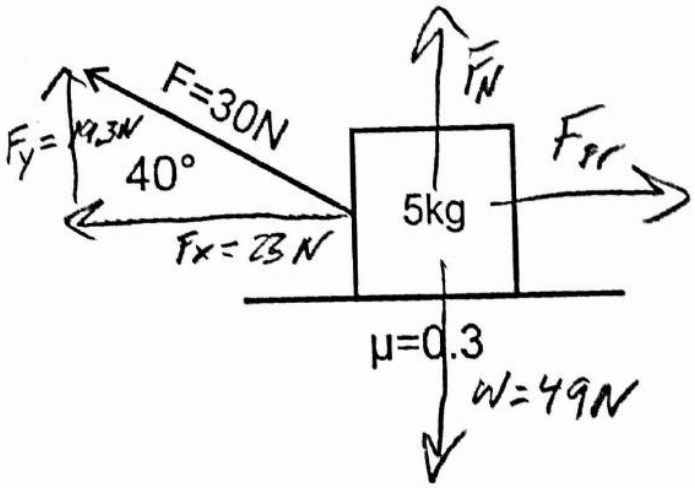
$\Sigma F_x = 29.9N$

$\Sigma F_x = m a_x$

$29.9N = 10kg\,(a_x)$

$a_x = 2.99\ m/s^2$

4. Find the acceleration of the 8kg mass.



$\Sigma F_y = F_y + F_N - w = 0$

$= 19.3N + F_N - 49N = 0$

$F_N = 29.7N$

$\Sigma F_x = F_{fr} - F_x$

$= \mu F_N - F_x$

$= 0.3(29.7N) - 23N$

$= -14.1N$

$\Sigma F_x = m a_x$

$-14.1N = 5kg\,(a_x)$

$a_x = -2.82\ m/s^2$