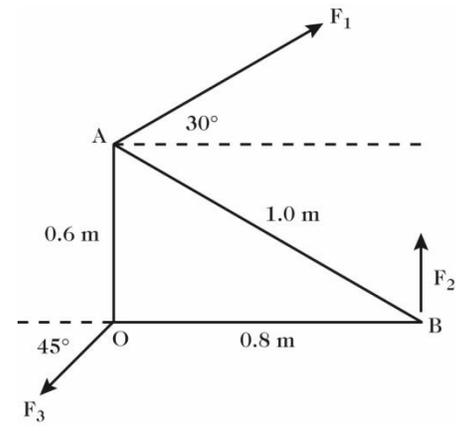


| | | | |
|----------------------------------|-----------------------------------|---|--------------------------------|
| $\Sigma F_x = ma_x$ | $f_s \leq \mu_s N$ | $f_k = \mu_k N$ | $a_c = \frac{v^2}{R}$ |
| $\tau = rF \sin \theta$ | $\Sigma \tau = I\alpha$ | $v = \omega r$ | $a = \alpha r$ |
| $\vec{p} = m\vec{v}$ | $\vec{J} = \vec{F}_{avg}\Delta t$ | $\vec{P}_f - \vec{P}_i = \vec{J}_{ext}$ | $W = Fd \cos \theta$ |
| $K_{rot} = \frac{1}{2}I\omega^2$ | $U_{grav} = mgy$ | $U_{spring} = \frac{1}{2}kx^2$ | $\Delta E_{th} = f_k \Delta x$ |
| | | | $K = \frac{1}{2}mv^2$ |
| | | | $\Delta E = W$ |

1. A triangular plate OAB with a moment of inertia of 4.0kg m² is in a horizontal plane. It is pivoted about a vertical axis through point O. Three forces, F₁ = 2N, F₂ = 4 N, and F₃ = 7 N, act on the plate. Calculate the angular acceleration of the plate.



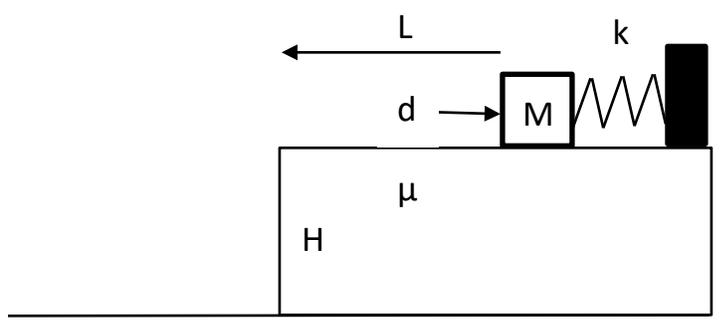
2. A spring is hanging vertically. You hang a mass of 450 g on the lower end of the spring and the spring stretches 14.0 cm from its equilibrium position

- a) What is the spring constant of this spring?
- b) If you add 200 g, how much further does the spring stretch?

3. Two students slide on a frictionless horizontal pond surface. Sam with mass *M* is originally moving eastwards. Amy with mass *m* is originally sliding northward. They collide and after the collision Sam is moving with speed *v_s* at angle θ north of east, while Amy is moving at angle ϕ south of east with speed *v_A*.

- a) Draw a diagram for the situations before and after the collision.
- b) What was the speed of each person before the collision?

4. A monkey places a box of bananas of mass *M* on a horizontal, rough cliff top next to a spring of force constant *k*. The cliff top is a height *H* above the ground. The box is pushed against the spring, compressing it a distance *d*. The box is now a distance *L* from the left edge of the cliff and it is launched from rest. The coefficient of kinetic friction between the box and cliff top is μ . The box travels along the cliff top and then flies off the edge. It strikes the ground where a second monkey is waiting.



Derive an expression for the speed *V* at which the box hits the ground in terms of system parameters.