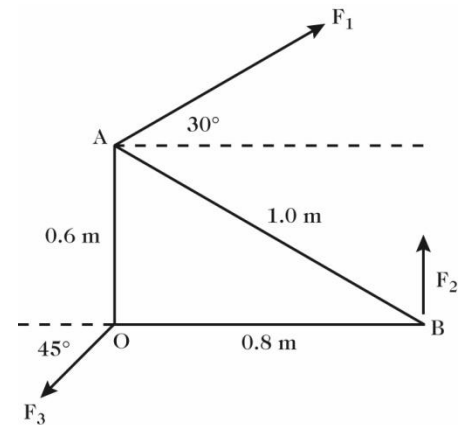


$\Sigma F_x = ma_x$	$f_s \leq \mu_s N$	$f_k = \mu_k N$	$a_c = \frac{v^2}{R}$
$\tau = rF \sin \theta$	$\Sigma \tau = I\alpha$	$v = \omega r$	$a = \alpha r$
$\vec{p} = m\vec{v}$	$\vec{J} = \vec{F}_{avg}\Delta t$	$\vec{P}_f - \vec{P}_i = \vec{J}_{ext}$	$W = Fd \cos \theta$
$K_{rot} = \frac{1}{2}I\omega^2$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

1. A triangular plate OAB with a moment of inertia of 4.0 kg m^2 is in a horizontal plane. It is pivoted about a vertical axis through point O. Three forces, $F_1 = 2\text{ N}$, $F_2 = 4\text{ N}$, and $F_3 = 7\text{ N}$, act on the plate. Calculate the angular acceleration of the plate.



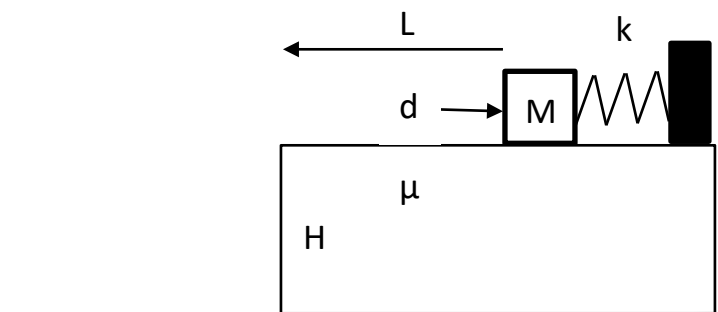
2. A spring is hanging vertically. You hang a mass of 450 g on the lower end of the spring and the spring stretches 14.0 cm from its equilibrium position

- What is the spring constant of this spring?
- 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 .

- Draw a diagram for the situations before and after the collision.
- 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.