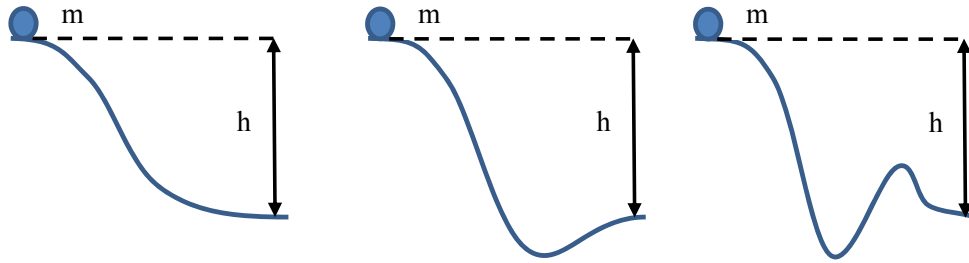


1. What is the velocity of the ball after it has rolled down the ramp? Assume negligible friction and that the initial velocity is zero in each example.



$$mgh = \frac{1}{2}mv^2 \rightarrow v = \sqrt{2gh}$$

2. How can you use this to find an expression for the resonance frequency of a mechanical harmonic oscillator (spring-mass system)?

Set the maximum stored kinetic energy equal to the maximum stored potential energy, and assume harmonic motion of the mass to find:  $\omega = \sqrt{k/m}$

3. How does the resonance frequency change (up, down, or unchanged) if the spring sets the mass into rotation as it is elongated? Assume that the rotation speed is proportional to the linear speed.

The resonance frequency goes down.

4. How can you use the same thinking to find the shape of a beamed curved by positioning and twisting its ends (positioning the ends and fixing their angles)?

The curve with the minimum stored elastic energy is the correct solution.