1. A block, mass 0.7 kg, is "shot" from a spring gun as shown: The table has a height 1.2 m and is frictionless. If the spring has $k = 24 N/m$ and is originally compressed 0.2 m, how fast will the block be going when it hits the ground?

2. A bullet is shot into the air with muzzle velocity $v_0$ at an angle $\theta$ with the horizontal. Use energy considerations to find a) the highest point reached and b) the magnitude of the velocity when the bullet is at half its maximum height.

3. A particle can only move along the $x$ axis. Forces act on it so that its potential energy function is $U(x) = \frac{1}{2} k_1 x^2 + \frac{1}{4} k_2 x^4$
   where $k_1$ and $k_2$ are positive. The particle is started at $x = a$ with zero velocity.
   a. Where is the velocity a maximum? What is its magnitude?
   b. Where else will the velocity be zero?
   c. What is the force on the particle as a function of $x$?

4. A vertical spring, spring constant $k$, is compressed a distance $A$. A mass $m$ is placed on top of the spring and then released. The mass rises a distance $H$ above its initial position.
   a. Find $H$ in terms of the other parameters.
   b. What is the velocity of the block when the spring has returned to its unstretched length?
7. A block of mass 0.50 kg is pushed against a spring with spring constant k = 25 N/m.

A block is being pushed by the spring.

(a) What is the force which slides along a surface with coefficient of friction \( \mu = 0.2 \)? The block is released and it slides along a surface with coefficient of friction \( \mu = 0.2 \). The block is released and it slides along a surface with coefficient of friction \( \mu = 0.2 \).

(b) If the block starts at \( x = 0 \), moving to the right, with velocity \( v_0 \), where will it stop?

\[ \frac{dx}{dt} = \frac{|F|}{m} \]

6. (This is a one-dimensional problem.) A particle of mass is attached to the origin. The block has a velocity of magnitude 6 m/s, which is the coefficient of friction between the block and plane.

8. A 10 kg block is placed at rest on a plane inclined at \( 37^\circ \).