
Additional problems30 September 2024

- P1.** (KnK9.5) A block of mass $m = 2\text{kg}$ attached to one end of a spring moves in a circle of radius r on a frictionless horizontal surface. The other end of the spring is held by a frictionless pivot. The spring exerts a force kr where $k = 3$ SI units. The mass has a total energy $E = 12\text{J}$.
- (a) Calculate the radius of the orbit and the velocity of the mass.
 - (b) The mass is given a short impulse providing it with an instantaneous outward radial velocity of $v = 1\text{m/s}$. Indicate the state of the system before and after this impulse on its energy diagram.
 - (c) Find the maximum and minimum values of r for the new orbit.
- P2.** A satellite of mass m orbits a planet of mass M in a circular orbit of radius R .
- (a) Determine the energy and angular momentum of the satellite.
 - (b) An asteroid now hits the satellite with an impulse J radially inward. Determine the properties of the new orbit, assuming it to be an ellipse. Calculate its eccentricity.