

EXAM 1

15 October 1998

Directions

- This exam is open notes, open book.
 - You may not collaborate on this exam; do not work with others.
 - When you are done with the exam, give it to me. Don't put it my mailbox.
 - Remember to include units.
 - To receive full credit on these problems you must show your work clearly.
1. Consider two velocity vectors, \vec{v}_1 and \vec{v}_2 . Let \vec{v}_1 have a magnitude of 10m/s and point due south. Let \vec{v}_2 have a magnitude of 5m/s and a direction of 37 degrees north of east.
 - (a) Find $\vec{v}_1 - \frac{1}{2}\vec{v}_2$. (5 points)
 - (b) Find the magnitude of $\vec{v}_1 - \frac{1}{2}\vec{v}_2$. (5 points)
 - (c) Compute $\vec{v}_1 \cdot \vec{v}_2$. (5 points)
 2. The mass of the moon is 7.35×10^{22} kg. The radius of the moon is 1740km. Consider a 2 kg bowl of oatmeal in a spaceship 100 km above the surface of the moon. The oatmeal falls out of the ship and lands on the surface of the moon. What is the oatmeal's change in gravitational potential energy. (10 points)
 3. Consider a spring with a spring constant $k_s = 100\text{J/m}^2$. When relaxed, the spring has a length of 10 cm. In 2 seconds the spring is compressed 3 cm. What is the spring's change in potential energy? (10 points)
 4. Kerry Wood can throw a 115 gram baseball 100 mi/hr. Suppose he throws a baseball straight up. What is the baseball's speed when it is 50 meters high. Ignore air resistance. (25 points)
 5. Two pucks collide on a frictionless surface. One puck has a mass of 2 kg and is moving due north at 6 m/s. The second puck has a mass of 3 kg. The two pucks collide and stick together. After the collision the two pucks move at 5 m/s, 37 degrees north of east. What was the velocity (magnitude and direction) of the 3 kg puck immediately before the collision. (40 points)