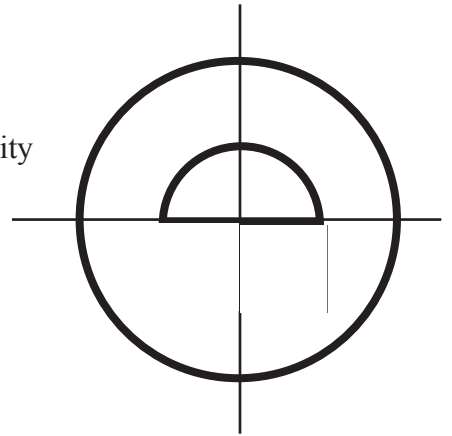


Beverly Hills High School -- AP Physics C -- Test #6 -- 90 points

As usual, be neat and complete. Units on everything. Pay attention to those details! Fifteen points apiece.

- 1) An object, with mass m and speed v relative to an observer, explodes into two pieces, one is $3/2$ as massive as the other; the explosion takes place in deep space. The less massive piece stops relative to the observer. How much kinetic energy is added to the system during the explosion, as measured in the observer's reference frame?

- 2) Suppose you had a circular metal plate of radius $2R$ with a semi-circular cut out of radius R , as shown. Assuming the plate is of uniform density and thickness, find the center of mass of the cut-out plate.



- 3) An 18.5 g bullet is fired into a 2.70 kg block of wood vertically suspended on a weightless, frictionless string. The combination rises 0.48 m above its starting point. Find the initial speed of the bullet.
- 4) Consider an elastic collision between two balls moving on a frictionless table. Ball 1 has mass 0.32 kg and is initially traveling at 1.25 m/s at an angle of -15° toward the collision point. Ball 2 has mass 0.48 kg and is initially traveling at 1.60 m/s at an angle of 80° toward the collision point. Ball 2 bounces away from the collision at a speed of 1.45 m/s at an angle of 28° . Find the final speed and direction of ball 1.

- 5) Three points. Define impulse and show how it can be understood as a change in momentum.
- 6) Ten points. A 4000 kg train is moving eastward at 15 m/s. Another train, of mass 6000 kg, is moving westward at 11 m/s. After they couple, find their displacement from the collision point one minute after they collide. Neglect friction, air resistance and the engineer's screaming.
- 7) Seven points. A 145 gram baseball is thrown horizontally at a hitter at a speed of 40 m/s. The batter hits the ball right back at the pitcher at 50 m/s. If the bat and ball are in contact for 0.08 seconds, how much force did the batter apply on the ball?

8) Find the center of mass of this system of point masses with the given data: (Ten points)

	mass	position
mass 1	12.5 kg	(8, -5)
mass 2	6.9 kg	(-4, 11)
mass 3	5.6 kg	(3, 15)