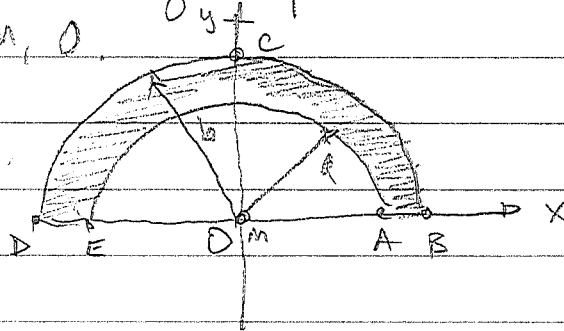


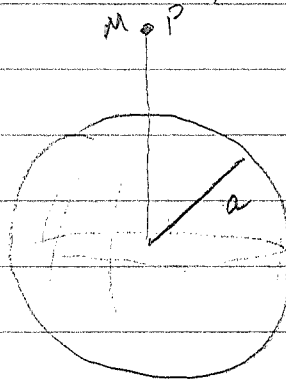
— SPRING BREAK — Challenge Problems

OPTIONAL

- ① A uniform plate has its boundary consisting of 2 concentric half circles of inner and outer radii a and b respectively, as shown in the figure. Find the force of attraction of the plate on a mass m located at the center, O .



- ② Find the force of attraction of a thin spherical shell of radius a on a particle P of mass m at a distance $r > a$ from its center.



- ③ Prove that the path of a planet around the sun is an ellipse with the sun at one focus. (Use vector methods)
- ④ Prove that the speed v of a particle moving in an elliptical path in an inverse square field is given by

$$v^2 = \frac{k}{m} \left(\frac{2}{r} - \frac{1}{a} \right)$$

where a is the semi-major axis.

- Q. A man-made satellite revolves about the earth at a height H above the surface. Determine a) the orbital speed and b) orbital period so that a person in the satellite will be in a state of weightlessness.