Second Problem Set Phy132
Due Friday, April 19

Problem 1. David has a mass of 70 Kg and is standing on the earth. Find:

a)The force in Newtons between David the earth.
b)The force in Newtons between David and the moon.
c)The force in Newtons between David and the sun.

You can use average values for the distance between David and the sun and moon.

Problem 2. Sally takes a space ship to an unknown planet, which has a uniform density. She picks up some soil and measures its density to be 6 g/cm^3. While standing on the surface, she takes a rock and drops it from a height of 2 meters. The rock takes 1 second to hit the ground. What is the radius and mass of the unknown planet?

Problem 3. Marie takes two small marbles, each with a mass M, and places them on the x-axis. One mass is at distance a to the right, (+a,0), and the other is at a distance a to the left, (-a,0), of center.

She takes a third marble of mass m and moves it along the y-axis.

a) Find an expression for the gravitational force on the mass m for all points on the y-axis.

b) Marie now takes the third marble of mass m and places it on the positive x-axis. Find an expression for the gravitational force on the mass m for points on the x-axis for values of x greater than a.

Express your answers in terms of G, m, M, a, and y or x.

Problem 4. The mass of one planet is M, and the mass of its moon is $M/4$. The planets are separated by a distance d. At a particular point between the planet and its moon the net gravitational force (due to the planet and moon) is equal to zero. How far from the planet is this point of zero net force? Express your answer in terms of d.

Problem 5. Two point particles each have a mass m. Initially they are held apart a distance d away from each other and are initially both at rest. How they are let go, and due to the gravitational force they are attracted to each other. What is their speed when they are a distance $d/2$ apart? Express your answer in terms of G, m, and d.

Problem 6. A spacecraft approaches a ring of mass. The spacecraft is very small and has a mass of m. The ring has a radius R, ad a relatively large mass of magnitude M, $M \gg m$. The spacecraft is located along the axis of the ring a distance of $4R$ from its center, and is initially at rest. See the figure on the figures page.

a) What force does the spacecraft feel due to the ring of mass M?
b) The spacecraft, which was initially at rest with respect to the ring, cannot start its propulsion unit and drifts toward the center of the ring. What is the velocity of the spacecraft when it reaches the rings center? Assume that the ring is very massive and hardly moves as the spacecraft is pulled towards its center.
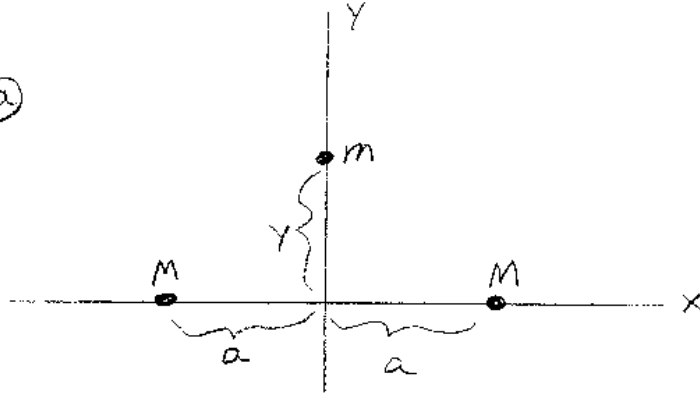
Express your answers in terms of G, m, M, and R.

Problem 7. A binary star system consists of two stars rotating about their center-of-mass. Suppose there is a binary star system consisting of two stars of equal mass, m. Let the distance between the stars be d. That is, each star rotates with a radius of $d/2$ about the center. Find an expression for the period T of the stars in terms of G, m, and d.
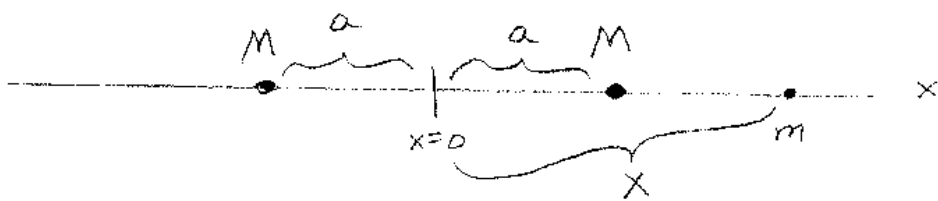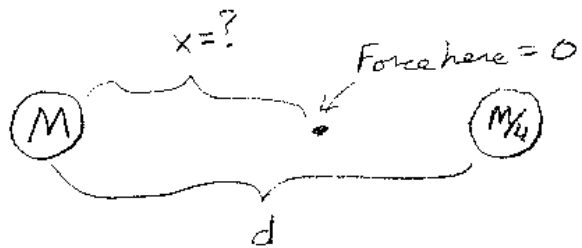
Figures for Homework 2

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R

M

m

— 4R —→