P113 University of Rochester NAME _____
S. Manly Fall 2003

# Exam 3 (December 9, 2003)

*Please read the problems carefully and answer them in the space provided. Write on the back of the page, if necessary. Show all your work. Partial credit will be given unless specified otherwise.*

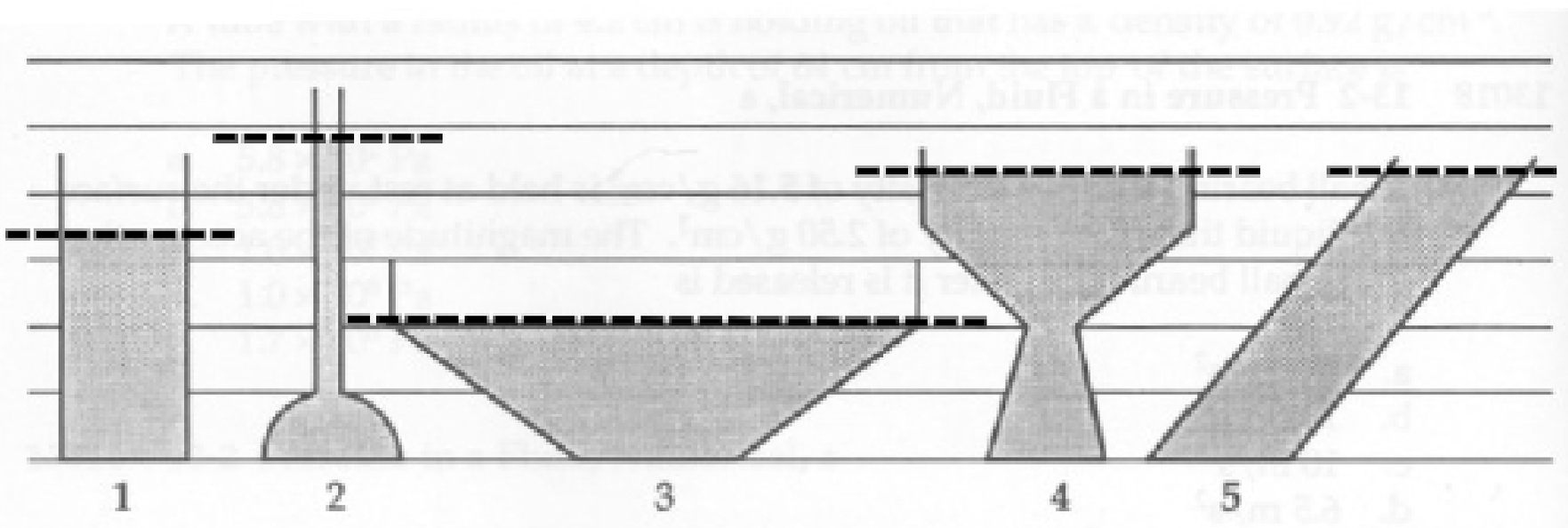
**Problem 1 (12 pts, briefly justify your answers to get credit):**

**Consider The vessels in the figure below. They each contain liquids of the same density. The vessel that has the greatest pressure at its base is**

**a) 1**
**b) 2**
**c) 3**
**d) 4**
**e) 5**
**f) any vessel, since all vessels have the same pressure at the base.**

**An identical pebble sits on the bottom surface of each vessel. In which container will the apparent weight of the pebble be the least? That is to say, in which vessel will the normal force of the base on the pebble be least? Assume the fluid is incompressible (has constant density throughout the volume).**

**a) 1**
**b) 2**
**c) 3**
**d) 4**
**e) 5**
**f) It will be the same in each vessel.**



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| | |
|---|---|
| 1) | /12 |
| 2) | /10 |
| 3) | /10 |
| 4) | /10 |
| 5) | /10 |
| 6) | /16 |
| 7) | /16 |
| 8) | /16 |
| tot | /100 |

**Problem 2 (10 pts, briefly justify your answers to get credit):**

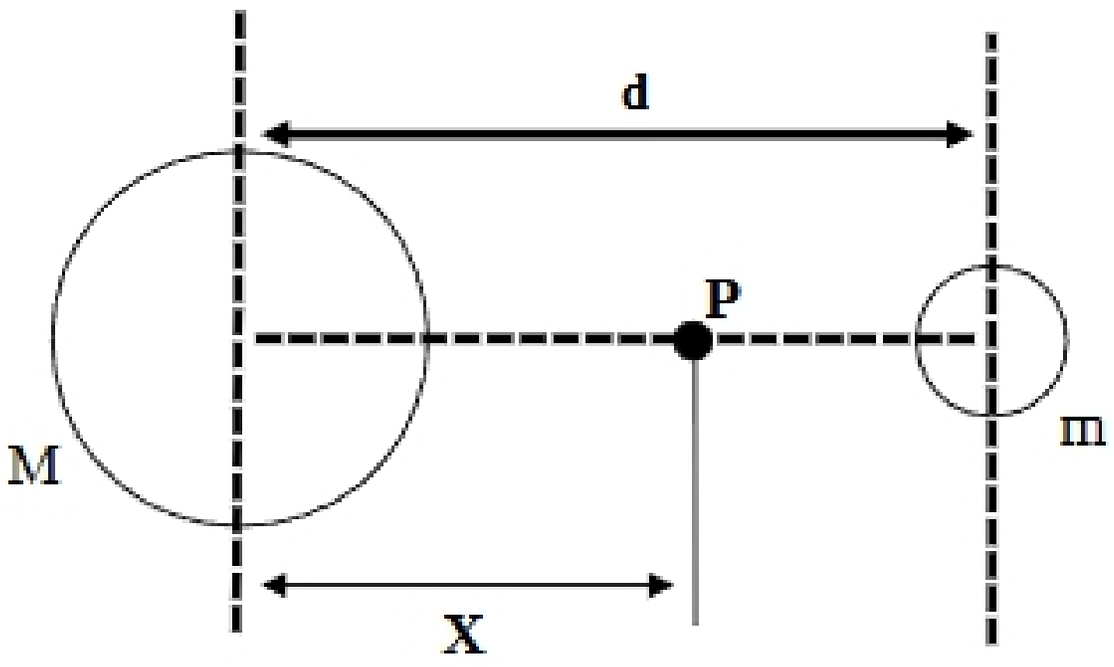
**Two identical cylindrical disks have a common axis. Initially one of the disks is spinning. When the two disks are brought into contact, they stick together. Which of the following is true?**

a) **The total kinetic energy and the total angular momentum are unchanged from their initial values.**
b) **Both the total kinetic energy and the total angular momentum are reduced to half of their original value.**
c) **The total angular momentum is unchanged, but the total kinetic energy is reduced to half its original value.**
d) **The total angular momentum is reduced to half its original value, but the total kinetic energy is unchanged.**
e) **The total angular momentum is unchanged, and the total kinetic energy is reduced to one-quarter of its original value.**

**Problem 3 (10 pts):**

**Spaceman Spiff flies his spacecraft near two planets whose centers of mass are separated by a distance d. He finds that when he is at a position P between the two planets (as shown below) the gravitational field is zero, i.e. there is no net gravitational force on Spiff and his spacecraft. Spiff determines through a careful measurement that the point P lies at a distance X=4d/5. "Ah ha!" Spiff declares. "Now I know the mass of the large planet (M) in terms of the mass of the small planet (m)!"**

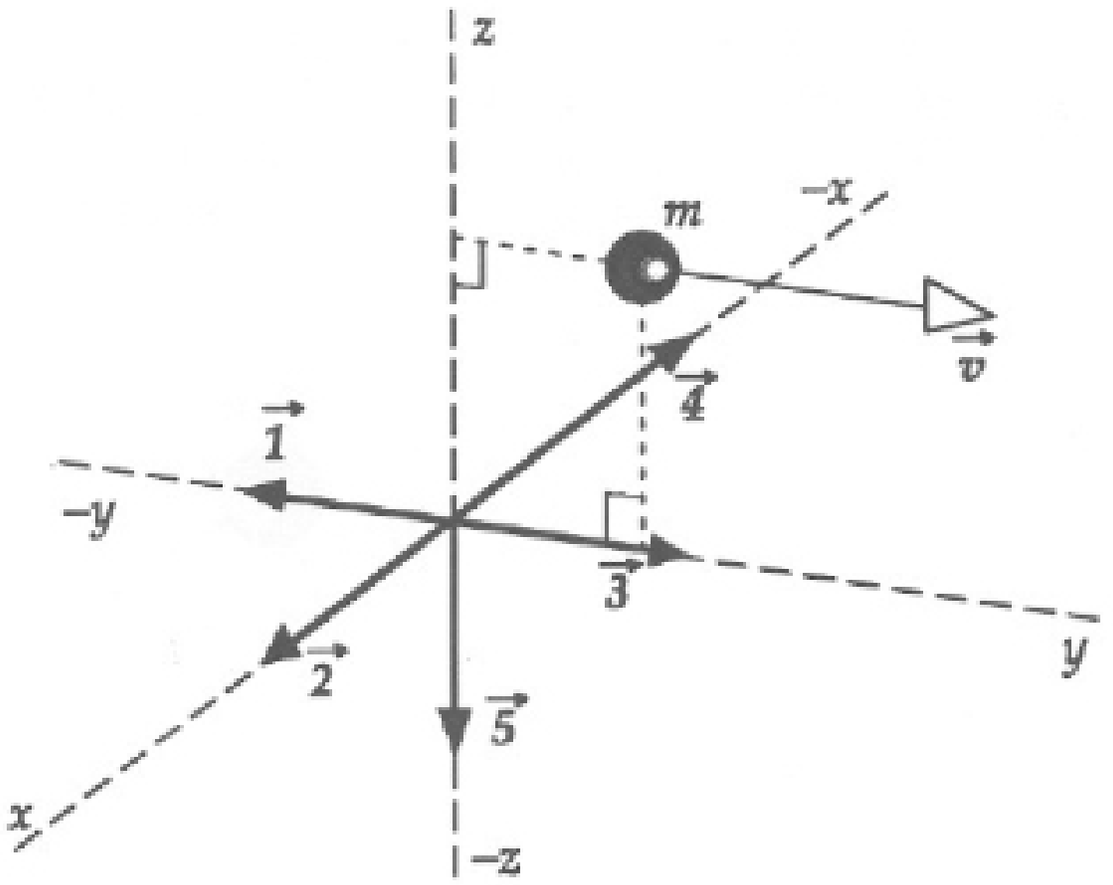
**Duplicate Spiff's calculation here. That is to say, calculate how much more massive is the large planet than the small planet in terms of multiples of the small planet's mass.**



**Problem 4 (10 pts, no partial credit):**

**A particle of mass m is moving with a velocity v in the yz plane as shown in the figure. The vector that most nearly represents the angular momentum about the x axis is**

a) 1
b) 2
c) 3
d) 4
e) 5




**Problem 5 (10 pts, no partial credit):**

**A wheel is rotating clockwise on a fixed axis perpendicular to the page (vector 3 is into the page, vector 1 is out of the page). A torque that causes the wheel to slow down is best represented by the vector**

a) 1
b) 2
c) 3
d) 4
e) 5