FOURTH PRACTICE MIDTERM B
MATH 18.02, MIT, AUTUMN 12

You have 50 minutes. This test is closed book, closed notes, no calculators.

There are 5 problems, and the total number of points is 100. Show all your work. *Please make your work as clear and easy to follow as possible.*

Name:_____

Signature:_____

Student ID #:_____

Recitation instructor:_____

Recitation Number+Time:_____

Problem	Points	Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

1. (20pts) Set up a triple integral in cylindrical coordinates for the mass of the region of space bounded below by the paraboloid $z = x^2 + y^2$ and above by the plane $z = 4$. Assume the density $\delta = 3x$.

2. (20pts) Set up an iterated integral, in both cylindrical and spherical coordinates, giving the average distance from the origin to the portion of the unit cylinder $x^2 + y^2 < 1$ which lies between $z = 0$ and $z = 1$.

3. (20pts) A solid D has the shape of a right circular cone, with axis along the z-axis, and a flat base. The base radius and the height are a. Set up an integral in spherical coordinates which gives the gravitational attraction on a unit mass placed at the vertex. Assume the density δ is one.

4. (20pts) Let S be the surface formed by the part of the paraboloid $z = 1 - x^2 - y^2$ lying above the xy-plane. Orient S so that the normal vector is pointing upwards. Let $\vec{F} = x\hat{\imath} + y\hat{\jmath} + 2(1-z)\hat{k}$.
(i) Find the flux of $\vec{F}$ across S directly.

(ii) By computing the flux across a simpler surface and using the divergence theorem.

5. (20pts) Let

$$\vec{F} = (y+z)\hat{\imath} - x\hat{\jmath} + (7x+5)\hat{k},$$

be a vector field and let S be the part of the surface $z = 9 - x^2 - y^2$ that lies above the xy-plane. Orient S by using the outward normal vector. Find the outward flux of $\vec{F}$ across S.