

# Math 53 Homework 9

Due Wednesday 11/6/13 in section

(The problems in parentheses are for extra practice and optional. Only turn in the underlined problems.)

## Monday 10/28: Triple integrals in cylindrical coordinates; applications

- **Read:** section 15.7 from p. 1022; section 15.8.<sup>1</sup>
- **Work:** 15.7: (39), (43), 46, (53), 54.<sup>2</sup> (feel free to use cylindrical coordinates!)  
15.8: (9), (15), (17), (19), 21, 22, (25), (26), 30.<sup>3</sup>  
Problem 1 below.

## Wednesday 10/30: Triple integrals in spherical coordinates

- **Read:** section 15.9. [6th edition: 15.8.]
- **Work:** 15.9: (5), (7), 9, (13), 14, 15, (17), 19\*, (23), 26, (29), 30, 33, 35, (39).<sup>4</sup>  
Problem 2 below.

\* For 15.9 # 19: set up the integral *both* in cylindrical and in spherical coordinates.

## Friday 11/1: Vector fields

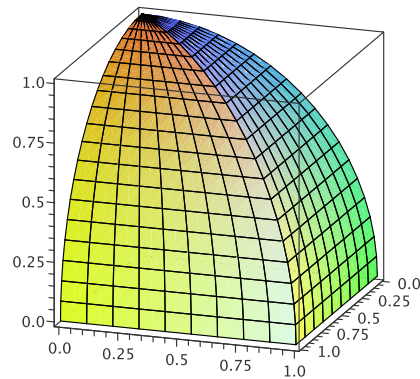
- **Read:** section 16.1.
- **Work:** 16.1: (5), 11, 13, (15), 18, (21), 26, 31.<sup>5</sup>

### Problem 1.

The picture shows the portion of the solid formed by the intersection of the solid cylinders  $y^2 + z^2 \leq 1$  and  $x^2 + z^2 \leq 1$  (two cylinders of radius 1, centered on the  $x$ -axis and on the  $y$ -axis respectively) which lies in the first octant ( $x \geq 0$ ,  $y \geq 0$ ,  $z \geq 0$ ). The front “face” is a portion of the cylinder  $x^2 + z^2 = 1$ , while the right “face” is part of  $y^2 + z^2 = 1$ .

Find the volume and the centroid  $(\bar{x}, \bar{y}, \bar{z})$  (= center of mass with uniform density  $\rho = 1$ ) of the pictured solid.

(Hint: the integral is easier to set up in the order  $dx dy dz$ ).



**Problem 2.** Recall that the *average value* of  $f(x, y, z)$  over a region  $D$  in space is

$$\frac{1}{V(D)} \iiint_D f(x, y, z) dV, \quad V(D) = \text{volume of } D$$

Set up the integral *both* in cylindrical and spherical coordinates for the average distance from a point in the solid sphere of radius  $a$  to a point on the surface, and evaluate both integrals. Put the point on the surface at the origin and make it the South pole of the sphere.

<sup>1</sup>6th ed: section 15.6 from p. 995; section 15.7.

<sup>2</sup>6th ed: 15.6: (37), (41), 44, (51), 52.

<sup>3</sup>6th ed: 15.7: (9), (15), (17), (19), 21, 22, (23), (24), 28.

<sup>4</sup>6th ed: same problem numbers but in 15.8 instead of 15.9.

<sup>5</sup>6th ed: 16.1 # 11 and 13 are different from the 7th edition. Do either version.