

**18.01 SPRING 2005
PROBLEM SET 6
DUE TUESDAY, MARCH 29**

Have a nice Spring break!

The Usual Instructions

- Write up your solutions neatly, preferably with all pages stapled. You need not show every arithmetic calculation, but must always show enough work to demonstrate the process by which the answer is reached. Without this, the grader can't be sure that you didn't just copy the answers from someone else, and there's no way to give partial credit.
- You're free to work together in groups, but you must write up the solutions independently. Plagiarism is easy to detect.
- You can either hand in your solutions in class by the due date, or slip them through the slot in my office door (2-172) by 11:59pm that night.

Reading

Simmons 7.3, 7.4, 5.4, 8.5.

Ungraded problems

Do the following exercises for practice—preferably after the corresponding lecture—but *do not hand them in*. The solutions are available to you, so you should check your work. Starred problems are especially recommended.

Each problem is from the Notes unless stated otherwise:

- *Th 3/17/05*: 4B-1, 4B-2, 4B-3*, 4B-7*, 4C-1, 4C-3
- *Fr 3/18/05*: 3F-1, 3F-2, 3F-3, 3F-4, 3F-8

Graded problems, Part A [44 pts total]

From Simmons:

- 7.3 #2, 6, 18 [4 pts each], 22 [5 pts]
- 7.4 #4, 6 [2 pts each], 10 [4 pts]
- 5.4 #2, 4 [2 pts each], 8, 10, 20 [3 pts each]
- 8.5 #6 [2 pts], 16 [4 pts]

Graded problems, Part B [10 pts total]

1. [10 pts] Recall that a *regular tetrahedron* is a solid with four identical faces, each an equilateral triangle—you can think of it as a symmetric pyramid whose base is an equilateral triangle instead of a square. Use integration and your knowledge of the area of a triangle to show that a regular tetrahedron with edges of length s has volume

$$V = \frac{\sqrt{2}}{12} s^3.$$

Hint: it may help to think of the base as a triangle in the xy -plane with vertices $(a, 0)$, $(-\frac{1}{2}a, \frac{\sqrt{3}}{2}a)$ and $(-\frac{1}{2}a, -\frac{\sqrt{3}}{2}a)$, where $a > 0$ is a number related to s . In this case the fourth vertex of the tetrahedron is a point somewhere on the z -axis.