

Problem Set for Week 12–13

The work handed in should be entirely your own. You can consult Stewart and/or the class notes but nothing else. To receive full credit, justify your answer in a clear and logical way. Due Friday, Apr. 24.

Reading. This is the most important part of the homework: Read Sections 15.8–15.9, 16.9 of the textbook carefully.

1. Section 15.8 Exercises 8, 10, 16, 18, 24, 30,
2. Section 15.9 Exercises 8, 10, 14, 22, 26, 40,
3. The solid B is the cap of a sphere, given by the equations $x^2 + y^2 + z^2 \leq 4$, $z \geq 1$. Evaluate the integral $\iiint_B z dV$
 - a) in cylindrical coordinates,
 - b) in spherical coordinates.
4. Section 16.9 Exercises 4, 8, 12, 18, 26,
5. Evaluate the integral $\iint_S \mathbf{F} \cdot d\mathbf{S}$. Here \mathbf{F} is the field

$$\mathbf{F}(x, y, z) = \frac{x^2}{2}\mathbf{i} + y\mathbf{j} + \mathbf{k},$$

and the surface S is the top of a cone, oriented upward, given by the equations

$$z = 1 - \sqrt{x^2 + y^2}, \quad z = 0.$$

6. Evaluate the integral $\iint_S \mathbf{F} \cdot d\mathbf{S}$. Here \mathbf{F} is the field

$$\mathbf{F}(x, y, z) = \frac{x}{(x^2 + y^2 + z^2)^{3/2}}\mathbf{i} + \frac{y}{(x^2 + y^2 + z^2)^{3/2}}\mathbf{j} + \frac{z}{(x^2 + y^2 + z^2)^{3/2}}\mathbf{k},$$

and the surface S is the ellipsoid, oriented outward, given by the equation

$$\frac{x^2}{4} + \frac{y^2}{9} + \frac{z^2}{16} = 1.$$