

Name \_\_\_\_\_

Homework 22  
Sections 19.1 & 19.2

1. (5) Let  $S$  be the part of the graph of  $z = 9 - x^2 - y^2$  with  $z \geq 0$ . If  $\vec{F}(x, y, z) = 3x\vec{i} + 3y\vec{j} + \vec{k}$ , find the flux of  $\vec{F}$  through  $S$ , where  $S$  has the outward orientation.

2. (3ea) Consider the vector field  $\vec{F}(x, y, z) = xz\vec{i} + 2y\vec{k}$ . Set up simplified (i.e. compute the dot products) iterated integrals to represent the flux of  $\vec{F}$  through the hemisphere  $x^2 + y^2 + z^2 = 9, z \geq 0$ , oriented upward using

(a) Cartesian coordinates

(b) Spherical coordinates

3. (5) Compute the flux of  $\vec{F} = xz\vec{i} + 2y\vec{k}$  through the hemisphere  $x^2 + y^2 + z^2 = 9$ ,  $z \geq 0$ , oriented upward using one of your integrals from the previous problem.

4. (5) Find the flux of  $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^3\vec{k}$  through an open cylinder of height 6 and radius 2 centered along the  $z$ -axis, oriented away from the  $z$ -axis. *Hint:*  $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$