Review problems for final exam.

1. Calculate the flux of $\vec{F} = \langle xz, yz, z^2 \rangle$ through the sphere of radius 12 centered at the origin, oriented outward.

2. Calculate the flux of $\vec{F} = \langle z, x, 0 \rangle$ through the surface $\vec{r}(s,t) = \langle s^2, 2s + t^2, 5t \rangle$ for $0 \leq s \leq 1$, $1 \leq t \leq 3$ oriented upward.

3. Let C be the circle of radius 8 parallel to the yz-plane centered at $(1, 1, -1)$ oriented counterclockwise when viewed from the origin. Evaluate $\oint_C \vec{F} \cdot d\vec{r}$ where $\vec{F}(x, y, z) = \langle 8y, -2z, 3x \rangle$.

4. Calculate the flux of $\vec{F} = \langle 0, 0, \cos(x^2 + y^2) \rangle$ through the portion of the surface $z = 25 - x^2 - y^2$ above $z = 0$ oriented downward.

5. Calculate the flux of $\vec{F} = \langle x - y, z, 3x \rangle$ through the surface $z = x + y$ oriented upward with $0 \leq x \leq 2, 0 \leq y \leq 3$.

6. Let σ be the upward-oriented surface parametrized by

$$x = a\cos\theta, y = a\sin\theta, z = \sin\left(a^2\right)$$

with $0 \leq \theta \leq \pi$ and $1 \leq a \leq 3$. Calculate the flux of $\vec{F} = \langle -2/x, 2/y, 0 \rangle$ through σ.

7. Let $\vec{F} = \langle y + x^3, z + y^3, x + z^3 \rangle$ and let C be the oriented triangle obtained by tracing out the path $(2, 0, 0)$ to $(2, 0, 5)$ to $(2, 3, 5)$ and back to $(2, 0, 0)$. Evaluate $\oint_C \vec{F} \cdot d\vec{r}$.

8. Calculate the flux of $\vec{F} = \langle e^{yz^2}, \arctan x, \sin(xy^2) + z \rangle$ through the closed box $0 \leq x \leq 2$, $1 \leq y \leq 3$, $2 \leq z \leq 5$ oriented inward.

9. As many of 15.1.7–16, 15.2.17, 15.2.22, 15.3.1–17 until you feel comfortable with the methods