Assignment 9

This assignment will not be collected. However, it is very important that you do the problems as this material will be emphasized on the exam.

1. Section 16.9: 18

2. Section 16.9: 24

3. Section 16.8: 17

4. Section 16.8: 18

5. Evaluate each of the following either by a direct computation or by applying Stokes' Theorem or the Divergence Theorem, as convenient.

   (a) $\displaystyle\int\int_S (xy\mathbf{i} + z\mathbf{j}) \cdot d\mathbf{S}$ where S is the part of the surface $xyz = 1$ with $1 \leq x \leq 2$, $1 \leq y \leq 2$. Assume S is given the upward orientation.

   (b) $\displaystyle\int\int_S \mathbf{F} \cdot d\mathbf{S}$, where $\mathbf{F} = (x + e^{y^2})\mathbf{i} + \mathbf{k}$ and where S is the part of the paraboloid $z = 1 - x^2 - y^2$ that lies between the planes $z = 0$ and $z = 1$. Assume S is given the upward orientation.

   (c) $\displaystyle\int_C e^{x^2}\, dx + x\, dy + xy\, dz$ where C is the curve of intersection of the cylinder $x^2 + y^2 = 1$ and the plane $x + 2y + z = 10$. Here C is assumed to be oriented counterclockwise when viewed from above.

6. Let $\mathbf{F}(x, y, z) = \langle \frac{-y}{x^2+y^2}, \frac{x}{x^2+y^2}, 0 \rangle$. (Note that you've seen this vector field before as a vector field in $\mathbf{R}^2 - \{(0,0)\}$. We're viewing it now as a vector field defined in $\mathbf{R}^3$ except on the z-axis.) Check that $curl\mathbf{F} = \mathbf{0}$. Let C be any simple closed curve that encircles the z-axis once counterclockwise. Find $\int_C \mathbf{F} \cdot d\mathbf{r}$.