Review exercise 1

1) Proceed as in Example 6 (page 519) to evaluate the given line integral

$$\oint_c \frac{-y^3dx + xy^2dy}{(x^2+y^2)^2}$$

where C is the ellipse $x^2 + 4y^2 = 4$ (Problem 25, page 521)

2) Evaluate $\iint_S (3z^2 + 4yz)\, dS$, where S is the portion of the plane $x + 2y + 3z = 6$ in the first octant. Use the portion of S onto the coordinate plane indicated in the given plane.
(Problem 25 and 26, page 528)

3) Use Stokes' theorem to evaluate $\oint_C \vec{F} \cdot d\vec{r}$. Assume C is oriented counterclockwise as viewed from above. $\vec{F} = xy\vec{i} + 2yz\vec{j} + xz\vec{k}$. ; C the boundary of the plane $z = 1 - y$ shown in Figure 9.121(page 534) (Problem 9, page 534)

4) Use triple integrals and cylindrical coordinates to find the volume of the solid that is bounded by the graphs of the given equations.
$x^2 + y^2 = 4$, $x^2 + y^2 + z^2 = 16$, $z = 0$ (Problem 51, page 545)

5) Use triple integrals and spherical coordinates to find the volume of the solid that is bounded by the graphs of the given equations.
$z = \sqrt{x^2 + y^2}$, $x^2 + y^2 + z^2 = 9$ (Problem 75, page 545)

6) Consider the function $\vec{f}(x, y) = x^2y^4$. At $(1,1)$ what is:
(a) The rate of change of $\vec{f}$ in the direction of $\vec{i}$?
(b) The rate of change of $\vec{f}$ in the direction of $\vec{i} - \vec{j}$?
(c) The rate of change of $\vec{f}$ in the direction of $\vec{j}$? (Problem 29, page 559)

7) Find the volume of the solid shown in Figure 9.152 (page 559)
(Problem 38, page 559)

8) Find the indicated expression for the vector field $\vec{F} = x^2y\vec{i} + xy^2\vec{j} + 2xyz\vec{k}$
(a) $\nabla \cdot \vec{F}$, (b) $\nabla \times \vec{F}$, (c) $\nabla \cdot (\nabla \times \vec{F})$, (d) $\nabla(\nabla \cdot \vec{F})$ (Problem 39~42, page 559)

9) If $\vec{F} = x\vec{i} + y\vec{j} + z\vec{k}$, use the divergence theorem to evaluate $\iint_S (\vec{F} \cdot \vec{n})\, dS$, where S is the surface of the region bounded by $x^2 + y^2 = 1$, $z = 0$, $z = 1$.
(Problem 59, page 560)