1.) Evaluate $\displaystyle\int_0^2 \int_{(1/2)y}^1 e^{x^2}\ dx\ dy$.

2.) Use a triple integral to find the volume of the region D enclosed by the cylinder $(x-1)^2+y^2 = 1$, the plane $z = 0$, and the plane $z = 2 + y$.

3.) Let loop C be the triangle with vertices $(0,0)$, $(2,0)$, and $(2,6)$. Evaluate the line integral $\oint xy\ dx + (x-y)\ dy$ two ways :

a.) directly as a line integral.

b.) using one of Green's Theorems.

4.) Let loop C be the circle $x^2 + y^2 = 4$. Use one of Green's Theorems to find the Flux of $\vec{F}(x, y) = (5x)\vec{i} + (-3y)\vec{j}$ across C .

5.) Let surface S be that portion of the cylinder $x^2 + y^2 = 4$ cut by the planes $z = 0$ and $z = 2 + y$.

a.) Sketch surface S and parametrize it.

b.) Use a surface integral to find the area of S.

6.) Evaluate the surface integral $\displaystyle\int\!\!\int_S (xz)\ dS$, where S is given parametrically by $\vec{r}(\phi, \theta) = (\sin\phi\cos\theta)\ \vec{i} + (\sin\phi\sin\theta)\ \vec{j} + (\cos\phi)\ \vec{k}$ for $0 \le \phi \le \pi/4$ and $0 \le \theta \le \pi/2$. .

7.) Verify the Divergence Theorem for $\vec{F}(x, y, z) = (y)\ \vec{i} + (-x)\ \vec{j} + (-xz)\ \vec{k}$, where the solid D is enclosed by the paraboloid $z = x^2 + y^2$ and the plane $z = 1$.

8.) Verify Stoke's Theorem for $\vec{F}(x, y, z) = (x)\ \vec{i} + (y)\ \vec{j} + (xz)\ \vec{k}$, where the surface S is that portion of the plane $2x + 2y + z = 2$ lying in the first octant, and the unit normal vector $\vec{n}$ is pointing upward.

The following EXTRA CREDIT PROBLEM is worth . This problem is OPTIONAL.

1.) Assume that curve C is given parametrically by $\vec{r}(t) = (f(t))\ \vec{i} + (g(t))\ \vec{j} + (h(t))\ \vec{k}$ for $t \geq 0$. Let $s = s(t)$ be the arc length of curve C from $t = 0$ to t. Assume that the unit tangent vector is given by

$$\vec{T}(t) = \vec{T}(t(s)) = (s)\ \vec{i} + (s^2)\ \vec{j} + (s^3)\ \vec{k}\ .$$

Find the curvature of C when the arc length is $s = 1$.