Vector & Tensor Analysis
Exam # 2

1) Let $\bar{F} = (x+y)\bar{i} + z\,\bar{j} + x\,z\,\bar{k}$. If $\sum$ is the surface of the cube defined by $x = \pm 1$, $y = \pm 1$, $z = \pm 1$, what is flux of $\bar{F}$ across $\sum$?

(20 points)

2) Evaluate $\iint_{\sum} z\,ds$ where $\sum$ is the portion of the cone $z^2 = x^2 + y^2$ that lies between the planes $z = 1$ and $z = 4$.

(25 points)

3) Let Q be the region bounded by the circular cylinder $x^2 + y^2 = 4$ and the planes $z = 0$ and $z = 3$. Let $\sum$ denote the surface of Q. If $\bar{F} = x^3\bar{i} + y^3\bar{j} + z^3\bar{k}$, use the divergence theorem to find the flux of $\bar{F}$ across $\sum$.

(20 points)

4) Use stokes' theorem to evaluate the work of the vector field $\bar{F} = (x+y)\bar{i} + (y+z)\bar{j} + (z+x)\bar{k}$ along the curve C which is the boundary of the triangle having vertices (1, 0, 0), (0, 1, 0), and (0, 0, 1). Notice this triangle is obtained by intersecting the plane $x + y + z = 1$ with the first quadrant.
(Orient C counter clockwise)

(25 points)

5) Check if $\bar{F} = (3x^2 + y^2)\bar{i} + 2xy\,\bar{j} - 3z^2\bar{k}$ is conservative or not.

(10 points)