Math 13: Written Homework # 9
Due May 28 at 5pm

Please make sure your homework is stapled, if necessary before handing it in. Do not use paper clips or any variation of folding techniques to connect papers.

Solutions should be justified in a rigorous way. If you are unsure how much work to show, you can ask me prior to turning in your assignment. The problems are taken from the 7th edition of Stewart's *Calculus*, although occasionally a problem will be modified to be slightly different from its textbook counterpart.

(1) (Problem #18, Chapter 16.9) Let $\boldsymbol{F}(x, y, z) =< z\tan^{-1}(y^2), z^3\ln(x^2+1), z >$. Find the flux of $\boldsymbol{F}$ across the part of the paraboloid $x^2+y^2+z=2$ that lies above the plane $z=1$ and is oriented upwards.

(2) (Problem #24, Chapter 16.9) Use the Divergence Theorem to evaluate

$$\iint_S (2x+2y+z^2)dS,$$

where S is the sphere $x^2+y^2+z^2=1$.

(3) (Problem #17, Chapter 16.8) A particle moves along line segments from the origin to the points $(1,0,0)$, $(1,2,1)$, $(0,2,1)$ and then back to the origin under the influence of the force field $\boldsymbol{F} =< z^2, 2xy, 4y^2 >$. Find the work done in two separate ways: (a) by directly evaluating the line integral, and (b) by using Stokes' Theorem with a suitable choice of surface S.

(4) (Problem #18, Chapter 16.8) Evaluate $\int_C (y+\sin x)dx + (z^2+\cos y)dy + x^3dz$, where C is the curve $\boldsymbol{r}(t) =< \sin t, \cos t, \sin 2t >$, $0 \le t \le 2\pi$. (Hint: Observe that C lies on the surface $z = 2xy$.)