Problem Set # 10

(due: April 16)

1. **Page 427** : # 3(a).

2. Find the mass of a wire bent in the shape of a helix $\vec{\mathbf{c}}(t) = (\cos 2t, \sin 2t, t)$, for $0 \le t \le \frac{\pi}{2}$, and whose density is $f(x, y, z) = 16y$.

3. **Page 447** : # 1(d), 2(a)(d), 4(a), 7.

4. If C is the curve $y = x^2 + 2x$ from $(0, 0)$ to $(1, 3)$, compute the following :

(a) *Path integral* : $I_1 = \displaystyle\int_C f\,ds$, where $f(x, y) = x^2 - y - 2$.

(b) *Line integral* : $I_2 = \displaystyle\int_C \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}}$, where $\vec{\mathbf{F}} = (xy + 1)\,\vec{\mathbf{i}} - x\,\vec{\mathbf{j}}$.

(c) *Line integral* : $I_3 = \displaystyle\int_C 2xy\,dx + x\,dy$.

5. Compute the line integral $\displaystyle\int_C \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}}$, where $\vec{\mathbf{F}} = (2xe^{2y} - \cos y)\,\vec{\mathbf{i}} + (2x^2e^{2y} + x\sin y - 2y)\,\vec{\mathbf{j}}$ and C is *any* smooth curve starting at $(1, 0)$ and ending at $(2, 1)$.

(*Hint*: Find a function$f(x, y)$, if possible, so that $\vec{\mathbf{F}} = \nabla f$.)