Math 202 - Quiz I - 2014
Previouses Problems

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1) Use **Gauss divergence Theorem** carefully to find the outward **flux** $\iint_S \boldsymbol{F.n}\ \ d\boldsymbol{\sigma}$ of the vector field $F = 1/\rho < 9x,\ y,\ 8\rho^{-2} z >$ where $\rho = \sqrt{x^2 + y^2 + z^2}$ across i) the surface $\rho = 2$ ii) the surface surrounding the region $1 \le \rho \le 2$ between two spheres.

2) Use **Stokes' Theorem** to find the outward flux of CURL(F)

$\iint_S$ **Curl**$(\boldsymbol{F}).\boldsymbol{n}\ \ \boldsymbol{d\sigma}$ of the vector field $\mathbf{F} = <6\mathbf{y},\ \ 4\mathbf{x},\ \ \mathbf{z}>$ across the upper part of the ellipsoid $\mathbf{x}^2 + 2\mathbf{y}^2 + \mathbf{z}^2 = 16$ whose boundary C lies on the plane z = x+4.

Hints: C also lies on the cylinder $(\mathbf{x}+2)^2 + \mathbf{y}^2 = 4$. dz = dx (but why?)

3a) Let **F** = < **5y, 8x, z** > and let S be the <u>open</u> paraboloid $z = 2(x^2 + y^2) - 8$ & $z \leq 0$.
Find $\iint_S \boldsymbol{F}.\boldsymbol{n} \;\; \boldsymbol{d\sigma}$ (where n is the outer normal vector to our surface)
by Gauss Divergence Theorem (by using a standard trick)

3b) Let **F** = < **5y, 8x, z** > and let S be the <u>open</u> paraboloid $z = 2(x^2 + y^2) - 8$ & $z \leq 0$.

Find $\iint_S \mathbf{Curl}(\boldsymbol{F}).\boldsymbol{n} \;\; \boldsymbol{d\sigma}$ (by any method) (where n is the outer normal vector to our surface)

Reminder: The boundary C is on z=0.

4a) Change the following D.E <u>to a linear DE in standard form</u> **<u>then STOP!</u>**

$$xy' - (x^2+1)y^{5/4} = \left(\frac{x^2}{x^4+1}\right)y$$

4b) Change the following (non-exact) D.E **<u>to exact then STOP</u>**!

$$(8 - 7y + x^3e^x)\,dx + x\,dy = 0$$

5a) **Simplify** $\nabla \cdot (\nabla f)$ and $\nabla \cdot (\nabla f + f \nabla g)$ in terms of f & g and their partial derivatives.

5b) **<u>Set up the integrals (but do not evaluate)</u>**

to find the surface area of the ellipsoid $4\mathbf{x}^2 + 9\mathbf{y}^2 + \mathbf{z}^2 = 16$

(Hint: You may use symmetry (with $\mathbf{z} \geq 0$)

6a) Change the DE $(7y^2+2xy)y' = 3x^2 + 4xy\sin(\frac{7x+y}{x+2y})$

to a separable DE. **<u>Then STOP!!</u>**

6b) Change (by substitution) the DE $xy' = y\sin(xy)$ into a separable DE . **<u>Then STOP!</u>**

7a) If { y'=f(x,y) ; y(1)=1 } has 3 solutions,
does this contradict our Existence/uniqueness Theorem for IVP?

7b) If { y'=f(x,y) ; y(1)=1 } has no solutions,
does this contradict our Existence/uniqueness Theorem for IVP ?

7c) If { y'=f(x,y) ; y '(1)=1 } has no solutions,
does this contradict our Existence/uniqueness Theorem for IVP ?

7d) Find all 3 solutions of of the IVP: $y' = y^{1/3}$; $y(1) = 0$.: