You must show **all** work to receive full credit. All work is to be your own. Oct 19 2020

This is a closed books and notes test. Be organized. Total points: **100** 18:40- 19:55

Submit to BB a single b/w pdf file, named using your last name. emailed solutions won't be graded

1. §10.1 Line Integral. Work done by a force. Calculate $\int_C \mathbf{F}(\mathbf{r})\cdot d\,\mathbf{r}$ for the following data. If $\mathbf{F}$ is a force, this gives the work done in the displacement along C. (Show the details.) 10 points
$\mathbf{F} = \sin x\ \mathbf{i} + \cos y\ \mathbf{j} + xz\ \mathbf{k}$, $C : \mathbf{r}(t) = t^3\ \mathbf{i} - t^2\ \mathbf{j} + t\ \mathbf{k}$ from $(0, 0, 0)$ to $(1, -1, 1)$.

2. §10.2 Show the form under the integral sign is exact in space and evaluate the integral. Show the details of your work. 10 points

$$\int_{(5,3,\pi)}^{(3,\pi,3)} (\cos yz\,dx - xz\sin yz\,dy - xy\sin yz\,dz)$$

3. §10.4 Evaluation of Line Integrals by Green's Theorem.
Using Green's Theorem, evaluate $\boxed{\int_C y^3\,dx - x^3\,dy}$ counterclockwise around the boundary curve C of the region R, where C is the circle $\boxed{x^2 + y^2 = 4}$. 20 points

4. §10.6 Flux Integrals (3) $\iint_S \mathbf{F} \cdot \mathbf{n}\, dA$ Evaluate the integral for the given data. Describe the kind of surface. Show the details of your work. 20 points
$\mathbf{F} = [0,\ \sinh z,\ \cosh x]$, $S:\ x^2 + z^2 = 4,\ \ 0 \le x \le \sqrt{2},\ \ 0 \le y \le 5,\ \ z \ge 0$

5. §10.7 Application of the Divergence Theorem: Surface Integrals $\oiint_S \mathbf{F} \cdot \mathbf{n}\, dA$ 20 points

Evaluate the surface integral $\oiint_S \mathbf{F} \cdot \mathbf{n}\, dA$ by the Divergence Theorem. Show the details.

$\mathbf{F} = [3xy^2,\, xe^z,\, z^3]$, S is the surface of the solid bounded by $\boxed{y^2 + z^2 = 1}$ and $\boxed{x = -1}$, and $\boxed{x = 2}$

6. §10.9 Evaluation of $\oint_C \mathbf{F} \cdot \mathbf{r}'\, ds$ 20 points

Calculate this line integral by Stokes's theorem for the given $\mathbf{F}$ and C. Assume the Cartesian coordinates to be right-handed and the z-component of the surface normal to be nonnegative. Show the details.

$\mathbf{F} = [z,\, e^z,\, 0]$, C the boundary curve of the portion of the cone $z = \sqrt{x^2 + y^2}$, $x \geq 0$, $y \geq 0$, $0 \leq z \leq 1$