Fall 2020	ENG 5300	Test 1	Yufan Lu

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.)
$\mathbf{F} = [x-y,\ y-z,\ z-x]$, $C : \mathbf{r} = [2\cos t,\ t,\ 2\sin t]$ from $(2,0,0)$ to $(2,2\pi,0)$. 10 points

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

$$\int_{(0,1,0)}^{(1,0,1)} (e^x \cosh y \, dx + (e^x \sinh y + e^z \cosh y) \, dy + e^z \sinh y \, dz)$$

3. §10.4 Evaluation of Line Integrals by Green's Theorem. Using Green's Theorem, evaluate $\oint_C \mathbf{F}(\mathbf{r}) \cdot d\mathbf{r}$ counterclockwise around the boundary curve C of the region R, where
$\mathbf{F} = [x^2 e^y, y^2 e^x]$, R the rectangle with vertices $(0,0)$, $(2,0)$, $(2,3)$, $(0,3)$ 20 points

4. §10.6 Flux Integrals (3) $\iint_S \mathbf{F} \cdot \mathbf{n} \, dA$ Evaluate the integral given below for the following data. Indicate the kind of surface. (Show the details of your work.) 20 points

$\mathbf{F} = [0, x, 0]$, $S: x^2 + y^2 + z^2 = 1, \; x \geq 0, \; y \geq 0, \; z \geq 0$

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

Evaluate the surface integral by the Divergence Theorem. Show the details.
$\mathbf{F} = [e^x\,,\, e^y\,,\, e^z]$, S the surface of the cube $|x| \le 1$, $|y| \le 1$, $|z| \le 1$

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.

$\mathbf{F} = [z^3, x^3, y^3]$, C the circle $x = 2$, $y^2 + z^2 = 9$