MATLAB Assignment 3

Due **Tuesday** November 26, 2019 at the start of discussion.

Instructions

On ELMS, see the file MATLAB_basics.pdf to learn how to get MATLAB and do some basic commands first.

Submitting: At the top of the program, click on the PUBLISH tab. Click on the publish button, and it should output an html file with all the code/output. Print this out and include your name on it (either by commenting in the code or handwrite it). **Remember to separate each problem/part by a section using the double percent signs.** Even if you have the correct code, **if there is no output, you will NOT receive full credit!**.

(separate problems by using double percent signs!!!!)

1. (a) Find the surface area of the vase parameterized by

$$\mathbf{r}(u, v) = \langle (3 + \sin(v)) \cos(u), (3 + \sin(v)) \sin(u), v \rangle, \text{for } 0 \leq u, v \leq 2\pi.$$

   You can begin by first defining the surface i.e. "$F = [(3 + sin(v))..]$. Use the *int*, *norm*,*cross* command to help.

   (b) Use the *fsurf* command to plot the vase.

2. In spherical coordinates, the function $\rho(\theta, \phi) = 1 + \frac{\sin(a\theta)\sin(b\phi)}{5}$ is used to model tumors, where a and b are various integers.

   (a) We plot this for $a = 3, 4$ and $b = 4, 5$. Copy the following code (simply include these 4 figures when submitting)

```
syms u v
for a=3:4
for b=5:6
    figure

fsurf((1+1/5*sin(a*u)*sin(b*v))*sin(v)*cos(u),(1+1/5*sin(a*u)*sin(b*v))*sin(v)*sin(u),(1+1/5*sin(a*u)*sin(b*v))*cos(v),[0 2*pi 0 pi])

end
end
```

   (b) Consider the case when $a = 4$, $b = 5$. Use the integral command in Matlab to compute the volume of this solid. Looking at the code in part (a) can help you.

3. The command *potential* finds the potential function of the vector field (if it exists). Use the *curl* command to verify whether or not the vector field is conservative for the two following vector fields. If it is, find the potential function. Then determine $\int_C \mathbf{F} \cdot d\mathbf{r}$, where C is an arbitrary curve from $(1,1,1)$ to $(2,2,2)$.

   (a) $\mathbf{F}(x,y,z) = \sin(y)\mathbf{i} + (x\cos(y) + \cos(z))\mathbf{j} - y\sin(z)\mathbf{k}$

   (b) $\mathbf{F}(x,y,z) = \langle \frac{2x}{x^2+y^2+z^2}, \frac{2y}{x^2+y^2+z^2}, \frac{2z}{x^2+y^2+z^2} \rangle$

4. Let $\mathbf{F} = (yz)\mathbf{i} + (2xz)\mathbf{j} + (e^{xy})\,\mathbf{k}$. Suppose C is the circle $x^2 + y^2 = 16$ lying on the plane $z = 5$, counterclockwise when viewed from above. This is the boundary curve around surface S. Copy the following:

```
F=[y*z 2*x*z exp(x*y)]
param= [? ? ?]   %parameterize the surface using u and v
param2= [? ? ?] %parameterize the curve C using t
```

   We verify Stokes' Theorem.

   (a) Edit the lines above for the parameterizations.

   (b) Use appropriate commands of *diff*, *curl*, *cross* to compute the surface integral represented by Stokes' Theorem over S. You will need to see the output of your normal to assure it is in the correct direction. You can use the *subs* command to evaluate the vector field at the parameterization. Define your surface integral value as *surfaceint*.

   (c) Use appropriate commands to compute the line integral represented by Stokes' Theorem over C. Define your surface as *lineint*.