Math 3202 **Due Tue Feb 7** **Assignment #3**

1. The position function of the spaceship is

$$\vec{r}(t) = (\cos t, \sin t, \tan t)$$

and the coordinates of the space station are $(-\sqrt{2},\, 2\sqrt{2},\, 7)$.

a) At what moment of time t should the captain turn off the engines in order to coast into the station?

b) What is the angular momentum $\vec{L}$ of the spaceship at the moment of time when the engine was turned off. (Recall $\vec{L} = \vec{r} \times \vec{v}$, assuming that mass is 1.)

c) Find the speed and the distance traveled by the spaceship with the engine turned off.

d) How long it takes the spaceship to reach the station after turning off the engine?

(you may assume that time is measured in minutes and distance in miles.)

2. Evaluate the line integral along given curve

(a) $\int ye^x\, ds$, along the line segment jointing $(1,2)$ to $(4,7)$.

(b) $\int (2x+9z)\, ds$, along the arc $x=t,\ y=t^2,\ z=t^3,\ 0 \le t \le 1$.

(c) $\int x^2 z\, ds$, along the line segment jointing $(0,6,-1)$ to $(4,1,5)$.

3. Find the mass and the center of mass of a thin wire in the shape of

a) quarter-circle $x^2+y^2=4,\ x\ge 0,\ y\ge 0$, if the density function is $\rho(x,y)=x+y$.

b) helix $x=t,\ y=\cos t,\ z=\sin t,\ 0\le t\le 2\pi$ if the density at any point is equal to the square of the distance from the origin.

4. Answer questions 1 – 3 for each of the following functions (a) –(f).

1. Sketch level curves $f(x,y)=k,\ k=0,1,2$ (if such a curve exists).
2. Name and sketch the surface given by $z=f(x,y)$.
3. Find partial derivatives f_x and f_y.

(a) $f(x,y) = \sqrt{25-4x^2-y^2}$,

(b) $f(x,y) = \sqrt{x^2+\dfrac{y^2}{9}-1}$,

(c) $f(x,y) = \sqrt{2+x^2+\dfrac{y^2}{4}}$,

(d) $f(x,y) = x^2-\dfrac{y^2}{4}$,

(e) $f(x,y) = 5-x^2-\dfrac{y^2}{4}$,

(f) $f(x,y) = \sqrt{y^2+\dfrac{x^2}{4}}$,