Math 3202 **Due Tue Feb 8** **Assignment #3**

1. Given position vector $\vec{r}(t) = (e^t, e^t \sin t, e^t \cos t)$, find tangential and normal components of the acceleration vector. at $(1, 0, 1)$.

2. The position function of the spaceship is

$$\vec{r}(t) = (1 + t, 8 + t^2, 28 + t^3)$$

and the coordinates of the space station are $(0, 0, 0)$. At what moment of time t should the captain turn off the engines in order to coast into the station?

3. Answer questions 1 – 5 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.
   4. Write equation of the tangent plane at point (x_0, y_0, z_0), where x_0, y_0, z_0 are given below.
   5. Find gradient vector at point (x_0, y_0) and sketch it at the same pictire as the level curves.

   (a) $f(x, y) = x^2 - \frac{y^2}{4}$, $x_0 = 1$, $y_0 = 2$, $z_0 = 0$;

   (b) $f(x, y) = x^2 + \frac{y^2}{4}$, $x_0 = 1$, $y_0 = 2$, $z_0 = 2$;

   (c) $f(x, y) = \sqrt{2 + x^2 + \frac{y^2}{4}}$, $x_0 = 1$, $y_0 = 2$, $z_0 = 2$;

   (d) $f(x, y) = \sqrt{x^2 + \frac{y^2}{4}}$, $x_0 = 1$, $y_0 = 0$, $z_0 = 1$;

   (e) $f(x, y) = \sqrt{3 - x^2 - \frac{y^2}{4}}$, $x_0 = 1$, $y_0 = 2$, $z_0 = 1$;

   (f) $f(x, y) = \sqrt{x^2 + \frac{y^2}{4} - 1}$, $x_0 = 2$, $y_0 = 2$, $z_0 = 2$;