

**Math 2415**  
**Paper Homework #5**

1. [13.2 & 13.3: Calculus on Curves] Let  $C$  be the curve parametrized by

$$\mathbf{r}(t) = \sqrt{2}t\mathbf{i} + e^t\mathbf{j} + e^{-t}\mathbf{k} \quad \text{for } -1 \leq t \leq 1.$$

- (a) Find the velocity vector at  $t = 0$ .
  - (b) Find the acceleration vector at  $t = 0$ .
  - (c) Parametrize the tangent line to  $C$  at  $t = 0$ .
  - (d) Calculate the length of  $C$ . **Hint:** Show that the formula for the speed of the curve is the square root of a perfect square.
2. [14.1: Functions of Several Variables] Sketch the level curves  $f(x, y) = c$  of the following functions  $z = f(x, y)$  at the specified values of  $c$ .
- (a)  $f(x, y) = \frac{1}{1+x^2+4y^2}$ ,  $c = 0.25, 0.5, 1$ .
  - (b)  $f(x, y) = \exp(x^2 - y^2)$ ,  $c = 1, 2, 3$ .
  - (c)  $f(x, y) = y - \sin x$ ,  $c = 0, \pm 1, \pm 2$ .
  - (d)  $f(x, y) = 1 + xy^2$ ,  $c = 0, \pm 1$ . **Hint:** Solve  $f(x, y) = c$  for  $x$  in terms of  $y$  and  $c$ .