

Math 2415

Paper Homework #5

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

$$\mathbf{r}(t) = t \sin t \mathbf{i} + t \cos t \mathbf{j} + \sqrt{3}t \mathbf{k} \quad \text{for } 0 \leq t \leq 4\pi.$$

- (a) Sketch the curve.
 - (b) Find the velocity vector at $t = 0$.
 - (c) Find the acceleration vector at $t = 0$.
 - (d) Parametrize the tangent line to C at $t = 0$.
 - (e) Calculate the length of C .
2. [14.1: Functions of Several Variables] Match the functions $z = f(x, y)$ with the surfaces representing their graphs. **Provide a written explanation for your answers.** (The origin is in the middle of each box. The figures only show that portion of the surface that is inside a box.) **Hint:** For each equation take slices (traces) in planes like $x=0$, $y=0$, $x=k$, $y=k$, $z=k$. Sketch some of those slices (you may need to use your Calculus I graph sketching skills). What happens as (x,y) gets a long way from origin? Look for the graphs that have the same shaped slices and/or behaviors.

- (a) $f(x, y) = x^2 + y^2$
- (b) $f(x, y) = x^2 + x^3y^2$
- (c) $f(x, y) = (x^2 - y^2) \exp(-x^2 - y^2)$
- (d) $f(x, y) = \sin(x^2 + 2y^2)$
- (e) $f(x, y) = x^2 \exp(-x^2) - \exp(-y^2)$
- (f) $f(x, y) = x - y$

