7. Let $C$ be the curve parametrized by $f(t) = (t, \frac{t^2}{\sqrt{2}}, \frac{t^3}{3})$ where $-2 \leq t \leq 2$.

(a) (3 pts) Show $C$ is smooth and simple.

(b) (6 pts) Find the length of $C$.

8. (15 pts) Let $f(t) = (\cos t, \sin t)$, where $0 \leq t \leq \pi$ and $g(t) = (-t, \sqrt{1-t^2})$ where $-1 \leq t \leq 1$, and let $F(x, y) = (3x - y, x)$.

(a) Show that $f$ and $g$ both parametrize the same curve $C$ (Hint: First establish what $C$ should be.) What is the orientation of each path?

(b) Compute the line integral $\int_C F \cdot dx$ along both of the parametrizations and verify that your answers coincide. Explain why this makes sense (without writing a proof).

(c) Now compute the line integral $\int_\gamma F \cdot dx$ along the path $\gamma$ parametrized by $h(t) = (-t, t^2 - 1)$ where $-1 \leq t \leq 1$. Notice that the endpoints of $\gamma$ and $C$ are the same. Is your answer the same as what you got in part (b)?

(d) Let $G(x, y) = (x + 2, 2y + 3)$. Compute the line integrals $\int_C G \cdot dx$ and $\int_\gamma G \cdot dx$ and compare the answers.

(e) Write a statement that summarizes your findings in this problem.