

## Annie's Survival Kit 5 - Math 324

- (10 points) (a) (8 points) Let  $\mathbf{F} = \langle 3x^2y, x^3 + 3y^2 \rangle$  and let  $C$  be the path going along  $x = y^2$  from  $(4, 2)$  to  $(0, 0)$ . Calculate  $\int_C \mathbf{F} \cdot d\mathbf{r}$  either by doing so directly, by using path-independence to replace  $C$  by some other path or by using the fundamental theorem for line integrals, i.e.  $\int_C \mathbf{F} \cdot d\mathbf{r} = f(P_1) - f(P_0)$  where  $\nabla f = \mathbf{F}$  and  $P_0$  and  $P_1$  are the endpoints of  $C$ .  
(b) (2 points) Do it in another way.
- (10 points) Find the mass of a wire in the shape of the semi-circle  $x^2 + y^2 = 1$  where  $y \geq 0$ , and whose density is the distance from  $y = 1$ .
- (10 points) Evaluate  $\int_C x\sqrt{y}dy$  when  $C$  is the path going along  $x = \frac{\cos^2(t)}{\sin(t)}$  and  $y = \sin^2(t)$  for  $t \in [\frac{\pi}{4}, \frac{\pi}{2}]$ .