## Problem 1

For $r(t)=\frac{1}{1+t^{2}} i+\frac{1}{t} j+\cos ^{2}(t) k$, find $\int r(t) d t$.

## Problem 2

For $r(t)=e^{2 t} i+\sec ^{2}(t) j+t^{4} k$, find $\int_{0}^{\frac{\pi}{4}} r(t) d t$.

## Problem 3

Projectile with arbitrary initial position: Recall from class that we found that if a projectile is launched at an angle of $\alpha$ at a speed of $v_{0}$, then our initial velocity vector function is $v(0)=v_{0} \cos (\alpha) i+v_{0} \sin (\alpha) j$. Now we shall suppose that (instead of launching from the ground) we launch our projectile from an arbitrary point in space (2-D):

Given $a(t)=-g j$, determine the position function $r(t)$ with the initial conditions:

$$
\begin{aligned}
& v(0)=v_{0} \cos (\alpha) i+v_{0} \sin (\alpha) j \\
& r(0)=x_{0} i+y_{0} j
\end{aligned}
$$

(isn't this cool???)

## Problem 4

How would you change problem 3 to incorporate headwind/tailwind? (this question is just for pondering, not points).

