Angie Proctor
Math 32
Research Proposal

Proposed Research Topic: Airplane Physics

All of my life I have been fascinated by airplanes—in fact, my mother tells me that "plane" was one of my first words, and one of my earliest memories is the first time I rode in a jet airliner. During my junior and senior years of high school, I was able to take flying lessons at the Bakersfield Municipal Airport, and I have had my aviator's license for two years now. (Unfortunately, I have not been able to use it since I came here to school.)

There was a bit of math that I had to learn in flight school, including trigonometry and some formulas for calculating fuel consumption, but one thing that I have wondered about but never studied in detail is how airplanes actually work. I know all about what to do to keep an airplane in the air (airspeed, attitude, fuel richness, etc.) but I have to admit that it is still a little mysterious to me how those things keep it from falling, or how just air alone can be strong enough to hold up a heavy metal machine. I have decided to study the physics of flight for my research project.

I took a basic physics course in high school, and I already understand more or less how a propellor works: since momentum is conserved, you can move yourself forward by throwing enough mass of air backwards. But the specific question that I would like to be able to answer is this: How is it that a propellor which is not powerful enough to lift an airplane straight up in the air can still lift it by moving the airplane forward instead? I know that the wings do the actual lifting, and I have heard that it has to with something called the Bernoulli effect, but I would like to understand it for myself.

My flight instructor once tried to explain the Bernoulli effect to me, so I know that it involves some mathematics—in fact, that was what kept me from understanding it the first time. I was able to reach her this week, and she gave me the names of two books to look at. I found one of them, called **The Physics of Flight**, at the library. I have not read much of it yet, but it looks like a good source, since it gives the actual mathematical formulas and explains them. The other book is a mathematics textbook called **Fear of Flying by the Numbers**, which apparently uses examples from aviation to teach mathematics. This sounds like it may be an ideal source, but unfortunately I have not been able to get a copy of it yet. I may be able to get my mother to borrow the copy my flight instructor has and mail it to me; in the mean time I have also been looking for other sources, including some books in the bibliography of **The Physics of Flight** and some books that I found references to when I did a search on the internet. I still need to talk to my father's friend who works for Boeing; he may be able to recommend some books as well. My roommate's boyfriend is a math major, and he has said he will try to explain anything I have trouble getting past on my own.

I do not expect to learn a very large portion of everything there is to know about aerodynamics in just four weeks; apparently not even aerodynamicists understand everything. But I hope that I can learn enough mathematics from these books to give me a good understanding of what is happening when my wheels leave the ground.