H. Hickam Rocketry Club of Smalltown Smalltown, ND 58377 October 24, 2014

Calculus Student Brigham Young University Provo, UT 84602

Dear calculus student,

I am writing to you because my good friend, George Bush of Growing Mature Arboreal Trees, recommended you as a mathematical genius that can solve any problem. All of us here at the model rocket association are stumped, and we hope you can help us out.

We build and launch model rockets, and have recently run afoul of FAA regulations. The FAA says that they will take away our license to launch rockets unless we can give them details about how fast and how high the rockets are travelling.

We have tried a number of things in order to figure out the height and speed of our rockets, but have failed miserably. First, we borrowed a radar gun, from one of our members, a police officer. Our first attempt involved mounting one of these radar guns facing straight up directly under the rocket as we launched it. Unfortunately, we discovered that the rockets exhaust almost instantly destroyed the radar gun (which was primarily made of hard plastic). This was an expensive lesson, as we had to pay to replace the radar gun, and those things aren't cheap. One of our members said that we should mount the radar gun on the rocket and point it down, but then we wouldn't be able to read it at the correct time (when the rocket is high in the air). Also, the rockets tend to land very hard, and the landing would probably destroy the radar gun. We managed to get the police to loan us a second radar gun, but they have told us that we can't use the radar gun less than 1000 feet from the launch pad (and that we can most definitely not launch it with the rocket).

In addition, we have gotten the county surveyors to loan us a survey sight, which has a telescopic sight on it that can measure angles very accurately. We mounted both the surveying equipment and the radar guns exactly 1000 feet from our launch pad. At our next rocket launch the rocket flew perfectly, going straight up, and the radar gun said that when the rocket ran out of fuel it was travelling at 87.2 miles per hour, and our surveyor's scope said that the rocket was 57.23 degrees above the ground. When we spoke to the FAA representative, he said that this measurement was not good enough-since the radar gun was off at an angle from the path of the rocket, the measurement of the rocket's speed would actually be different than what the radar gun said. He seemed pretty confident that he was right, but wouldn't tell us how to do the calculation (I don't think that he actually knew).

He gave us two weeks to figure out a correct measurement, and suspended our rocket launching license until we can figure this out. If we could launch another rocket, we could try to collect more data, but that is not a possibility. Can you help us? How fast and how high was the rocket at the moment that the engines stopped? We figure that because we are measuring the speed at an angle, the rocket must have been going slower than 87.2 miles per hour, but we really don't know.

Please help us, so that we can continue to pursue our hobby. We need your answer by November 7.

Thank you,

H. Hickam