



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) George L. Yang	Project Number S1315
Project Title Cracking the Case: Investigating the Fracture Patterns of Glass	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of this project is to observe and record properties of glass fracturing in order to create a model and program, using mathematics, which can simulate fractured glass. My hypothesis is that there is a direct relationship between the number of fractures and the types of fractures that form and the force that is used to fracture the glass.</p> <p>Methods/Materials Materials used in this project included 3/32 inches thick window pane glass, a weight, a scanner, and a computer. The data collection stage of the project involved fracturing glass by hanging a wrench at a controlled height and then releasing it. Once that was completed, the glass was taped back together to be scanned into a computer for data analysis. By using a spreadsheet program, all of this data could be recorded and a system for arranging this data into a simulation could be created. This system included uses of linear interpolation and trigonometric equations.</p> <p>Results When the project was completed, a fully functional glass simulation program was created. Also, my hypothesis about a direct relationship between the number of cracks and the impact force was confirmed. I also found that even though glass may look identical with the human eye, deep down on a lower level, there are differences that affect the force required to fracture glass, otherwise known as critical stress.</p> <p>Conclusions/Discussion My results confirmed my hypothesis that there is linear interpolation between the number of fractures and the types of fractures that form and the force that is used to fracture the glass. I hypothesized that for a given force, there would be a certain number of cracks and certain types of cracks. Once the program was completed, simulations using a certain force did indeed match up with real world images that used the same force. These results and this program are small steps towards a greater understanding of glass fractures. Also, ideas such as the ones presented through this project can be used in programs to create more realistic simulations at a professional level. This project also presents a process for incorporating mathematics into creating simulations, thus allowing for more simulations based on real world data instead of the imagination of an artist.</p>	
Summary Statement This project's objective was to create a model and program using mathematics to simulate glass fractures.	
Help Received My mother gave lessons on using Microsoft Excel. Both of my parents took me out to pick up materials. My teacher sponsor supported me along the way and told me about the science fair.	