



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Austin Aldrich; Ari Freedman	Project Number J0301
Project Title Testing the Relative Strengths of Three Arches Defined by Mathematical Equations	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Our objective was to investigate which arch, defined by a mathematical equation, had the highest weight bearing capacity. Based on mathematical predictions, we hypothesized that the parabolic arches would be the strongest, next strongest would be the catenary arches, and the weakest would be the elliptical arches.</p> <p>Methods/Materials The materials that were used in this project were a Pitsco structure tester, foam core, band saw, Geometer's Sketchpad 5 (an interactive geometry software), and Elmer's glue. Our method was to create the mathematical equations for the arches, create the physical arches out of composite foam core, and then use the Pitsco structure tester to crush the arches and find the arches' weight bearing capacities.</p> <p>Results Our results were that the elliptical arches were the strongest, the next strongest were the catenary arches, and the weakest were the parabolic arches.</p> <p>Conclusions/Discussion Our results turned out to be the exact opposite of our hypothesis, which stated that the strongest arches would be those that distributed the most weight towards their feet. We believe that our hypothesis was contradicted because of the arches' varying areas, which were impossible to control given the other controlled parameters. Since the strongest arches had the largest areas, we concluded that the arches' weight bearing capacities and their areas were directly related. Our results can be applied to architectural constructions such as arches, arch bridges, or any other construction that requires the use of strong arches.</p>	
Summary Statement In our project, we chose three mathematical curves, made them into foam core arches, and then tested for their weight bearing capacities.	
Help Received Science teacher supervised the breaking of the arches; Woodshop teacher helped cut out the arches.	