



CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s) Zachary H. Seligman Karen	Project Number 33494
Project Title An Investigation of Shapes of Unvarying Height	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals This research seeks to examine the characteristics and traits of shapes of unvarying heights regardless the orientation. Through simple proofs using geometric/trigonometric principles, I derived the general formulas for the areas and perimeters of Reuleaux Polygons, constructed from an n-gon with an odd number of sides. Furthermore, to observe their general behavior as the number internal sides approaches infinity, the equations derived were evaluated with limits with cases of L'Hopital's Rule.</p> <p>Methods/Materials The construction is simple; using the longest diagonal from each of the vertices on any regular, odd-sided n-gon as a radius to create an arc.</p> <p>Results The perimeter of these shapes is based on the length of the arcs, the height and number of internal sides being the only variables. The area is particularly interesting as it encompasses both the area of the regular, odd-sided n-gon and the area of the little "smigums" allowing for the regular height. "Smigums" being defined as the difference between a sector and its corresponding internal triangle. Also, if the constructed shape is rotated around an axis of symmetry, it creates a three dimensional prism with the property of uniform height too.</p> <p>Conclusions/Discussion Although a circle is the first shape that comes to mind to many people when asked to think of a shape that has a uniform height regardless the orientation, this study showed that infinitely many shapes with a uniform height exist, all based on regular polygons with an odd number of sides.</p>	
Summary Statement This project sought to bring light to the behavior and characteristics of Reuleaux Polygons, bringing them into the third dimension, and potential application.	
Help Received Father gave guidance in the construction of the standing display board and the 3-dimensional models; Mother made sure I was fed so I could think properly; Annabel Adriatico gave tips on general logistics for the writing of the project; Nicolas Abruzzo helped flush out ideas for the direction to take in the	