



CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s) Dylan J. Sanfilippo	Project Number J1411
Project Title Deriving a Trigonometric Equation for Determining Object Height in Photographs	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals I received a camera for the holidays. I love film and photography. After examining some photography I came up with the idea of finding the height of an object in a photograph by developing a trigonometric equation, involving the focal length, to accomplish this. I believed that I would also need to know the distance from the camera to the object in order to find the height. I believed that if this equation was accurate, then perhaps it could be used in mapping land with a rover to help the authorities mathematically determine the height of land structures.</p> <p>Methods/Materials I used a DSLR camera, the Canon Rebel EOS t3i, to take the photographs. I used a metric ruler to determine how many meters the camera was placed from the object and to verify how many meters the object was in height. I marked the different lengths with tape. I took photographs of objects from various distances. Since tangent of the angle facing the right angle, equals leg1 divided by leg2. I calculated the angle of view using the arc-tangent vertical dimension of the sensor and the focal length. The equation I developed was calculated in radians. This was the formula I developed to determine heights of objects in a photograph.</p> <p>"Distance[tan(height of object in printed photograph/height of photograph{2[arctan(vertical dimension of the camera's sensor/2*focal length)}})]=H"</p> <p>Results I found that my equation worked. I tested a total of 20 different photographs and each time I used the equation I found the height of the object. There was an average of 4.55 millimeters or 0.0455 meter difference when comparing the actual height to the calculated height, with a standard deviation of 0.031 meter difference. I believe this difference occurred because I wasn't precise enough in my measuring and taping.</p> <p>Conclusions/Discussion I created my own equation to find the height of an object in a photograph and my results appeared to support my hypothesis. If I were to continue this testing, I would be more careful with my measurements. This equation could be applied to a camera on a controlled robot to map out land and determine how tall mountains or boulders are on earth and even on mars.</p>	
Summary Statement I created a trigonometric equation to find the heights of object in printed photographs.	
Help Received Mother took 2 photographs of me;	