

Question:

Is our laser triangle a right triangle, what is the deviation of the measure app, what are the measurements of our laser triangle, and is the law of reflection true?

Hypothesis:

The deviation of the measure app will be about 2cm, our laser triangle is a right triangle, we don't have A hypothesis on our triangle's side lengths, and the law of reflection is true

Procedure:

1. Place mirrors at the correct angles to form a right triangle
2. Activate laser
3. Collect data by taking photos and measure with app
4. Measure with ruler (for reference)
5. Save all the data

Data/analysis:

Photos one and two were both "measure" app measurements however, the measurements written in red were measured using a ruler. Using the ruler measurements, we can establish that the legs are 42cm and 27cm, and the hypotenuse is 52cm. We can test this with Pythagorean theorem as well; using the equation $42^2 + 27^2 = 49^2$. To determine the deviation of the app, we compared the ruler measurements with the app measurements.

Leg measurement by iPad Air (without LiDAR): 41 cm
Actual measurement: 42 cm

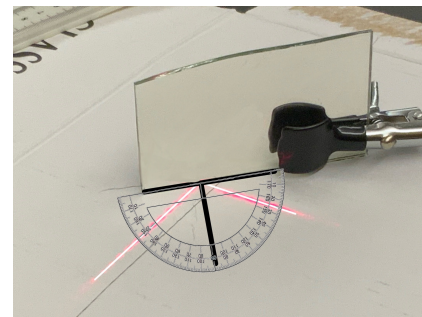
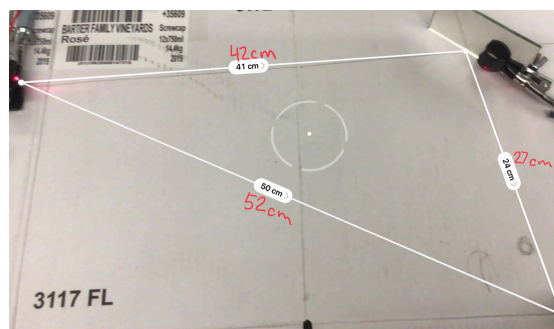
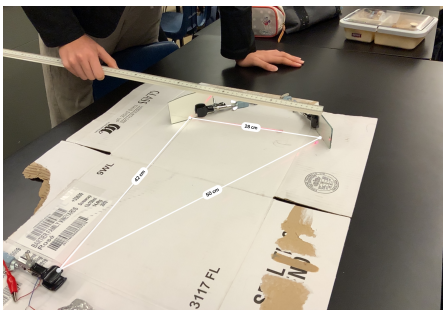
Leg measurement by iPad Pro (with LiDAR): 28 cm
Actual measurement: 27

Hypotenuse measurement by iPad Air: 50 cm
Hypotenuse measurement by iPad Pro: 50 cm
Actual measurement: 52 cm

The deviation of the app is about 2cm.

We can also confirm the law of reflection by measuring the normals and the angles the light bounces off the mirrors

In the third photo, we measured the normal and the light reflecting off the mirror. The law of reflection explains that the angle of incidence and angle of reflection should be the same size to the normal, which it was. The angle itself was 90° and the angle of incidence and reflection were both 45° . We then decided to use the Pythagorean theorem to measure the legs



as well as to check that our measurements were correct. We then discovered that it had to be 41cm instead of 42 cm for it to be a proper right triangle. Then we corrected our measurements by 1 cm on the cardboard model.

$$\begin{aligned}50^2 &= 1^2 + 28^2 \\2500 &= 1^2 + 784 \\2500 - 784 &= 1716 = 41\end{aligned}$$

$$\begin{aligned}50^2 &= 1^2 + 41^2 \\2500 &= 1^2 + 1681 \\2500 - 1681 &= 819 = 28\end{aligned}$$

Conclusion:

We discovered that the deviation of the measuring app was about 2cm depending on iPad model and position of camera. Using the iPad Pro, the deviation varied around 0-1cm however on the iPad Air the deviation was instead around 1-2cm. The side lengths of the triangle are 42 cm, 27 cm for the legs; and 49 cm for the hypotenuse. The triangle was indeed a right triangle, as seen in our calculations. The law of reflection was confirmed as well within this experiment.