

Voyager & Ozobot: NGSS Science and Engineering Practices Challenge

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This lesson provides a challenge that incorporates all eight of the Next Generation Science Standards (NGSS) science and engineering practices:

- *Asking Questions and Defining Problems*
- *Developing and Using Models*
- *Planning and Conducting Investigations*
- *Analyzing and Interpreting Data*
- *Using Mathematics and Computational Thinking*
- *Constructing Explanations and Designing Solutions*
- *Engaging in Argument from Evidence*
- *Obtaining, Evaluating, and Communicating Information*

Although this lesson makes use of both Ozobot and Voyager, neither of these is required, as all data have been collected and are supplied in an accompanying Excel file. The Excel file contains angular velocity data for Ozobot traveling at a constant speed on the geometric shapes shown in Figure 1.

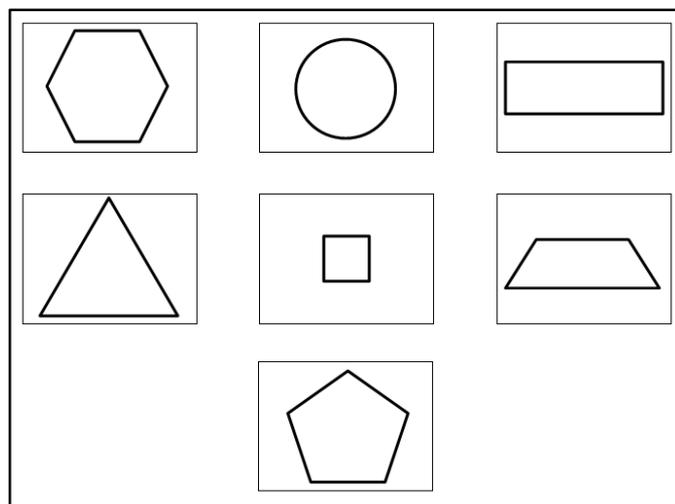


Figure 1

Voyager was mounted to the top of an Ozobot with a small piece of modeling clay and the pair was then placed on a shape. The z-component of angular velocity was recorded as Ozobot moved around the shape. Figure 2 shows the setup with a small portion of the resultant angular velocity vs. time graph in view. Ozobot is moving counterclockwise around the pentagon. Students should also view the short movie entitled *Video Pentagon Shape.mp4* to see an example of how Ozobot and Voyager move around the shapes.

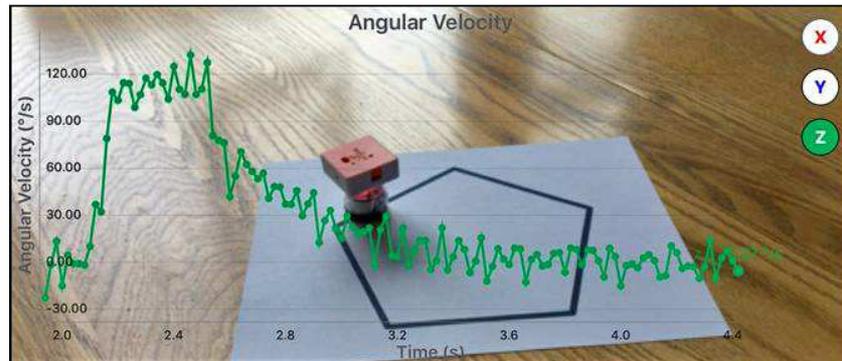


Figure 2

The student's tasks are:

- Match each of the geometric shapes in Figure 1 with its corresponding angular velocity vs. time data found in the worksheets (*Shape 1* through *Shape 7*) of the *Shapes Angular Velocity Data.xlsx* file.
- Determine the time required for Ozobot to make one complete cycle around the shape.
- Sketch the shape of a special unknown "Challenge Shape", whose angular velocity data is found in the final worksheet of the Excel file.

Students can work individually or as a team, as desired by the teacher. They should communicate their findings in a one-page "executive summary" that includes results and methods used during their investigation.