Sphero RVR: Right Triangle Paths

After completing an assignment where they figure out the side lengths and angle measures of certain right triangles, students program their RVR robots to move along the triangle path. These programs will use the movement and control blocks from the Sphero EDU website or mobile app. Also, they will use the results from a previous video and assignment: Speed Test.

Materials

- Sphero RVR robot
- Masking Tape or floor markers
- Student assignment worksheet "RVR Right Triangle Paths" (make your own copy)
- Sphero RVR Speed Test Chart, found here (make your own copy)
- Measuring Tape
- Floor Space

Student Objectives

- Given a right triangle with missing side lengths and missing angle measures, students will be able to fill in the missing amounts using the Triangle Angle Sum Theorem and the Pythagorean Theorem.
- Working in pairs, students will write Sphero EDU block programs to have their RVR robots travel along each triangle path.
- Using the Speed Test Chart, they will use movement blocks to program the robot to use directional headings and travel specific distances (in centimeters) along this path to make it back to the starting point.

Teacher Technology Skills Needed

- Understanding of the Sphero RVR movement blocks and speed settings

Standards

NYSED Standards

- NY-8.G.7 Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in the real world and mathematical problems in two and three dimensions.
- GEO-G.SRT.8 Use sine, cosine, tangent, the Pythagorean Theorem and properties of special right triangles to solve right triangles in applied problems.

Procedure

1. Distribute the student worksheet and use Problem #1 as a model. Explain that the students will need to review 45-45-90 and 30-60-90 special right triangles and the Pythagorean Theorem.
    a. Since the legs of this triangle are measured the same, this is a 45-45-90 special right triangle. Therefore, the hypotenuse is $\sqrt{2}$ times longer than 70 cm (1.414 * 70 is about 99 cm).
2. Discuss how students should think about programming the robot to go along these triangle paths. Depending on the direction is it going when it gets to a triangle vertex, the students have to figure out the correct headings at each turn. This will involve knowing the interior angle at each vertex and also the exterior angle at each vertex. Review the heading settings of Sphero EDU block programming.
3. Review the movement blocks from Sphero EDU programming app and/or website http://edu.sphero.com . Remind students that the speed block requires number settings from 0 to 255.
4. Review the Speed Test Chart (here) and remind them that in general, **for every 10 speed units** in the Sphero movement blocks the RVR travels **7 centimeters per second**, based on previous results.
5. Give students time to work through the four problems on the worksheet as they work in pairs. Once they are finished, they should move on into the programming phase of their work: open the Sphero EDU app, write a program for the Problem #1 Triangle Path and share with the teacher. Then they work on the other ones; note that Problem #4 allows them to use their own side lengths, but given the information shown, not all distances will work.
6. Encourage lots of discussion and troubleshooting opportunities:
    a. Did the robot travel far enough along one of the sides of the triangle? If not, adjust the speed numbers and/or the # of seconds needed.

b. Did the robot go in the proper heading to stay in the correct angle at the vertex points of your triangle? If not, correct the heading numbers in the code.
c. Did the RVR make it back to the exact starting point of the triangle? If not, what else went wrong and what can be corrected?

Extension Activities

This basic programming challenge can be enhanced by having students add the following ideas to their program (assuming it works and follows the teacher's criteria):

- ✓ Add LED and sound programming so that when the RVR starts moving, it will flash certain colors and/or play sounds.
- ✓ Once the RVR correctly travels along the triangle path, can the students change the speed and time numbers in the movement blocks to still make it work?
- ✓ Using the Speech blocks, can the students program their RVR to say aloud how long each side of the triangle is and what each angle measure is?