Unit 1 Challenge: Around Olympus Mons!

THE ON-RAMP TO ROBOTICS – TI-NSPIRE CXII PYTHON **TEACHER NOTES**

Overview of Mars Challenge:

Students use the student map to plot the shortest path around Olympus Mons. The scaled values and angles are used to write a program on a calculator connected to TI-Innovator™ Rover. Students test their paths and programs on the drive mat that you set up on the floor of the classroom.

Goals:

Students will:

1. plot a course on the student map using a ruler and protractor to navigate around Olympus Mons.
2. use proportional reasoning to convert student map distances into scaled drive distances.
3. use their scaled map measurements to write a TI Python program on their calculator.
4. test and refine their program by driving a TI-Innovator™ Rover on the Olympus Mons drive mat.

Background:

Orienteering is a navigation skill that uses several tools to identify the shortest path from one point to another, often while avoiding obstacles in the terrain. Some of these orienteering tools include a terrain map, protractor, and ruler. Most maps have a scale and compass rose printed in the corner. The scale is a proportion factor that converts a distance measured on the map to the distance in the actual terrain. Similarly, the compass rose is a diagram on the map that indicates the true north direction in the actual terrain. A skilled person with a scaled map and proper tools can lay a course on that map and use it to navigate the course on the terrain. In this activity, the drive mat represents the "actual terrain" while the student map is the "scaled map".

Teacher Tips:

- Tape down the edges of the Olympus Mons drive mat to the floor (the mat is about 1 square meter).
- Place obstacles on the inside of black "X" marks around the perimeter of the volcano.
  - Students should consider the width of the rover when determining their path to avoid obstacles.

Student Directions:

Find the *scale* of the student map.

1. Measure the width of the Olympus Mons drive mat in the unit of meters and record the value in the table below.
2. Measure the width of the Olympus Mons student map in the unit of centimeters and record the value in the table below.

Note: Be sure students measure in units of *meters* on the drive mat and *centimeters* on the student map.

3. Calculate the scale of the student map using the formula below.

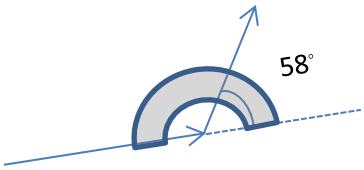
Note: Be sure students calculate with meters in the numerator and centimeters in the denominator.

4. Design a path around the volcano that avoids the marked obstacles. Use a ruler and pencil to draw that path of line segments onto the student map.

Materials:

- TI-Innovator™ Rover
- laminated Olympus Mons drive mat
- meter stick
- ruler
- protractor
- masking tape
- obstacles such as miniature traffic cones, Styrofoam blocks, rocks, etc.
- student map of Olympus Mons

5. Use a protractor to measure the exterior angles that are needed for Rover to turn from one line segment to the next along your path. You may find it helpful to extend the path line beyond the turning point to aid in measuring the exterior angle.
   Example exterior angle measurement:



6. Measure each path segment in cm and record in the table; use the map scale to calculate the distance the Rover must drive on the Olympus Mons drive mat.
   Example calculation: a drive segment may be 6 centimeters and the student map scale may be .04m = 1 cm (this is an example only. Students must find the actual scale using their own calculations and measurements), find the drive distance in meters:

$$6cm \times \frac{.04m}{1cm} = .24m$$

7. Write a TI-Innovator Rover program that drives each segment in path.
   Example: rv.left(58)
   rv.forward(.24,"m")

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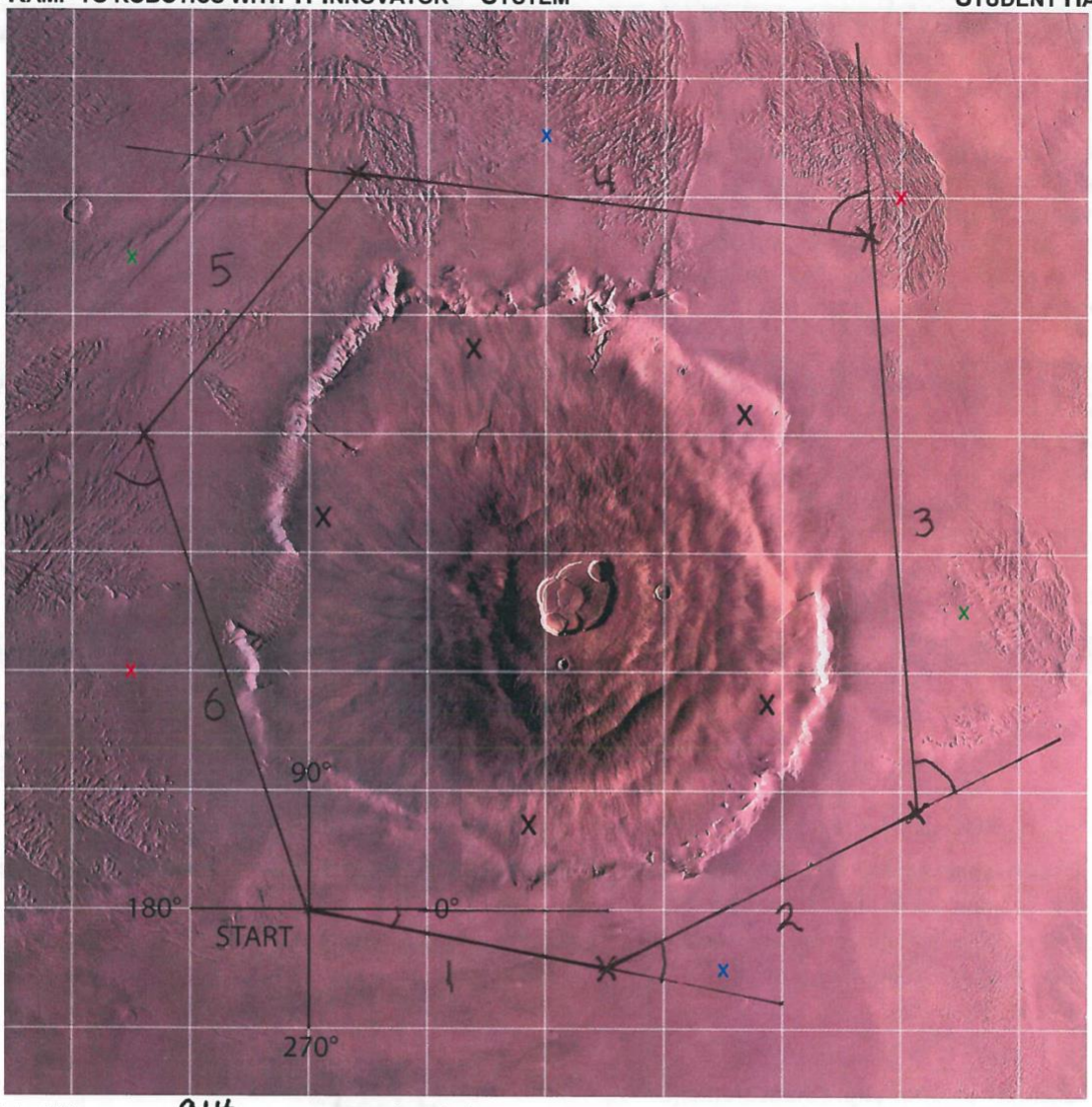

Drive Mat width: .914 meters (m)

Student Map width: 16.3 centimeters (cm)

Scale (Drive Mat Width ÷ Student Map Width): .0561 meters/centimeter

Segment	Angle (degrees)	Turn Direction (L/R)	Student Map Length (cm)	Scaled Drive Mat Length (m)
1	11.0	R	4.55	.255
2	38.0	L	5.30	.297
3	67.0	L	8.70	.488
4	78.0	L	7.80	.438
5	58.0	L	5.10	.286
6	58.5	L	7.60	.426