



Program Overview:

Students will use the TI-Innovator™ Rover and the provided file to design and measure a segmented path. They will then verify their measurements and directions using Rover with the provided file.

Math Objectives:

- Students will measure lengths and angles.
- Students will use angle relationships to solve problems.

Teacher Tip: If you are using the TI-Innovator Rover for the first time, some initial assembly is required. Please visit education.ti.com/rover for information.

Math Course Connections:

In the Pre-Algebra Classroom, this activity is an engaging way to bring the concept of angle measurements and angle relationships to life. Students will reinforce their skills in measurement with rulers and protractors. Students will determine angle measurements. Finally, students will input the information into the TI-Innovator Rover and either verify the measurements or modify their directions so that the Rover will trace the path they have designed.

Teacher Tip: If you or your students are not familiar with how to transfer a file to a TI graphing calculator, files can be transferred from calculator to calculator of the same technology. Files are found at education.ti.com/mathinmotion.

Materials and Set-up:

- TI graphing calculator with the file preloaded
 - TI-Nspire™ CX handheld – Design_a_path.TNS
 - TI-84 Plus CE graphing calculator – DESPATH.8xp
- TI-Innovator™ Hub with TI LaunchPad™ Board and USB Cable
- TI-Innovator™ Rover
- Meter stick
- Protractors
- Rulers

- Butcher paper
- Tape (try painter's tape for easy removal)

The TI-Innovator Rover will need plenty of space to move for the activity. Be sure to have a clear space of at least 2 square meters so the Rovers do not run into each other.

Be sure to have the TI-Innovator Rover and the calculator fully charged.

Teacher Tip: If students are not familiar with running TI-Basic programs on the calculators: For TI-Nspire CX, instruct students to press enter after the closed parenthesis to execute the program. If students are using the TI-84 Plus CE, students should press the **prgm** key, navigate to the program, press enter to paste the program name to the home screen, and then press enter to execute the program.

Tasks for Student Investigation:

Students should work in groups of two. Each group should tape their piece of butcher paper to the ground so that it won't move when the Rover moves along the path. Students should use the meter stick or another straight edge and a pencil to draw their path on the butcher paper. We recommend a path with six segments but the calculator file can accept from two to ten segments. Each segment can be any length. After students draw their path, they should use their meter sticks to measure the length of each segment in centimeters and their protractors to measure the exterior angles. Students will then input their directions into the program.

1. Each student or partner pair should draw a **six** segment path on butcher paper for the TI-Innovator Rover to follow.
2. Students will measure and label each segment in centimeters.
3. Students will measure and label each angle in the path. Since students will need the exterior angle, they can measure the given angle and calculate or construct the supplement. (See the figure on the next page.)



Design a Path

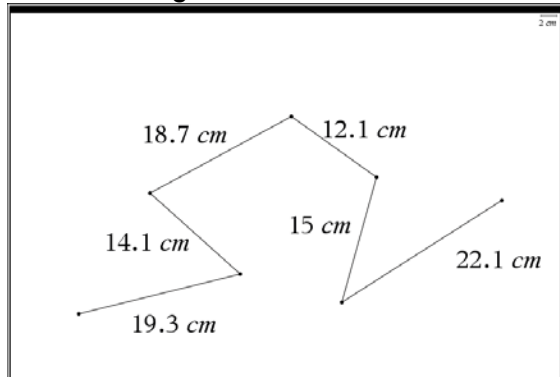
USING THE TI-INNOVATOR™ ROVER

MATH IN MOTION TEACHER USAGE GUIDE

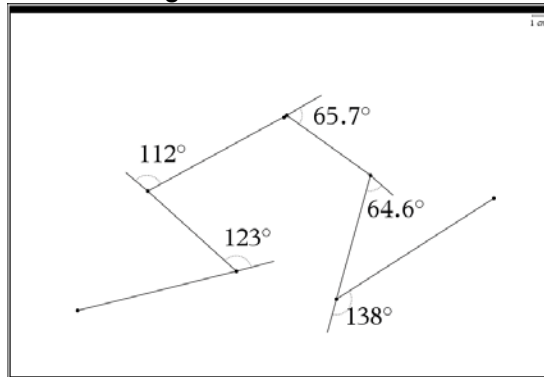
- Students should set the Rover at the starting point of the path and make sure that the Rover is aligned. Students should look down the barrel of the pen-holder and center the starting point below the Rover.
- Students will run the program. The program will prompt the students for the number of segments in the path. Then, it will prompt for the distance in centimeters, whether they should turn right or left, and the exterior angle for each segment. *Note: To type R or L on the TI-84 Plus CE, press the alpha key first and then the key for R or L.*
- If the directions are correct, the Rover will follow the drawn path on the butcher paper.
- If the directions are incorrect, students should determine their miscalculation and try again.

Sample:

Path with length measurements



Path with angle measurements



Path:

19.3 cm
Left 123°
14.1 cm
Right 112°
18.7 cm
Right 65.7°
12.1 cm
Right 64.6°
15 cm
Left 138°
22.1 cm

Questions for Students:

- If you drove your path in reverse order, would you only switch the order of the lengths? Justify your answer.
- If you wanted to have the Rover drive backwards through your path, how would your inputs differ? Why?
- If you drive a convex polygon, what is the sum of the angles you turned? Is this always true? Why?

Teacher Tip: A common student mistake is to measure and enter the supplementary angle for the turning angle. If the TI-Innovator Rover doesn't follow the path, ensure the student understands how the Rover rotates at each angle. Students should imagine that they are driving a Rover and following their path.

Going Further:

Have students create their own programs to follow a path composed of as many segments and turns as they desire. The main programming commands are:

```

001 ClrHome
002 Wait 1
003 Send ("CONNECT RV")
004 Wait 1
005
006 Send ("RV FORWARD DISTANCE .25 M )
007 Send ("RV LEFT 53.1 DEGREES ")
008
009 Send ("RV FORWARD DISTANCE .5 M )
010 Send ("RV RIGHT 53.1 DEGREES ")

```

Additional Resources and Teaching Tips:

Before students attempt the challenges in the *Going Further* section, you may wish to have students complete the [10 Minutes of Code with TI-Innovator™ Hub and TI-Innovator™ Rover](#) to help provide a foundation for coding principles.