Speed Check

USING THE TI-INNOVATOR™ ROVER

Program Overview:

Students will use the TI-Innovator™ Rover and the provided file to explore the relationship between speed, distance and time. The students will relate their choices to the actions of Rover and understand they have the ability to control these values as they explore speed, distance and time. In addition, they see how closely Rover can match their choices.

Science Objectives:

- Students will explore the relationship between speed, distance, and time.
- Students will apply an understanding of the speed = distance/time equation to navigate a defined path.

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.

Science Course Connections:

The relationship between time, distance, and speed is typically taught in the middle grades physical science classroom and then reviewed and explored further in the physics classroom.

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

Materials and Set-up:

- TI graphing calculator with the file(s) preloaded
  - TI-Nspire™ CX handheld– speedcheck.TNS
  - TI-84 Plus CE graphing calculator – SPEEDCHK.8xp & NAVIGATE.8xp
- TI-Innovator™ Hub with TI LaunchPad™ Board and USB Cable
- TI-Innovator™ Rover
- Meter stick
- Stopwatch (per student group)
- Tape (try painter's tape for easy removal)

The TI-Innovator Rover will need plenty of space to move for the activity. The Rover works best on a smooth clear surface. Be sure to have at least 1.5 meters by 2.5 meters space available for each group.

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:

Task 1 – Speed Check

Students will use the speed check program. They will run the Rover using the speed indexes 1 through 5 while using a stopwatch to time how long it takes to travel 2 meters. From this information, students should be able to calculate the magnitude and unit of measure for speed (meters per second). Students must calculate speed for each of the 5 speed indexes. They will need this information for the navigation challenge.

Student Tasks for Speed Check:

1. Working in small groups, students should use the program called Speed Check to determine the actual speed for each of the Rover speed index settings (1 through 5). Encourage students to create a data table to record their index setting, time trials, average time, and their calculated speed.
2. The Rover is will drive for 2 meters. For each index setting, students measure the time it takes the Rover to run from start to finish. Be sure to have plenty of space as the Rover will run for 2 meters. Record your time (seconds).
3. Repeat each speed index at least 3 times to determine an average time.
4. Use the average time and the speed formula to calculate the speed of each index. Reminder: Speed = Distance/Time

Questions for Students to consider during/after the exploration:

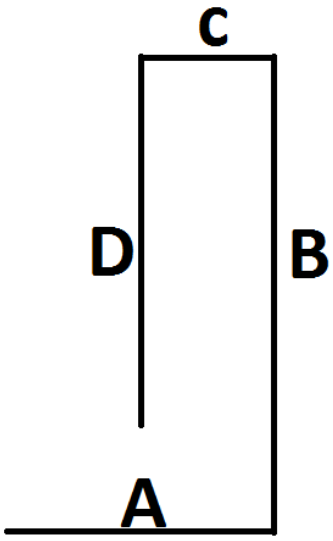
- How far apart are your times for the three trials? What are some possibilities that could cause the variation? What is the cause? (Variation in the rover, variation in the stopwatch operator, other reasons?)
- Do you think your calculations would change if you repeated the exploration on a different surface? Why or why not?

Task 2 –Navigate a Course (or Path)

The teacher should create a single course for all students to use to navigate their Rovers (based on the diagram below). You may consider creating multiple courses if space allows. The course needs to be on the same surface that the students used in the speed check portion of this activity. Use painter's tape to mark the course on your floor. If you have access to a large dry erase surface, you can also map out the course with a dry erase marker. Students will know the distances for each leg of the course but they will need to use their calculated speed from Task 1 to determine duration (time) and speed index (1-5) to travel that distance. Students will use the *navigate* program to test their duration and speed choices and navigate through the course. *Note: The course should be labeled with the measured distance.*

Students Tasks for Navigate a Course:

1. The objective is to navigate a course on the floor that requires the Rover to travel in a straight line for 1 meter (A), turn left (the Rover's left) 90 degrees, travel 2 meters (B), turn left 90 degrees again, travel .5 meters (C), turn left 90 degrees, and then travel 1.5 meters (D) to make it to the destination. *Note: Diagram provided here is not to scale.*
2. Using the speed formula and data collected from SPEEDCHECK, students will calculate how long the Rover needs to travel (time) per segment at a given speed (1-5).
3. Run the *navigate* program. The program will prompt students for the speed and time of each segment. *Note: The navigate program is a separate program file for the TI 84 Plus CE (NAVIGATE). For the TI-Nspire CX, it is the second page in the speedcheck.TNS file.*



Questions for Students to consider during/after the exploration:

- Did your Rover stay on course? If not, review your speed calculations and try again.
- Would there be a difference in course navigation using the same speed setting in each segment versus different speed settings? Is there more than one way to achieve navigation of the course?
- Can you attempt the course with four different speed settings?

Going Further:

Challenge: Have the groups explore the “speed check” portion of the activity on different surfaces and compare their findings across groups. The next step would be to run through the navigation path on that surface.