Two Rovers Leave the Station…

USING THE TI-INNOVATOR™ ROVER

Program Overview:

Students will use the TI-Innovator™ Rover and the provided file to help illustrate an intersection point of two lines. Students will crash two Rovers into each other. The crash will use the horizontal distance from the origin, $s(t)$, as the dependent variable and time, *t*, as the independent variable. The velocity is the slope of the linear equation, and the starting distance from the origin is the initial position.

Math Objectives:

- Students will solve systems of linear equations both graphically and algebraically.
- Students will interpret functions in terms of the situations they model.
- Students will use the TI-Innovator Rover to demonstrate a tangible application of an intersection point and as a visual form of formative assessment.

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:

Intersection of lines and systems of equations are topics that are taught from Algebra 1 to Pre-Calculus. This activity can be an engaging way to bring the concept of the intersection of lines to life, and is also easily adaptable to each of the different courses. The activity involves solving the system of equations both algebraically and graphically. The activity can be adapted to different courses simply by changing the method used to solve the system of equations.

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 Setup:

- TI graphing calculator with the file preloaded
  - TI-Nspire™ CX handheld – Two_Rovers.TNS
  - TI-84 Plus CE graphing calculator – TWOROVERS.8xp
- TI-Innovator™ Hub with TI LaunchPad™ Board and USB Cable
- TI-Innovator™ Rover
- Meter stick
- 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 smooth clear surface space of least 300 cm by 120 cm (approximately 10 feet by 4 feet) for each group. The longer dimension is the horizontal axis.

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:

Find the intersection point of $s(t) = 2t - 4$ and $s(t) = -1.5t + 10$ algebraically and by graphing on a TI Graphing Calculator. Have student groups discuss the meaning of the slopes, the y-intercepts, and the intersection point of the equations $s(t) = 2t - 4$ and $s(t) = -1.5t + 10$. Students should discuss that the slope is the velocity of each Rover, the intercept represents the initial position with reference to zero, and the intersection gives the time and position where the rovers crash. The t-coordinate will be time, s-coordinate will be position. (See setup for task 2)

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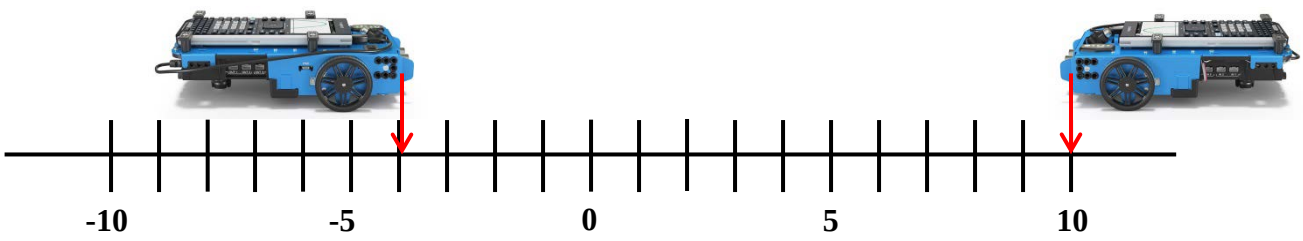
Teacher Tip: If you are not familiar with finding the intersection points on the TI Graphing Calculator, please check out our e-guides (TI-Nspire CX e-guide; TI-84 Plus CE e-guide).

Task 2:

Paired groups will work together to crash the TI-Innovator Rovers into each other at the intersection point of the equations. This intersection point is defined by the following assumptions for Task 2: Assume time is the independent variable measured in seconds, and distance is dependent variable measured in ten centimeter units.

Setup:



Student Tasks:

1. Students should create a number line by using a tape on the floor. The number line needs to accommodate the initial positions derived from Task 1. Each tick mark will need to be 10 centimeters apart.
2. Student will place each TI-Innovator Rover at the initial position on the number line created. The TI-Innovator Rovers should be facing each other.
3. Execute the program. Using the equations and information derived from Task 1, enter the velocity, position, and time until crash when prompted by the program. Delay is not needed for task number one but ask students why it might be included for an option. Use 0 seconds for the delay in this initial task.
4. Press Enter to start the Rovers
5. If the TI-Innovator Rovers did not crash at the point students expected, they should evaluate their information from Task 1 and try again.

Going Further:

Challenge students to update and change the given programs to have the TI-Innovator Rovers do this instead....

Challenge 1: Repeat Tasks 1 and 2 with $s(t) = 1.5t - 10$ and $s(t) = -2t + 4$.

Challenge 2: Repeat Tasks 1 and 2 with $s(t) = 2.3t - 11$ and $s(t) = -2t + 10.5$.

Challenge 3: Repeat Tasks 1 and 2 with $s(t) = 1.7t - 12$ and $s(t) = -1.5(t - 4) + 14$. Be sure to explain what t - 4 means in the context of this scenario. This is where the delay time becomes useful.