

<b>Aim:</b> How can we explore the distance formula in terms of the Pythagorean Theorem and rise and run?	<b>Objectives:</b> Students will be able to: 1.) Relate movement within the coordinate plane to the cardinal directions 2.) Calculate the distance between two points using the coordinate plane and the Pythagorean Theorem 3.) Create their own “Distance Formula” in terms of rise and run	<b>Performance Standards:</b> 3A, 5G, 5I
		<b>Materials:</b> TI-Navigator, TI-83/84 Calculators, laptop, LCD projector, SMARTboard

<b>Do Now:</b> <span style="float: right;"><i>5 mins.</i></span> Calculate the slope between (-7,-1) and (2,3) using the following 2 methods: 1.) Plotting the points on graph paper and finding rise/run 2.) Using $(y_2 - y_1)/(x_2 - x_1)$ .	<b>Prior Knowledge</b> – Students must be able to plot points & calculate slope using 1 of the 2 Do Now methods. Students must also be able to calculate the length of the hypotenuse using the Pythagorean Theorem. <b>Anticipated Response</b> – Students tend to have difficulties when creating a “Distance Formula” in terms of rise & run. Similarly, students also struggle to apply their method(s) when a coordinate plane is not given.
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<b>Mini-lesson :</b> <span style="float: right;"><i>20 mins.</i></span> Log in to the TI-Navigator, go to the Activity Center, and load the pre-prepared activity settings. Briefly explain the diagram, highlighting (1) the cardinal directions, (2) the location of the school at the origin, and (3) the supposition that blocks are counted according to x and y-units and not the background image. Individualize cursors, start the activity, and, for 2-3 minutes, verbally instruct students to go to specific cardinal (N, S, E, W) and ordinal (NE, SE, SW, NW) directions. Review Quadrants as necessary. Start a new activity, and ask students to move their cursor to one of the coordinates described in Example 1. Pause the activity, and ask students to construct a right triangle with these points as endpoints of the hypotenuse. After students calculate the length of the hypotenuse, ask the following question: <i>If the hypotenuse is a line segment with a positive or negative slope, what do the legs of the right triangle represent?</i> Go through Example 2 as a class. Ask: <i>How can we determine the lengths of the legs without graph paper?</i>
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<b>Cooperative Teams:</b> <span style="float: right;"><i>20 mins.</i></span> Instruct students to complete (strictly numeric) Examples 3 and 4 without the aid of graph paper. Encourage students to focus on the relationship between the Do Now and Examples 1 and 2. Once students have attempted examples 3 and 4 without graph paper, give them graph paper to verify their solutions. Ask students to create a method for finding the distance between two points without graph paper. All cooperative teams should be prepared to present their methods in the Activity Center.
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<b>Share:</b> <span style="float: right;"><i>15 mins.</i></span> Send students the Learning Check document entitled “Exploring the Distance Formula.” Collect the file after approximately 5 minutes, and discuss class responses using the Slideshow. Identify 1-2 cooperative team(s) with insightful methods for finding the distance between two points without graph paper, and ask them to share their work with the class.
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<b>Homework:</b> <span style="float: right;"><i>3 mins.</i></span> “Distance Formula Homework.” Math A - June 2003 #30, Jan 2005 #24
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## Possible Extensions of the Activity

Since the Midpoint Formula is so closely related to the Distance Formula, you may wish to explore modifications which address how to use rise and run (or, perhaps more generally, “rate of change”) to determine the midpoint of a segment.

If you reconsider the first Distance Formula example with Sammy and Mark, another possible extension can be based on the idea of taxicab geometry. Ask students to consider the following situation: “Suppose Sammy wants to take a cab to Mark’s location on the grid. Sammy wants the cab driver to follow a specific route, but the cab driver says that the route doesn’t matter because the distance driven is always the same. Do you agree with Sammy or the cab driver? Support your response with evidence.” For more information regarding taxicab geometry, visit [http://en.wikipedia.org/wiki/Taxicab\\_geometry](http://en.wikipedia.org/wiki/Taxicab_geometry).

## Creating a Working Copy of the Activity Center Coordinate Plane with a Google Earth Background Image

Many students – and adults – find it easier to participate in the Activity Center when they have a hard copy of the coordinate plane and background image to write on. Though there are a variety of ways this can be done, I’ve found that the following method is the most versatile:

- 1.) Download the free version of Google Earth at <http://earth.google.com/>. You will need administrative privileges on your computer to install the software. Once the software is installed, you can access a satellite image by simply typing in an address.
- 2.) Once you have a Google Earth image you’re satisfied with, save it by clicking *File, Save, Save Image*.
- 3.) Now this image can be imported into Activity Center by opening the TI-Navigator software, going to the Activity Center, and loading the background image (*File, Load, Load Background Image*). Sometimes you may want to adjust how the coordinate image is superimposed on the image. You can move the coordinate plane by clicking on the hand under the “List-Graph” tab.
- 4.) At this point you can print the entire Activity Center screen by using the print screen option on your computer. Depending on your image, you may find that the grid lines are difficult to see. There are a variety of ways you can adjust the width of the gridlines and brightness of your image. Unfortunately, none of this can be done in the TI-Navigator software.
- 5.) I’ve found that the most versatile way to do this is by using SMARTboard’s Notebook software to take a screen capture of the image in the Activity Center. Once this image is in the Notebook software, you can superimpose thicker grid lines and group them with the image. You can also adjust the image’s transparency (*right-click and look in Properties*). Students find that it is easier to write a hard copy of an image if it is somewhat transparent.
- 6.) Though you can print this adjusted image directly from the Notebook software, you may find that it is more effective to select the image, copy it (*Ctrl-C*), and paste it into Microsoft Word. Once this image is in Word, you can move it and type text as necessary.
- 7.) Print your final product on a laser printer since ink jets often distort the image.