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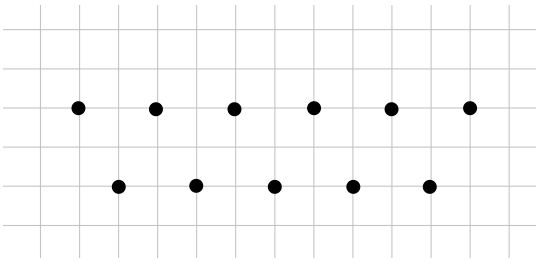
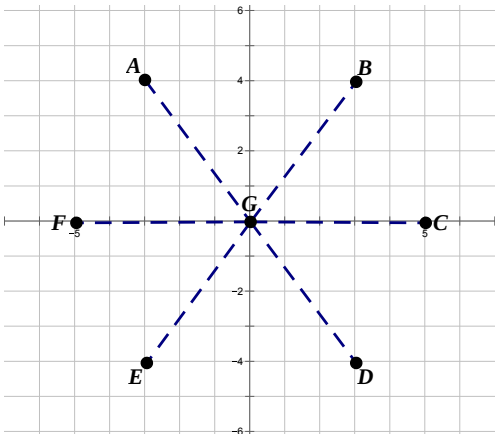
Go the Distance

A Develop Understanding Task

The performances of the Podunk High School drill team are very popular during half-time at the school's football and basketball games. When the Podunk High School drill team choreographs the dance moves that they will do on the football field, they lay out their positions on a grid like the one below:



In one of their dances, they plan to make patterns holding long, wide ribbons that will span from one girl in the middle to six other girls. On the grid, their pattern looks like this:

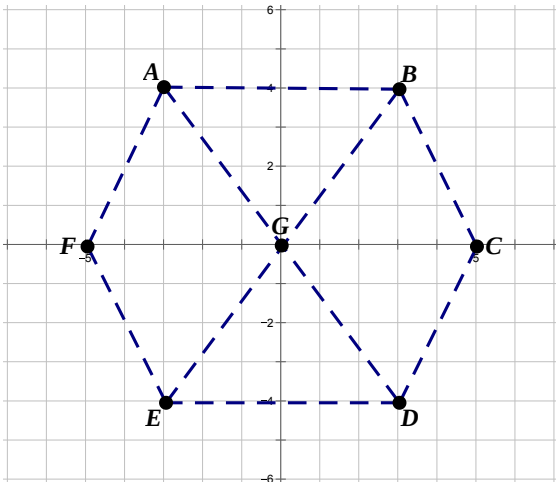


The question the girls have is how long to make the ribbons. Some girls think that the ribbon from Gabriela (G) to Courtney (C) will be shorter than the one from Gabriela (G) to Brittney (B).

1. How long does each ribbon need to be?

2. Explain how you found the length of each ribbon.

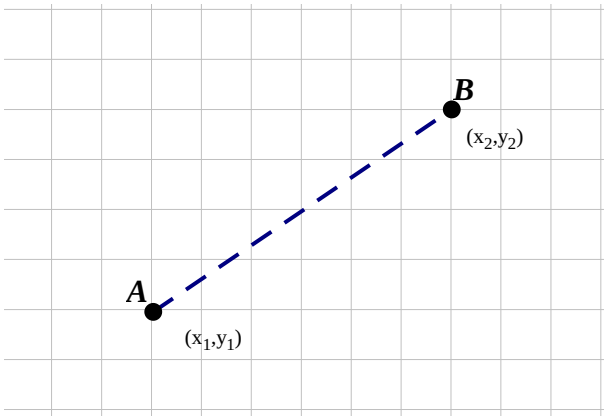
When they have finished with the ribbons in this position, they are considering using them to form a new pattern like this:



3. Will the ribbons they used in the previous pattern be long enough to go between Britney (B) and Courtney (C) in the new pattern? Explain your answer.

Gabriela notices that the calculations she is making for the length of the ribbons reminds her of math class. She says to the group, "Hey, I wonder if there is a process that we could use like what we have been doing to find the distance between any two points on the grid." She decides to think about it like this:

"I'm going to start with two points and draw the line between them that represents the distance that I'm looking for. Since these two points could be anywhere, I named them A (x_1,y_1) and B (x_2,y_2). Hmmmmm. . . . when I figured the length of the ribbons, what did I do next?"



4. Think back on the process you used to find the length of the ribbon and write down your steps here, using points A and B.

5. Use the process you came up with in #4 to find the distance between two points located at (-1, 5) and (2, -6)

6. Use you process to find the perimeter of the hexagon pattern shown in #3.

Go the Distance – Teacher Notes

A Develop Understanding Task

Note to Teachers: Calculators should be available for this task.

Purpose: The purpose of this task is to develop the distance formula, based upon students' understanding of the Pythagorean theorem. In the task, students are asked to calculate distances between points using triangles, and then to formalize the process to the distance formula. At the end of the task, students will use the distance formula to find the perimeter of a hexagon.

Core Standards Focus:

G. GPE Use coordinates to prove simple geometric theorems algebraically.

G.GPE.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.

Related Standards:

G.GPE.4. Use coordinates to prove simple geometric theorems algebraically.

Launch (Whole Class):

Begin the task by ensuring that student understand the problem situation. Project the drawing in #1 and ask students which ribbon looks longer, $\overline{GB}$ or $\overline{GC}$. Ask how they can test their claims. Some students may suggest using the Pythagorean Theorem to find the length of GB. Ask what they would need to use the Pythagorean Theorem. At this point, set students to work on the task.

Explore (Small Group):

During the exploration period, watch for students that are stuck on the first part of the problem. You may ask them to draw the triangle that will help them to use the Pythagorean Theorem and how they might find the length of the legs of the triangle so they can find the hypotenuse. As you monitor student thinking on #3, watch for students who are noticing how to find the length of the legs of the triangle when it has been moved away from the origin. Look for students that have written a good step-by-step procedure for #4. It will probably be difficult for them to use the symbols appropriately, so watch for words that appropriate describe the procedure.

Discuss (Whole Class):

Start the discussion by having a group show how they found the length of $\overline{BC}$ in problem #3. Move next to #4 and have a group that has written a step by step procedure. Try walking through the

group's procedure with the numbers from problem #3 and see if it gives the appropriate answer. If necessary, work with the class to modify the procedure so that the list of steps is correct. Once the steps are outlined in words, go through the steps using points A (x_1,y_1) and B (x_2,y_2) and formalize the procedures with the symbols. An example:

Steps in words	**Steps in symbols**
Find the length of the horizontal leg of the triangle	$x_2 - x_1$
Find the length of the vertical leg of the triangle	$y_2 - y_1$
Use the Pythagorean Theorem to write an equation	$(x_2 - x_1)^2 + (y_2 - y_1)^2 = c^2$
Simplify the left side of the equation	$(x_2 - x_1)^2 + (y_2 - y_1)^2 = c^2$
Take the square root of both sides of the equation	$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{c^2}$
Simplify	$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = c$ (c being the desired distance)

After going through this process, you should end with the distance formula. Apply the formula using the points in #5.

Aligned Ready, Set, Go: ***Connecting Algebra and Geometry 1***

Ready, Set, Go!

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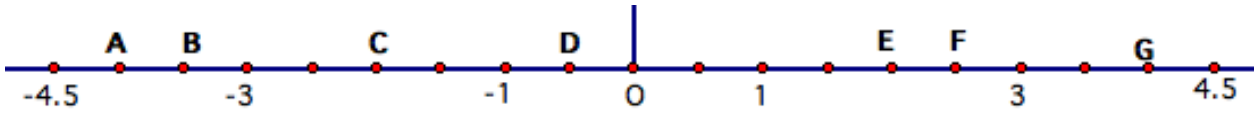
Ready

Topic: Finding the distance between two points

Use the number line to find the distance between the given points.

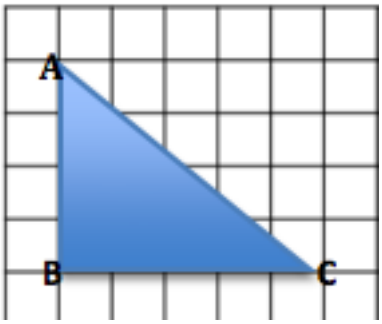
(The notation AB means the distance between points A and B.)

1. AE
2. CF
3. GB
4. CA
5. BF
6. EG



7. Describe a way to find the distance between two points on a number line without counting the spaces.

8. Use the grid to find AB, BC, and AC.

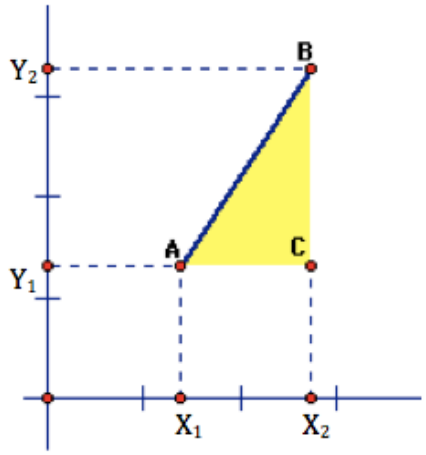


9. Why is it easier to find the distance between points A and B and points B and C than it is to find the distance between A and C?

10. Explain how to find the distance between points A and C.

Set

Topic: Slope triangles and the distance formula



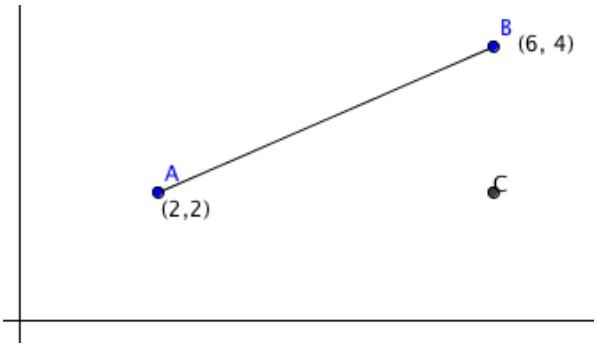
11. Triangle ABC is a slope triangle for the line segment AB where BC is the rise and AC is the run. Notice that the length of segment BC has a corresponding length on the Y-axis and the length of AC has a corresponding length on the X-axis.

The slope formula is written as $m = \frac{y_2 - y_1}{x_2 - x_1}$ where m is the slope.

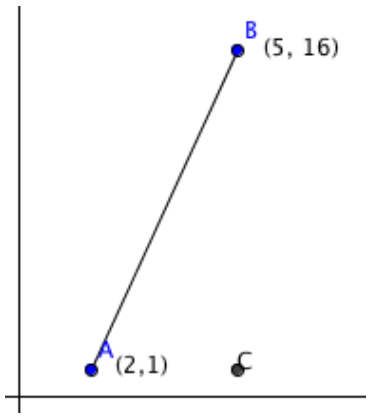
What do the values $(y_2 - y_1)$ and $(x_2 - x_1)$ tell you?

In the previous unit you found the length of a slanted line segment by drawing the slope triangle and performing the Pythagorean Theorem. In this exercise try to develop a more efficient method of finding the length of a line segment by using the meaning of $(y_2 - y_1)$ and $(x_2 - x_1)$ combined with the Pythagorean Theorem.

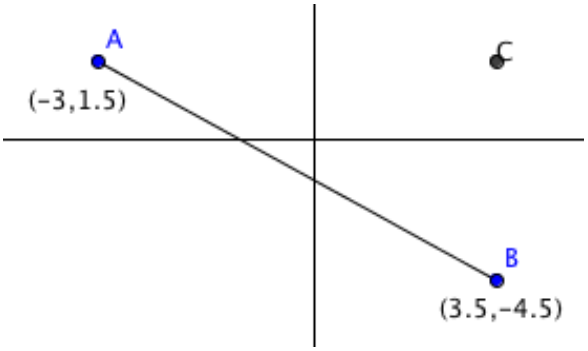
12. Find AB.



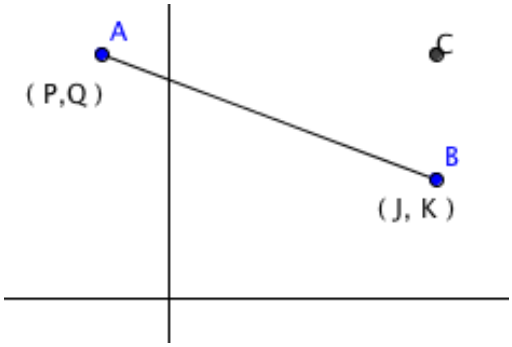
13. Find AB.



14. Find AB.



15. Find AB.



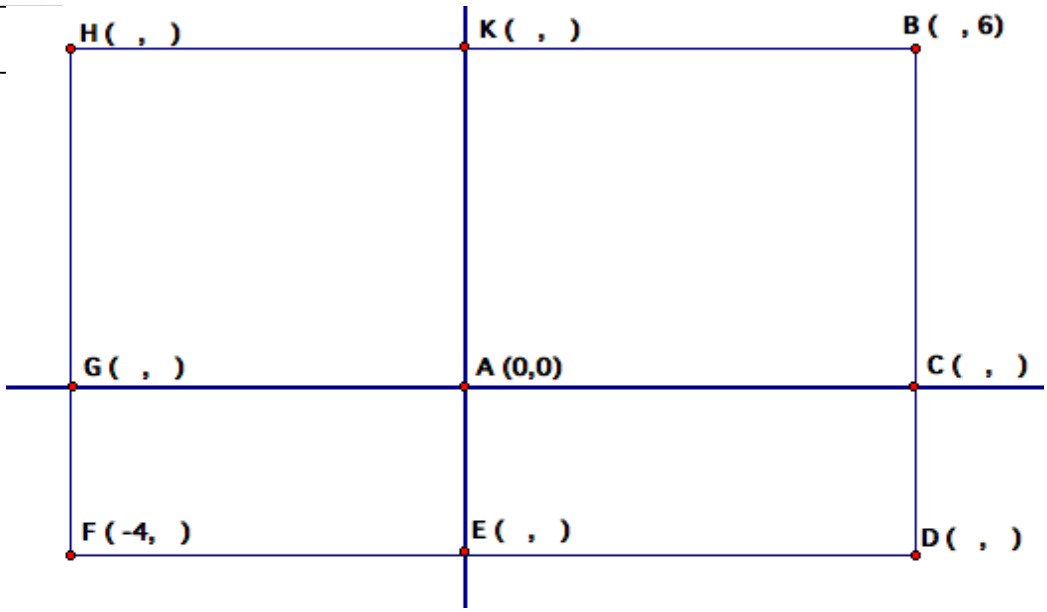
Go Topic: Rectangular coordinates

Use the given information to fill in the missing coordinates. Then find the length of the indicated line segment.

16.

HB = _____

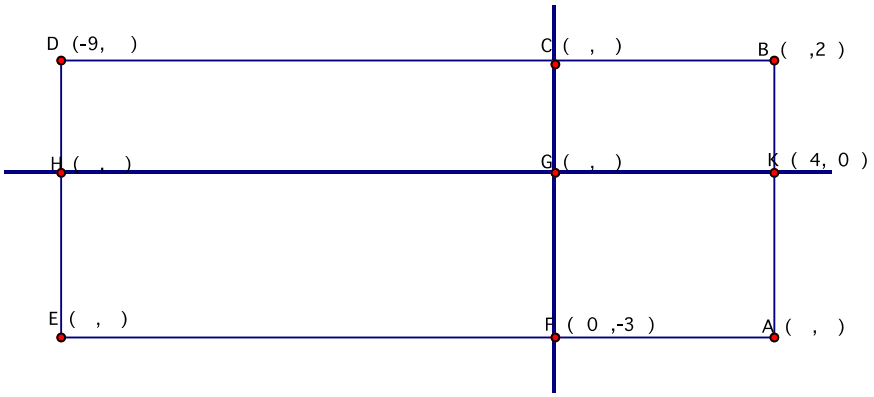
BD = _____



17.

DB = _____

CF = _____



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http://www.khanacademy.org/math/algebra/ck12-algebra-1/v/distance-formula