Grade 8 Basic Math: Geometry Name: ___TEACHER COPY _____

CCSS.Math.Content.8.G.B.8 Date: _____ Period: ____

Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Materials:

Powerpoint, Overhead, or Smartboard for displaying activity layout and worksheet
Worksheet for each student

Lesson Outline:

Launch (5 minutes): This lesson begins with the teacher posing the following challenge, "Alright class! Imagine that you and a couple buddies went on a camping trip at Huddart Park in Woodside,CA. If they hike in different directions, how might you calculate how far apart are the two pairs at any given time?

Introduction (5 minutes): First, let's go over a quick proof of the Pythagorean Theorem and how it's related to the distance formula. This will help us calculate how far apart two points are at any given time.

Investigation (20 minutes): Students will be working in groups of four on the worksheet with situations where they must use locations to determine distance and midpoint between two points. While students work in their groups, the teacher will circulate around the classroom and make clarifications and corrections as necessary.

Summary (10 minutes): At this point, the teacher brings the class back together and the whole group discusses the results of their study. Key points that the students should learn include:

The coordinates of two points can be used to find the distance directly between them (both graphically and with the distance formula).
The coordinates of two points can be used to find their midpoint (both graphically and with the midpoint formula).

Strategies: This lesson incorporates visuals that help English language learners to understand the concepts of distance and midpoint. Pictures are included to help ELL students understand that the first situation involves campfires and camping and the second situation involves school buildings and rooms. Also, having students graph points and find distance and midpoint that way is very visual and does not require as many language skills.

Questions and prompts to use are shown below (make sure to give ELL students plenty of time to answer each):

Could you use the two points you have to create a right triangle?
What have we learned recently about the relationship between the sides of a right triangle? Can we use this to help us find the distance?
How can we use the horizontal distance and the vertical distance to find the midpoint? Remember, the midpoint is midway between the two endpoints.

Assessment: Informal.

Student understanding will be monitored informally while the teacher circulates around the room and asks students probing questions. Also, students will summarize their findings at the end of class. Finally, students will complete a homework assignment on their own that will test their independence with the material. The assessment will help the teacher know if review is necessary before the next lesson. Students need to know how to measure distances between points and locate their midpoints as well.

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Informal, Visual Proof of the Pythagorean Theorem:

PROOF OF THE PYTHAGOREAN THEOREM

Let a right triangle have sides a, b, and hypotenuse c.

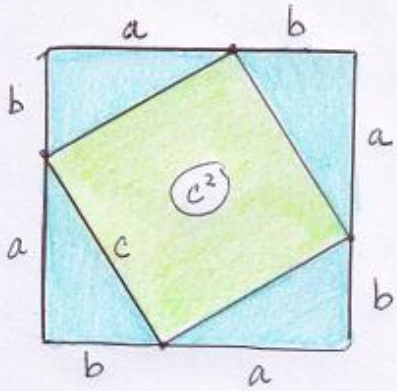

FIGURE 1

$A_1 = c^2 + 2ab$

Arrange four of these triangles to form a square whose side is a+b. (Figure 1)

Divide that square into two squares and two rectangles instead. (Figure 2)

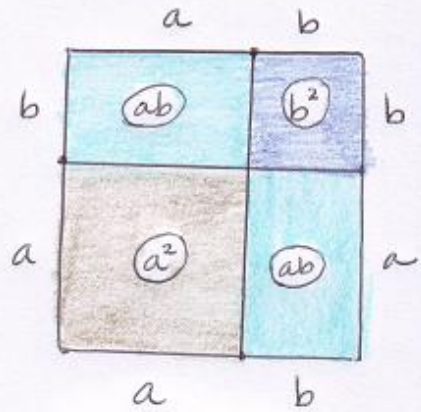

FIGURE 2

$A_2 = a^2 + 2ab + b^2$

Since this is the same size square, we can set the areas equal:

$$A_1 = A_2$$

$$c^2 + 2ab = a^2 + 2ab + b^2$$

$$\underline{-2ab} \qquad \underline{-2ab}$$

$$c^2 = a^2 + b^2$$ ⇐ Pythagorean Theorem

Taking the square root of each side of this equation, we have now derived the distance formula.

$$d = \sqrt{\Delta x^2 + \Delta y^2}$$

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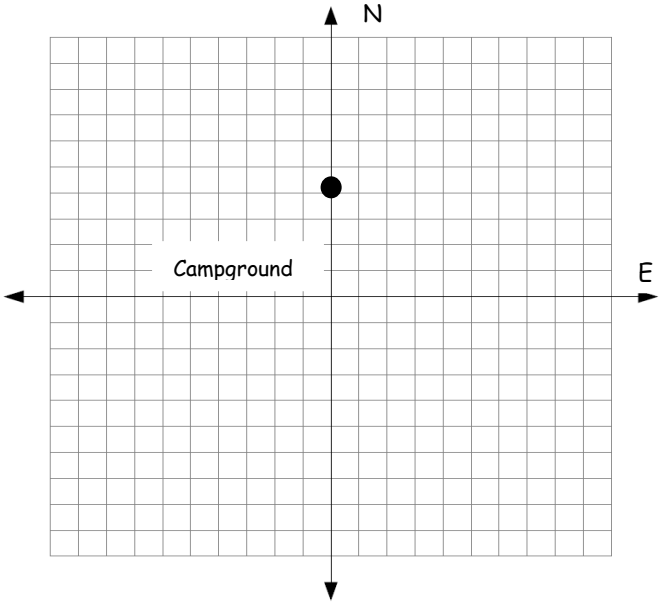
Investigation: Imagine that you and a couple buddies went on a camping trip at Huddart Park in Woodside,CA. Anthony and Eric decide that they want to hike this trail that takes them 2 km west and 5 km south. Similarly, Sophia and Danielle decide to hike a trail that leads them 4 km east and 3 km north. At this point, how far apart are the two pairs?

1. Let the campground be located at (0,0). Then Anthony and Eric's location is _____ and Sophia and Danielle's location is _____.



2. How far apart are the two pairs of hikers in the east-west direction? _____

3. How far apart are the two pairs of hikers in the north-south direction? _____

4. How can these two distances be used to find the distance between the two pairs of hikers?

5. This method for finding the distance between two points (x_1, y_1) and (x_2, y_2) is generalized in the distance formula.

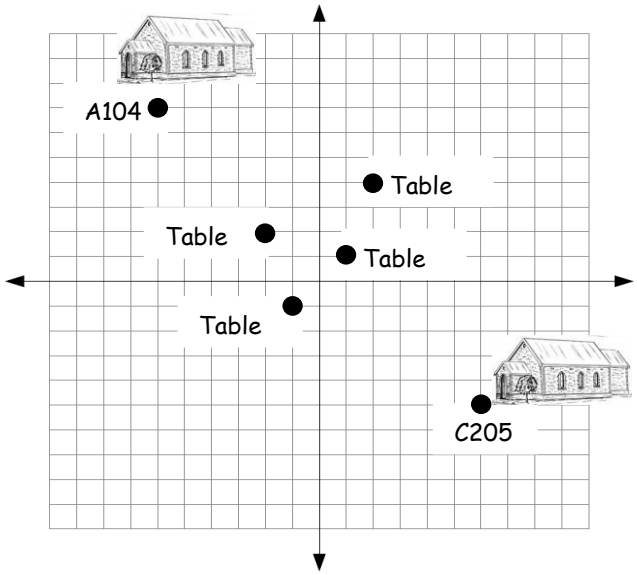
DISTANCE FORMULA:

6. If the two pairs of hikers decide to meet each other halfway, where will they meet? _____

7. This method for finding the midpoint between two points (x_1, y_1) and (x_2, y_2) is generalized in the midpoint formula.

MIDPOINT FORMULA:

8. Luke and Lauren are meeting up to study algebra problems after school. Luke's last class is in A104 and Lauren's last class is in C205. They want to meet at the lunch table that is closest to the midpoint of their locations. At which table should they meet? Show your work.



9. What is the direct distance between their two classes?