Grade Level	Content Area	Course Title	Unit Title
9	Mathematics	Math 1	How Far Can I Go?

Length of Unit	Time of Year Taught	Expected Prior Knowledge
Five 1.5 hour class sessions	2nd Quarter	M08 S4C3PO 2. Use the Pythagorean Theorem to find the distance between two points in the coordinate plane.

Unit Description

Students will solve problems using the distance formula to determine the distance between two points on a coordinate plane. They will determine distances from their home to school and to various landmarks in Tucson and beyond.

Strands, Concepts, and POs	MHS S4C3PO 3. Determine the distance between two points in the coordinate plane. MHS S1C2PO 1. Solve word problems involving absolute value, powers, roots, and scientific notation.
Summative Assessment	Students will demonstrate application of the distance formula by determining the distance between two points.
Assessment Scoring	Students will be assessed using a 25-point, 5-question, teacher-created quiz.
Materials/Resources Needed	Graph paper Local maps Rulers Copies of a coordinate plane on a transparency or clear sheet Overhead projector or LCD projector with a local map and coordinate plane

	Lesson 1	Lesson 2	Lesson 3	Lesson 4
PO Focus	MHS S4C3PO 3.	MHS S4C3PO 3. MHS S1C2PO 1.	MHS S4C3PO 3.	MHS S4C3PO 3.
Lesson/ Instruction	• Objective: Use previous knowledge (such as the Pythagorean Theorem) to find the distance between two points on a coordinate plane. • Bell Assignment: Pythagorean Theorem Review question. • Discussion: How do you determine how far you live from your best friend? The school? Do we	• Objective: Students will create word problems and find the distance between two points on a coordinate plane using the distance formula. • Bell assignment: What information do you need to determine the distance between two points? How do you use the information? • Students will be shown the distance formula as well as an example of how it works.	• Objective: Calculate the distance between two points on a coordinate plane using the distance formula. • Bell assignment: Determine the distance between two given points. • Students will be shown a local map. • Discussion: How do you determine distances on a map using the distance formula? • How is the distance formula	• Objective: Demonstrate mastery of the distance formula. • Teacher will distribute assessment.

	determine distances differently than a bird? • Show students a projection of a coordinate plane. Ask how students would find the distance between the two points to activate prior knowledge. Demonstrate an example to review.	• Discussion: How is the distance formula related to the Pythagorean Theorem? • Students will get into groups of four and each group will be given a local map.	give you a different calculation than if you were to actually walk or drive between two points?	
Student Activity	• Students will be divided into two teams. The first team will choose two points on the board and mark with a marker. The second team will determine the distance between the two points. Teacher will randomly choose one student to explain how to calculate the distance. The first team will check their work. Teams will switch roles at the end of each round.	• Student groups will create a coordinate plane on their map using main streets and/or a coordinate plane overlay. Students will research the distance the between main streets to create a scale for their map if none is given. • Students will work in groups to estimate the distance between the group members' homes and the school using the nearest coordinate point to their homes and school. • Students will write word problems using their maps and trade with a partner to solve. • Homework: Students will create a map and determine the distance between five landmarks they choose.	• Students will choose five points in Tucson that they determine to be the points they frequent most often. Students will work individually, or with partners for assistance, to create the following: • Students will list their intended destinations in order. • Students will determine the total distance travelled to each destination if riding their bike. • Students will determine the total distance travelled if flying to each location. • Students will determine the difference between the two total distances. Is the size of the difference expected?	• Students will complete assessment.

Quiz: Distance Between Two Points
(Summative Assessment: 100 pts possible)

Name: _____
Score: _____

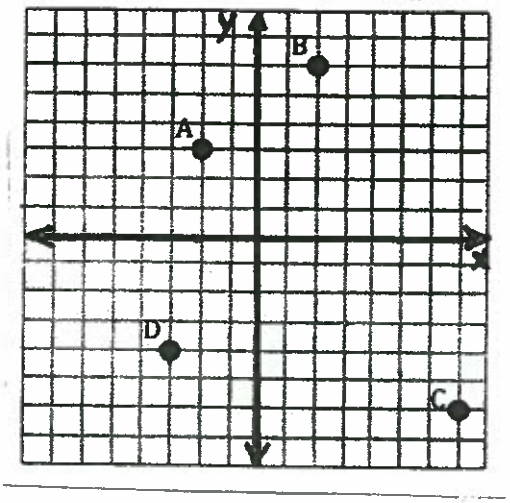
(8 points)

1. Given two points, $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$, **write the formula** for finding the distance, d, between these two points, P_1 and P_2.

   d = _____

2. Use the graph below to answer the following questions.

(8 points)



a) Label the coordinates (x,y) of each point:

A = (____ ,____), B = (____ ,____),

C = (____ ,____), D = (____ ,____)

(b) Find the distance between (i) the points B & C and (ii) the points D & B.
Round your answers to the nearest tenth, if needed. Clearly show your work!

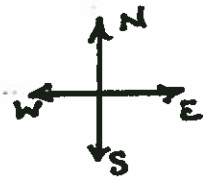
(17 points) (i) Distance between B & C = _____

(17 points) (ii) Distance between D & *B* = _____

3. Park Ranger Walker is patrolling the perimeter of the National Park and had just reached the southwest corner of the park when she received a call from dispatch. A bear had been sighted at the opposite corner of the park and she needs to secure the area immediately. Ranger Walker jumped in her truck and plotted a direct course to the bear.Given that the shape of the park is a rectangle 36 km long and 24 km wide,

(6 points)

a) Draw a quick sketch of the park, labeling the dimensions and marking both Ranger Walker's and the bear's positions.



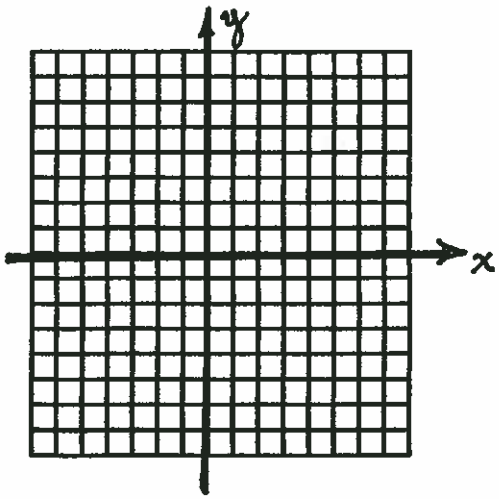
(10 points)

b) **Using the Pythagorean Theorem**, determine how far she will travel to reach the bear. Show your work and round to the nearest hundredth, if needed.

c) Using the given coordinate system below, where each unit represents 4 km, overlay both Ranger Walker's and the bear's positions relative to each other and

(6 points)

(i) assign appropriate coordinates to their positions, R (ranger) and B (bear)

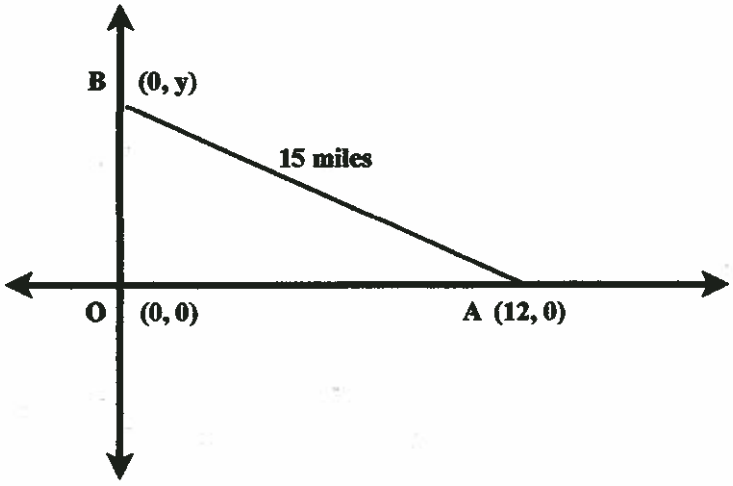


(15 points)

4. **Using the Distance Formula,** find the distance between points R & B above.

(13 points)

5. You are given that the distance between two points A & B is 15 miles and the coordinates of A & B are given by A (12, 0) and B (0, y), (see diagram).
Find the y coordinate of point B, that is, find the height of the triangle BOA.
Show your work clearly.



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— ANSWER KEY —

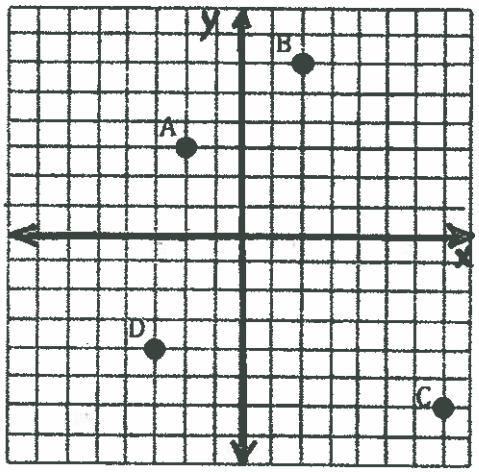
Quiz: Distance Between Two Points **Name:** _____
(Summative Assessment: 100 pts possible) **Score:** _____

(8 points)

1. Given two points, $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$, **write the formula** for finding the distance, d, between these two points, P_1 and P_2.

d = $\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$

2. Use the graph below to answer the following questions.



(8 points)

a) Label the coordinates (x,y) of each point:

A = (-2 , 3), B = (2 , 6),

C = (7 , -6), D = (-3 , -4)

(b) Find the distance between (i) the points A & C and (ii) the points D & B. Round your answers to the nearest tenth, if needed. Clearly show your work!

(17 points) (i) Distance between B & C = 13

$\sqrt{(7-2)^2+(-6-6)^2} = \sqrt{5^2+(-12)^2} = \sqrt{169} = 13$

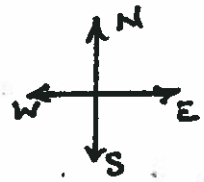
(17 points) (ii) Distance between D & B = 11.2

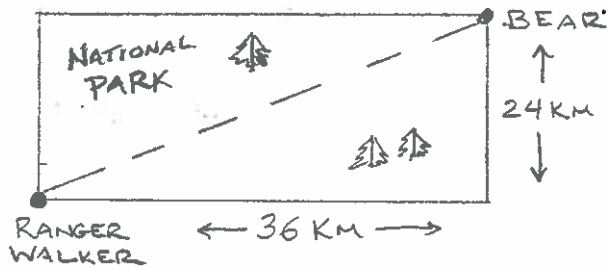
$\sqrt{(2-{}^-3)^2+(6-{}^-4)^2} = \sqrt{5^2+10^2} = \sqrt{125} \approx 11.18$

3. Park Ranger Walker is patrolling the perimeter of the National Park and had just reached the southwest corner of the park when she received a call from dispatch. A bear had been sighted at the opposite corner of the park and she needs to secure the area immediately. Ranger Walker jumped in her truck and plotted a direct course to the bear.Given that the shape of the park is a rectangle 36 km long and 24 km wide,

(6 points)

a) Draw a quick sketch of the park, labeling the dimensions and marking both Ranger Walker's and the bear's positions.





(10 points)

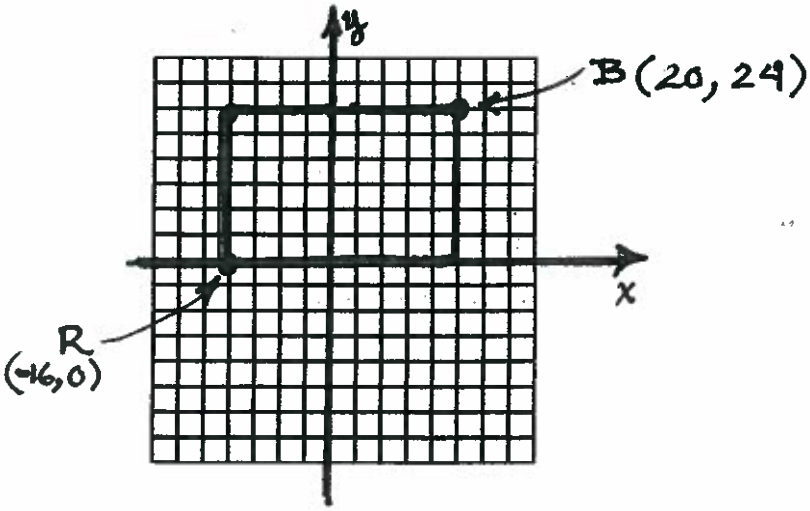
b) **Using the Pythagorean Theorem,** determine how far she will travel to reach the bear. Show your work and round to the nearest hundredth, if needed.

$c^2 = 36^2 + 24^2 \rightarrow c = \sqrt{1872} \approx 43.266 \approx 43.27$ KM

c) Using the given coordinate system below, where <u>each unit represents 4 km,</u> overlay both Ranger Walker's and the bear's positions relative to each other and

(6 points)

(i) assign appropriate coordinates to their positions, R (ranger) and B (bear)



*ANSWER WILL VARY: Student may place rectangle anywhere on coordinate system – as long as horizontal distance is 9 units (9 x 4 KM = 36 KM) and the vertical distance is 6 units (6 x 4 KM = 24 KM).

CHECK COORDINATE LABELS DEPENDENT UPON PLACEMENT OF RECTANGLE

(15 points)

4. **Using the Distance Formula,** find the distance between points R & B.

R = (-16,0) & B = (20,24)

$$d = \sqrt{(-16-20)^2 + (0-24)^2}$$

$$d = \sqrt{(-36)^2 + (-24)^2}$$

$$d = \sqrt{1872} \approx 43.266 \approx 43.27 \text{ KM}$$

(NOTE: NEEDS TO MATCH (3b))

$$\boxed{d \approx 43.27 \text{ KM}}$$

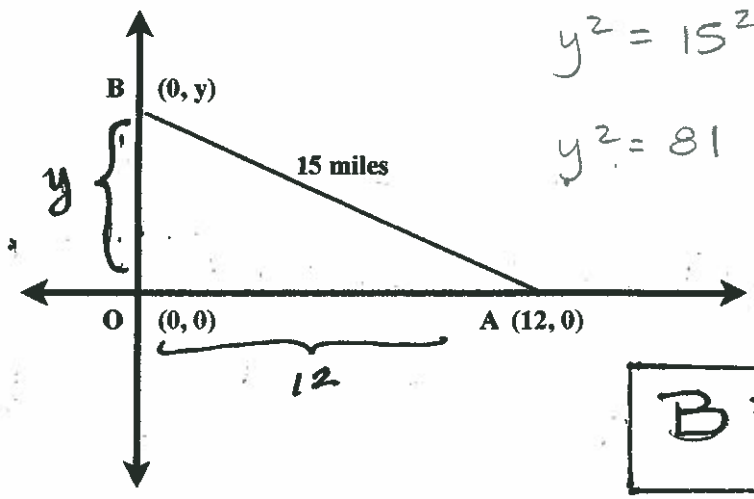
(13 points)

5. You are given that the distance between two points A & B is 15 miles and the coordinates of A & B are given by A (12, 0) and B (0, y), (see diagram). **Find the y coordinate of point B**, that is, find the height of the triangle BOA. Show your work clearly.

$$y^2 + 12^2 = 15^2$$

$$y^2 = 15^2 - 12^2$$

$$y^2 = 81 \longrightarrow y = 9$$



$$\boxed{B = (0, 9)}$$