Math: Grade 8, Lesson 18, Distance Between Two Points

Lesson Focus: Using the Distance Formula to calculate the distance between two points on a coordinate plane.

Practice Focus: Students will focus on understanding that the Pythagorean Theorem can be used to generate the Distance between Two Points Formula or Distance Formula in order to calculate the distance between two points on a coordinate plane.

Objective: Students will use the Pythagorean Theorem to calculate distance between two points on a coordinate plane in a right triangle. Students will use the Distance Formula to calculate distance between two points on a coordinate plane.

Key Vocabulary: coordinate plane, coordinates, Distance Formula

TN Standards: 8.G.B.6

Teacher Materials:

- Whiteboard & Markers
- Calculator
- Large grid/graph paper for demonstration or grid on a board.
- Student Practice Packet

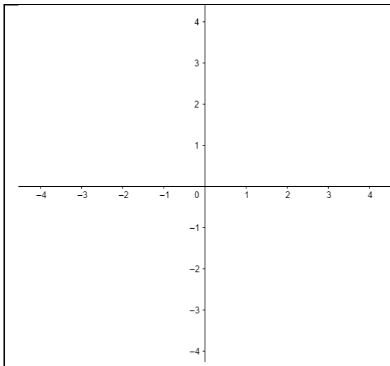
Student Materials:

- Paper and a pencil, and a surface to write on
- Calculator or calculator app strongly recommended
- Graph paper recommended but not required

**Note: Students will need a calculator to determine square roots of numbers. You will also want to graph paper or a grid board available for demonstrations. When writing out the distance formula equations, be sure to draw the square root bar across the entire half of the equation. The equation editor program wouldn't do this for me easily.*

Teacher Do	Student Do
<u>Opening</u> (1 min) **Hello! Welcome to Tennessee's At Home Learning Series for math! Today's lesson is for all our 8th graders out there, though all children are welcome to tune in. This lesson is the eighteenth in our series.** **My name is ____ and I'm a ____ grade teacher in Tennessee schools! I'm so excited to be your teacher for this lesson! Welcome to my virtual classroom!** **If you didn't see our previous lesson, you can find it on the TN Department of Education's website at www.tn.gov/education. You can still tune in to today's lesson if you haven't see any of our others. But, it might be more fun if you first go back and watch our other lessons since we'll be talking about things we learned previously.**	Students get materials ready for the lesson.

Today we will be learning about how to use the Pythagorean Theorem to find the distance between two points in a coordinate plane! Before we get started, to participate fully in our lesson today, you will need: • **Paper and a pencil, and a surface to write on** • **Calculator or calculator app recommended** • **Graph paper is recommended but not required.** **Ok, let's begin!**	
Intro (3 min) [The graph you are about to draw will be used in the lesson with the students, but the warm-up is focused on remembering how to plot points on a coordinate plane.] **Let's get warmed up. In Lessons 16 and 17, we explored the Pythagorean Theorem and its Converse that allowed us to calculate the missing side length in a right triangle and to determine if a particular triangle was a right triangle based on its side lengths.** **Today, we will explore another application of the Pythagorean Theorem when we move the triangles onto a coordinate plane. Let's warm up by reviewing how to read and plot ordered pairs on a coordinate plane. You probably started learning about this back in 5^{th} grade!** **Let's start with these three points or ordered pairs. You write these down with me.** [Write and read aloud.] **(1, 3)** **(1, -1)** **(-1, -1)** **Now, let's create a coordinate plane on our paper. If you have graph paper, this will be a little easier, but you can use regular paper too.** **I'll draw in the axes, and you draw along with me.** [Draw the x and y axis in a coordinate plane label the values. Make the coordinate plane at least 4 units on each side. The end results should look like this. It may also have grid lines depending on what you are using to draw on.]	Students review how to plot points on the coordinate plane in preparation for reading coordinate points to use in lesson.



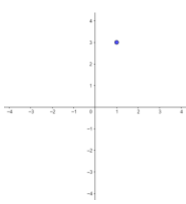
Remember that the horizontal axis is called the *x*-axis. [Point to the x-axis.], **and the vertical axis is called the y-axis.** [Point to the y-axis.].

Let's look back at our three points or ordered pairs. [Point at the three points listed previously.]

Remember that ordered pairs are listed as directions. You start at the origin [point at (0, 0)] **and the values tell you how many units to move horizontally on the x-axis and then vertically on the y-axis to get to the location of the point you want to put on the graph.**

Let's try one together.

Our first ordered pair is (1, 3). This tells us that we move from the origin [Place your marker at (0, 0).] **one unit to the right** [Move the marker one unit to the right.] **and then up three units** [Move the marker up 3 units.]. **Plot the first point here.** [Draw in the point. It should look like the following image.]

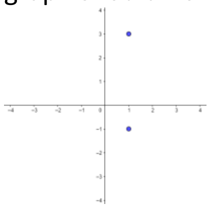


Are you remembering how to plot ordered pairs? It's not unusual to forget whether you start horizontally or vertically which is why we are taking a moment to practice.

Now, let's plot the next two points. You plot along with me.

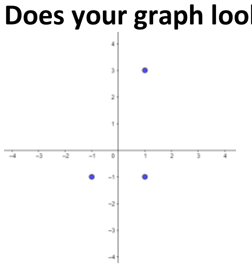
The next ordered pair is (1, -1). This tells us that we move from the origin [place your marker at (0, 0)] **one unit to the right** [Move the marker one unit to the right.] **then down one**

unit since the value is negative. [Move the marker down one unit.] **Plot the second point here.** [Draw in the point. The graph should now look like the following image.]



Now for the third ordered pair. Can you plot this one yourself? Give it a try. [Pause]

Let's see what you did. The third ordered pair is (-1, -1). So this tell us we need to move left one from the origin and down one to get to the location of this ordered pair. [Place your marker at (0, 0), move left one and down one. Then plot the point.]
Does your graph look like this? [Pause]



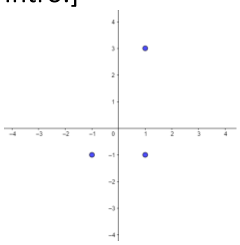
Keep this graph handy. We are going to use it as we move in to our lesson today, but here are a few things to keep in mind. Write these down with me. [Write and read aloud.]

- **Ordered pairs are always listed as values indicating horizontal (↔) then vertical (↕) directions from the origin.**
- **An ordered pair can be represented this way: (x,y)**
- **If you have more than one ordered pair, like we will today, they can be represented like this: (x_1, y_1)** [Read as x sub 1 and y sub 1.] **and (x_2, y_2)** [Read as x sub 2 and y sub 2.] **The subscript numbers help you identify which set of ordered pairs you are working with first, second, third, etc.**

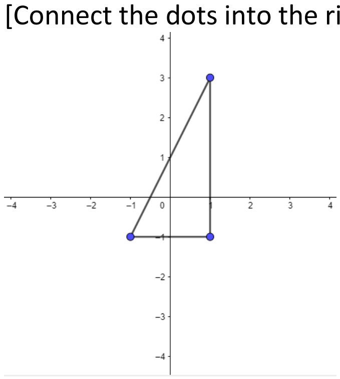
Are you feeling warmed up? [Pause]
Great! Let's get started on today's lesson.

Teacher Model (10-12 min) Objective 1: Students will use the Pythagorean Theorem to calculate distance between two points on a coordinate plane in a right triangle.	Objective #1: Students will use the Pythagorean Theorem to calculate distance between two points on a

[Example 1:]
Let's look back at the three points that we graphed on the coordinate plane. [Point at the diagram you created in the Intro.]



If we connect the dots, we create a right triangle like this.
[Connect the dots into the right triangle like the image.]



Our goal is to approximate the length of the hypotenuse to the nearest tenth. You can use a calculator to help you.

Let's first find the length of each leg.
[Point at the horizontal leg.] **This leg is two units long. Can you see that?** [Pause. Write the number 2 underneath the horizontal leg.] **What about the vertical leg?** [Point to the vertical leg.] **It is four units long.** [Write 4 to the right of the vertical leg.]

Now from Lesson 16, we know that if we have the length of two sides of a right triangle, we can use the Pythagorean Theorem to calculate the length of the missing side. [Point to the hypotenuse.]
We can tell from the model that we are missing the hypotenuse. It is the side opposite the right angle. So, we can solve for its length this way. You write this along with me. [Write the mathematics and read aloud as you go.]

$$\boldsymbol{a^2 + b^2 = c^2}$$

Remember that *a* and *b* represent the leg lengths, and *c* represents the hypotenuse length in the right triangle.

Substitute in what we know. Remember that we square the numbers first before we add by order of operations.

coordinate plane in a right triangle by counting the unit lengths of the two leg segments and solving for the missing hypotenuse length.

$$2^2 + 4^2 = c^2$$
$$4 + 16 = c^2$$
$$20 = c^2$$

Now, remember, to solve the equation for *c*, we need to take the square root of both sides. You will want your calculator or calculator app to help you.

$$\sqrt{20} = \sqrt{c^2}$$

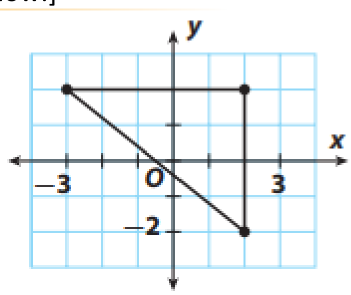
Round your result to the nearest tenth.

$$4.5 \approx c$$

So, we would say that the length of the hypotenuse is approximately 4.5 units long.

Does that make sense given the context of the problem? Looking at the length on the model, it should look like it is between 4 and 5 units long, and that is the longest measure of the triangle sides in this case. As it should be for the hypotenuse in a right triangle.

[Example 2]
Let's look at a second example. I will show you a model of a right triangle on a coordinate plane. We will determine the side lengths from the grid, and use the Pythagorean Theorem to determine the length of the hypotenuse. Let's see what we can identify here. [Prepare this grid ahead of time and show.]

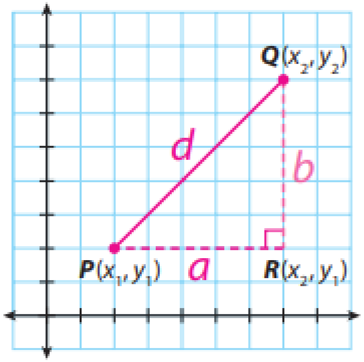


Let's look at the vertical leg. [Point to the vertical leg.] **How many units long is it?** [Pause]
If you said four units, you are correct!
Now, what about the horizontal leg. [Pause]
If you counted five units, you are also correct!

Now, we have enough information to use the Pythagorean Theorem to approximate the length of the hypotenuse. Let's give it a try. You follow along with me. [Write and read aloud.]

Objective #1 (cont): Students will use the Pythagorean Theorem to calculate distance between two points on a coordinate plane in a right triangle by counting the unit lengths of the two leg segments and solving for the missing hypotenuse length.

$$a^2 + b^2 = c^2$$ **Substitute in what we know. Remember that we square the numbers first before we add by order of operations.** $$4^2 + 5^2 = c^2$$ $$16 + 25 = c^2$$ $$41 = c^2$$ **Now, remember, to solve the equation for *c*, we need to take the square root of both sides. You will want your calculator or calculator app to help you.** $$\sqrt{41} = \sqrt{c^2}$$ **Round your result to the nearest tenth.** $$6.4 \approx c$$ **So, we would say that the length of the hypotenuse is approximately 6.4 units long.**	
Objective 2: Students will use the Distance Formula to calculate distance between two points on a coordinate plane. **There's a challenge with the method that we are using now. It will only work if the right triangle is situated in such a way that we can read the unit length of two of the legs. So, there must be a way to apply this in such a way that it will work for other types of models of right triangles.** **That way is called the Distance Formula. The Pythagorean Theorem can be transformed to derive this formula. Let's see if we can follow through with the logic.** **I'm going to show you another model, but this time, we won't count the units. We will identify the locations of the vertices by their ordered pairs. Take a look and make a sketch of this model.** [Prepare this model ahead of time, and show the model. Give students a moment to sketch the model.]	Objective 2: Students will use the Distance Formula that is derived from the Pythagorean Theorem to approximate the distance between two points on a coordinate plane.



Do you see that the points are labeled by their coordinates x and y but without values?

Let's talk through this together. You write along with me and think about what you are seeing on the model. [Write and read aloud as you go.]

- **Since $\overline{PR}$ is a horizontal segment, it's length, *a*, is the difference between its x-coordinates. Therefore a = $x_2 - x_1$** [Point at the x_2 and the x_1]
- **Since $\overline{QR}$ is a vertical segment, its length *b*, is the difference between its y-coordinates. Therefore b = $y_2 - y_1$** [Point at the y_2 and the y_1]
- **Use the Pythagorean Theorem to find *d*, the length of segment $\overline{PQ}$.**

$$d^2 = a^2 + b^2$$

$$d = \sqrt{(a^2 + b^2)}$$

Substitute the expressions from the previous statements for *a* and *b*. [Be sure to draw the square root bar across the entire half of the equation.]

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

Whew! That was actually a brief exploration into a proof of the Distance Formula! Make sure you have this formula written down and labeled as the Distance Between Two Points Formula. I'll read it again. [Point to the formula above and read it aloud as the distance is equal to the square root of the quantities x sub 2 minus x sub 1 quantity squared plus y sub 2 minus y sub 1 quantity squared.]

[Example 1]

Now, let's use the Distance Formula to estimate the length of the hypotenuse $\overline{PQ}$. We need to know these things. Write them out with me. [Write and read aloud.]

- **The coordinates of the endpoints of the hypotenuse.**
  - **The coordinates of P are (2, 2).**
  - **The coordinates of Q are (7, 7).**

Now, let P be the first set of ordered pairs, and let Q be the second set of ordered pairs. We will substitute into the Distance Between Two Points Formula (or Distance Formula for short) this way. Write this along with me. [Write and read aloud. Remember to extend the square root bar above the entire half of the equation.]

$$\boldsymbol{d = \sqrt{}\left((x_2 - x_1)^2 + (y_2 - y_1)^2\right)}$$
$$\boldsymbol{d = \sqrt{}\left((7-2)^2 + (7-2)^2\right)}$$

Remember the order of operations. In this case, you subtract before you square because of the grouping symbols. [Point at the parentheses around the 7-2.]

$$\boldsymbol{d = \sqrt{}\left((5)^2 + (5)^2\right)}$$

$$\boldsymbol{d = \sqrt{}(25 + 25)}$$

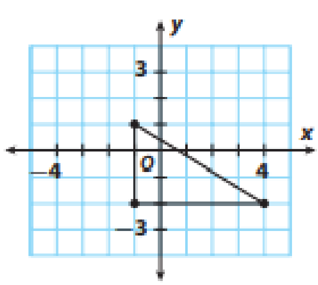
$$\boldsymbol{d = \sqrt{}(50)}$$

Now use your calculator or calculator app to help get the approximation. Round to the nearest tenth.

$$\boldsymbol{d \approx 7.1} \text{ units}$$

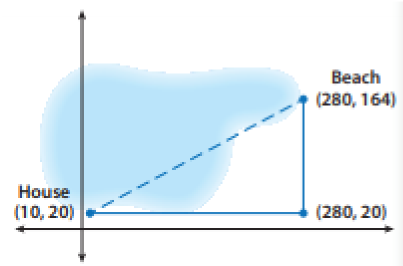
How are you feeling about that? [Pause]
Let's practice one more example. Follow along with me.

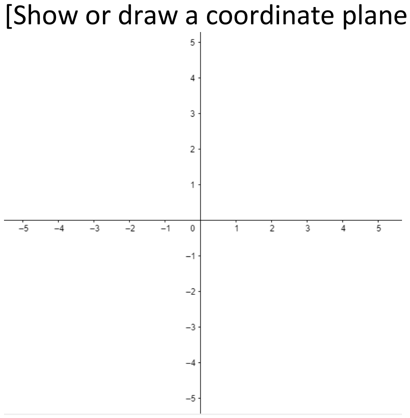
[Example 2]
Here's another grid. Take a look and make a sketch. See if you can read the coordinates of the end points of the hypotenuse. [Prepare the model ahead of time. Show and give students a moment to read the coordinates.]



Objective 2 (cont): Students will use the Distance Formula that is derived from the Pythagorean Theorem to approximate the distance between two points on a coordinate plane.

Do you see the endpoints of the hypotenuse? [Point to the locations (-1, 1) and (4, -2).] **Great! Now, if we read this graph correctly, the first endpoint is (-1, 1).** [Trace this out on the graph. Start with your finger or marker on the origin. Move left one and up one. Write down the ordered pair as (-1, 1).] **Our second endpoint is at (4, -2).** [Trace this out on the graph. Start with your finger or marker on the origin. Move to the right four and down two. Write down the ordered pair as (4, -2).] **Now, we can decide that (-1, 1) will be our (x_1, y_1) like this.** [Write x_1 over top of the -1. Write y_1 over top of the 1.] **That means that we can decide that (4, -2) will be our (x_2, y_2) like this.** [Write x_2 over top of the 4. Write y_2 over top of the -2.] **By substitution, we can use the distance formula to estimate the length of the hypotenuse. Like this. Write and follow along with me.** [Write and read aloud at each step.] [Write and read aloud. Remember to extend the square root bar above the entire half of the equation.] $d = \sqrt{}\left((x_2 - x_1)^2 + (y_2 - y_1)^2\right)$ $d = \sqrt{}\left((4 - -1)^2 + (-2 - 1)^2\right)$ **Remember the order of operations. In this case, you subtract before you square because of the grouping symbols.** [Point at the parentheses around the sets.] **Also, don't forget your integer rules for addition and subtraction.** $d = \sqrt{}\left((5)^2 + (-3)^2\right)$ **And don't forget here that when you square a negative number, you get back a positive.** [Point at the -3 squared.] $d = \sqrt{}(25 + 9)$ $d = \sqrt{}(34)$ **Now use your calculator or calculator app to help get the approximation. Round to the nearest tenth.** $d \approx 5.8$ **units** **Great work! Now, let's practice a couple more.**	
<u>Guided Practice </u>(10-12 min) I Do:	Students use their knowledge of the Distance Formula derived from the Pythagorean Theorem to find the

Let's think about this problem. I'll read it aloud while you think about it and look at the model. [Prepare the model ahead of time and show while you read the problem aloud.]  **Victor wants to find the distance between his house on one side of the lake** [Point to the house.] **and the beach on the other side** [Point to the beach.]**. He marks a third point forming a right triangle, as shown.** [Point to third point.] **The distances in the diagram are measured in meters.** **I'll read it again while you think about what we need to do. Victor wants to find the distance between his house on one side of the lake** [Point to the house.] **and the beach on the other side** [Point to the beach]**. He marks a third point forming a right triangle, as shown.** [Point to third point.] **The distances in the diagram are measured in meters.** **If we want to use the Distance Formula to find the length between the house and the beach, we can use the coordinates for each of those to substitute in. Follow along and write this example down with me.** [Write and read aloud.] **Let's say that (280, 164)** [Write down the ordered pair.] **will be our (x_1, y_1) like this.** [Write x_1 over top of the 280. Write y_1 over top of the 164.] **That means that we can decide that (10, 20)** [Write down this ordered pair.] **will be our (x_2, y_2) like this.** [Write x_2 over top of the 10. Write y_2 over top of the 20.] **By substitution, we can use the distance formula to estimate the length of the hypotenuse. Like this. Write and follow along with me.** [Write and read aloud at each step.] [Write and read aloud. Remember to extend the square root bar above the entire half of the equation.] $$\boldsymbol{d = \sqrt{}((x_2 - x_1)^2 + (y_2 - y_1)^2)}$$ $$\boldsymbol{d = \sqrt{}((280 - 10)^2 + (164 - 20)^2)}$$ **Remember the order of operations like before. In this case, you subtract before you square because of the grouping symbols.** [Point at the parentheses around the sets.]	distance between two points on a coordinate plane or two ordered pairs. Students follow along, then work along with the teacher, and then work independently on a problem.

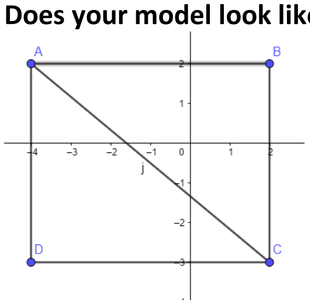
$$d = \sqrt{\left((270)^2 + (144)^2\right)}$$ **You will want to use your calculator or calculator app to help with the squaring.** $$d = \sqrt{(72,900 + 20,736)}$$ $$d = \sqrt{(93636)}$$ **Now use your calculator or calculator app to help get the approximation. Round to the nearest tenth.** $$d = 306 \text{ meters}$$ **So we would say that Victor's house 306 meters away from the beach.** We Do: **Here's another problem to think about. You listen and write down the coordinates in the problem.** [Read aloud.] **The coordinates of the vertices of a rectangle are A(-4, 2), B(2, 2), C(2, -3), and D(-4, -3). Plot these points on the coordinate plane and connect them to draw a rectangle. Connect points A and C. Then find the length of the diagonal segment AC.** **Did you catch all those? I'll read it again, but first, let's sketch out a coordinate plane. If you have graph paper, it will be helpful, but you can use regular paper as well. Make the coordinate plane like we did at the beginning of the lesson, but you can make it about 5 units long on each side this time. I'll give you a minute to do that.** [Pause] **Your coordinate plane should look something like this:** [Show or draw a coordinate plane with 5 units on each side.]  **Great! Now, I'll read the problem again. You listen for the ordered pairs, and write them down.** [Read aloud.]	

The coordinates of the vertices of a rectangle are A(-4, 2), B(2, 2), C(2, -3), and D(-4, -3). Plot these points on the coordinate plane and connect them to draw a rectangle. Connect points A and C. Then find the length of the diagonal segment AC.

I hope you wrote these four ordered pairs down. [Write or show and read aloud.]
A(-4, 2)
B(2, 2)
C(2, -3)
D(-4, -3)

Now, let's plot them on the coordinate plane like we did earlier in the lesson. I'll give you a minute to do that. Then you check your work against mine. Remember to draw the rectangle ABCD and then connect the diagonal segment AC.
[Pause]

Does your model look like this? [Show the completed model.]



Great! Now, let's find the length of AC. All we need in order to use the Distance Formula are the ordered pairs for A and C.

Let's make C (2, -3) [Write down the ordered pair.] **our (x_1, y_1) like this.** [Write x_1 over top of the 2. Write y_1 over top of the -3.]
That means that we can decide that A(-4, 2) [Write down this ordered pair.] **will be our (x_2, y_2) like this.** [Write x_2 over top of the -4. Write y_2 over top of the 2.]

By substitution, we can use the distance formula to estimate the length of the hypotenuse. Like this. Write and follow along with me. [Write and read aloud at each step.]
[Write and read aloud. Remember to extend the square root bar above the entire half of the equation.]

$$\boldsymbol{d = \sqrt{\left((x_2 - x_1)^2 + (y_2 - y_1)^2\right)}}$$
$$\boldsymbol{d = \sqrt{\left((-4 - 2)^2 + (2 - -3)^2\right)}}$$

Remember the order of operations like before. In this case, you subtract before you square because of the grouping symbols. [Point at the parentheses around the sets.] **And remember our integer rules for addition and subtraction! I'll give you a minute to start the calculations.** [Pause] **Did you end up here?** $$d = \sqrt{(61)}$$ **Compare your work to mine.** [Write and read aloud.] $$d = \sqrt{\left((-6)^2 + (5)^2\right)}$$ **You will want to use your calculator or calculator app to help with the squaring and remember that squaring a negative number should give you a positive value.** $$d = \sqrt{(36 + 25)}$$ $$d = \sqrt{(61)}$$ **Now use your calculator or calculator app to help get the approximation. Round to the nearest tenth.** [Pause] **Here's what I have. Compare your result to mine.** [Write and read aloud.] $$d \approx 7.8 \text{ units}$$ **So we would say that the length of the diagonal AC is approximately 7.8 units long.** You Do: **Great! Now, you try one on your own for a minute. Here are two ordered pairs. Use the Distance Formula to find the distance between the two points.** [Write and read aloud the ordered pairs.] **(1, 3) and (9, 18)** **I'll give you a minute to set it up and solve. I'll give you a hint. The result you should get will be somewhere between 10 and 20.** [Pause and allow time to work.] **How did you do?** [Pause] **The distance I found was 17 units. Here's how I got it. Check your work against mine.** **Let's make (1, 3)** [Write down the ordered pair.] **our (x_1, y_1) like this.** [Write x_1 over top of the 1. Write y_1 over top of the -3.]	

That means that we can decide that (9, 18) [Write down this ordered pair.] **will be our (x_2, y_2) like this.** [Write x_2 over top of the 9. Write y_2 over top of the 18.]	

By substitution, we can use the distance formula to estimate the length of the hypotenuse. Like this. Write and follow along with me. [Write and read aloud at each step.]
[Write and read aloud. Remember to extend the square root bar above the entire half of the equation.]

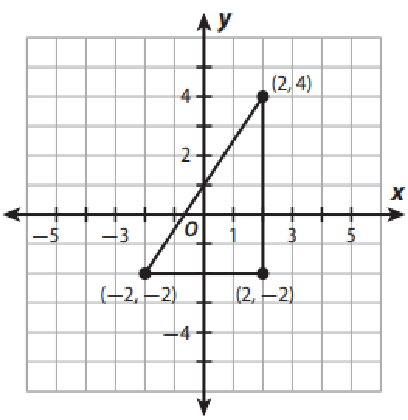
$$\boldsymbol{d} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$\boldsymbol{d} = \sqrt{(9-1)^2 + (18-3)^2}$$
$$\boldsymbol{d} = \sqrt{(8)^2 + (15)^2}$$
$$\boldsymbol{d} = \sqrt{(64 + 225)}$$
$$\boldsymbol{d} = \sqrt{(289)}$$
$$\boldsymbol{d} = \textbf{17 units}$$

So we would say that the distance between the two points (1, 3) and (9, 18) is 17 units.

Great work!

Additional Problems (if needed):

Here's another problem. Let's take a look at this grid. We will want to know the length of the hypotenuse. Let's see if we can identify the coordinates we need to use. [Prepare the model ahead of time and show giving time to allow students to observe where the two points are that they will need.]



Okay! I hope you identified that the hypotenuse length is that between the points (-2, -2) [Point to this location on the model.] **and (2, 4).** [Point to this location on the model.]

We could use the Pythagorean Theorem on this problem if we wanted to because we can count the unit length on each of the two legs. However, since we have the coordinates, let's practice using the Distance Formula again. **Let's make (-2, -2)** [Write down the ordered pair.] **our (x_1, y_1) like this.** [Write x_1 over top of the -2. Write y_1 over top of the -2.] **That means that we can decide that (2, 4)** [Write down this ordered pair.] **will be our (x_2, y_2) like this.** [Write x_2 over top of the 2. Write y_2 over top of the 4.] **By substitution, we can use the distance formula to estimate the length of the hypotenuse. Like this. Write and follow along with me.** [Write and read aloud at each step.] [Write and read aloud. Remember to extend the square root bar above the entire half of the equation.] $$d = \sqrt{((x_2 - x_1)^2 + (y_2 - y_1)^2)}$$ $$d = \sqrt{((2 - -2)^2 + (4 - -2)^2)}$$ **Remember the order of operations like before. In this case, you subtract before you square because of the grouping symbols.** [Point at the parentheses around the sets.] **And remember our integer rules for addition and subtraction! I'll give you a minute to start the calculations.** [Pause] **Did you end up here?** $$d = \sqrt{(52)}$$ **Compare your work to mine.** [Write and read aloud.] $$d = \sqrt{((4)^2 + (6)^2)}$$ $$d = \sqrt{(16 + 36)}$$ $$d = \sqrt{(52)}$$ **Now use your calculator or calculator app to help get the approximation. Round to the nearest tenth.** [Pause] **Here's what I have. Compare your result to mine.** [Write and read aloud.] $$d \approx 7.2 \text{ units}$$ **So we would say that the length of the segment between (-2,-2) and (2, 4) is approximately 7.2 units long.** [Additional example 2]	

Here's one more example for you to try. Let's think about this one. You start setting it up as I read it aloud. [Read aloud.] **Find the distance between the points (3, 7) and (15, 12) on the coordinate plane.** **Did you get the two coordinates written down? I'll read it one more time for you.** [Read aloud emphasizing the coordinate pairs.] **Find the distance between the points (3, 7) and (15, 12) on the coordinate plane.** **Now as before, let's go through the process.** **Let's make (3, 7)** [Write down the ordered pair.] **our (x_1, y_1) like this.** [Write x_1 over top of the 3. Write y_1 over top of the - 7] **That means that we can decide that (15, 12)** [Write down this ordered pair.] **will be our (x_2, y_2) like this.** [Write x_2 over top of the 15. Write y_2 over top of the 12.] **You might not need to label each part of the ordered pairs at this point, but it can help keep you from getting confused when you substitute the values into the formula if you have trouble.** **By substitution, we can use the distance formula to estimate the length of the hypotenuse. Like this. Write and follow along with me.** [Write and read aloud at each step.] [Write and read aloud. Remember to extend the square root bar above the entire half of the equation.] $d = \sqrt{\left((x_2 - x_1)^2 + (y_2 - y_1)^2\right)}$ $d = \sqrt{\left((15 - 3)^2 + (12 - 7)^2\right)}$ **I'll give you a minute to start the calculations.** [Pause] **Did you end up here?** $d =$ **13 units** **Compare your work to mine.** [Write and read aloud.] $d = \sqrt{\left((12)^2 + (5)^2\right)}$ $d = \sqrt{(144 + 25)}$ $d = \sqrt{(169)}$	

Now use your calculator or calculator app to help get the approximation. Round to the nearest tenth. [Pause] **Here's what I have. Compare your result to mine.** [Write and read aloud.] $\boldsymbol{d = 13}$ **units** **So we would say that the length of the segment between (3, 7) and (15, 12) is 13 units long.**	
Independent Practice (1 min.) **How are you feeling about using the Distance Formula to determine the distance between two points on the coordinate plane?** [Pause] **Terrific! You will likely see this concept again in your high school mathematics. After the lesson, you will have some problems to practice on your own. I will show you the independent practice problems now, or you can find them in the student practice for this lesson posted on our website, www.tn.gov/education.** [Teacher shows student practice page under document camera or camera zooms in on student practice page.] **Good luck and do your best!**	
Closing (1 min) **Students, I enjoyed exploring using the Pythagorean Theorem as the Distance Formula to find the distance between two points on a coordinate plane with you today! Thank you for inviting me into your home. I look forward to seeing you in our next lesson in Tennessee's At Home Learning Series! Bye!**	