STUDENT: We have two pairs of congruent sides.

CATHY HUMPHREYS: So how do you know that a rhombus cannot be a kite? And I want you to refer to the definitions because that is a really important part of math. So look at the definitions.

STUDENT: And this side is not parallel to this side.

CATHY HUMPHREYS: Okay, all sides of what have to be parallel?

STUDENT: All sides of a rhombus have to be parallel.

CATHY HUMPHREYS: Are you saying that they are all parallel?

STUDENT: No, like the opposite sides are parallel.

CATHY HUMPHREYS: Okay. Alright.

STUDENT: And a kite…

CATHY HUMPHREYS: What does it say about the kite Chris?

STUDENT: Opposite sides are not parallel.

CATHY HUMPHREYS: Ah, opposite sides are not parallel. So there we go. What do we know from that?

STUDENT: That they cannot…

CATHY HUMPHREYS: What's the "they"? Be careful of those pronouns.

STUDENT: A rhombus is not a special kind of kite.

CATHY HUMPHREYS: A rhombus is not a special kind of kite. Okay, good. Alright, you're doing great. So do you have a plan before now? How are you doing?

STUDENT: We just have to figure out– we are still trying to find out how we can do a trapezoid, a regular trapezoid.

CATHY HUMPHREYS: Okay, so here's what I'm going to…I don't want you to get derailed on that because that is hard. So let's do this, let's do all the other ones first, including an isosceles trapezoid. But don't worry about the not isosceles trapezoid for a while and if you are ahead then you can try and work on that one. Okay?

STUDENT: We split up the shapes between us each; which ones we understand most and then we shared how we found it with each other.

CATHY HUMPHREYS: You did?

STUDENT: Yeah, like the requirements that it needs to have to make the shape.

STUDENT: To make the shape every time.

CATHY HUMPHREYS: Wow, so are you knowing all the…

STUDENT: Well, we're trying to figure out how to make a right angle trapezoid.

STUDENT: Because we found out how to make a trapezoid but then we needed to make like… there are different trapezoids to make each time.

CATHY HUMPHREYS: Okay, so when you're talking about how to make a trapezoid, what kind of trapezoid were you talking about?

STUDENT: She was the one who found out how to make a trapezoid.

CATHY HUMPHREYS: Okay, this. What kind of trapezoid is this?

STUDENT: A regular?

CATHY HUMPHREYS: Regular. What's the word?

STUDENT: Convex.

CATHY HUMPHREYS: Okay. What's so special about this quadrilateral…trapezoid?

STUDENT: These two sides are congruent.

CATHY HUMPHREYS: Okay, that's called an isosceles trapezoid then and so here's what I'm going to suggest, if you've got a...if you're sure that you can guarantee an isosceles trapezoid then don't worry about the not isosceles trapezoid until you get all done with everything else because that's really a problem on its own. Alright? So now, let's see, have you…I guess where are you in the investigative process?

STUDENT: They're AHA proven, I guess.

CATHY HUMPHREYS: So do you have your AHA'S for every single shape?

STUDENT: That's what we're doing; we're like writing them down.

CATHY HUMPHREYS: Excellent, excellent Jerry! So then the next stage would be to go on to the proving and explaining part; and you're actually making so much faster progress then I thought that I haven't even talked about what to do with that. But you're doing…this looks really good. Do you feel good about the work you're doing so far?

STUDENT: Yeah.

STUDENT: So then wait. So I am doing this just out of curiosity. So this is just because they are both congruent? While I said that opposite sides are parallel and then the diagonals cross at the same spot...so if you made them at the same spot and the same lengths, what if they are different lengths? Do you think it will make a different trapezoid? Like, it will make it a trapezoid with…

STUDENT: Well, when I said same lengths, I meant like at these two.

STUDENT: At the same hole.

STUDENT: Oh, at the same hole.

STUDENT: Yeah, right.

STUDENT: So if it went like that, would it be a different…?

STUDENT: That wouldn’t be a trapezoid.

STUDENT: What about...how would you…this is bugging me. How would you make it a trapezoid that is not an isosceles if these are both congruent every time? Wait, all you have to do is just two parallel sides right?

STUDENT: Yeah.

STUDENT: So what if you make it like this though? Wait, wait so…

STUDENT: Then the sides would be parallel.

STUDENT: What if you make it like this?

STUDENT: No, but that isn’t parallel to the other one.

STUDENT: Wait, it could be like this.

STUDENT: No, those two are parallel right?

STUDENT: Yeah, those two might be parallel.

STUDENT: Where is another piece of paper?

STUDENT: Did we run out? I'll get some more.

STUDENT: Don’t these look parallel?

STUDENT: No, that one looks like...

STUDENT: Or maybe if it was like this.

STUDENT: Put it right on the table.

STUDENT: They are not perpendicular.

STUDENT: Push it up a bit. That's it. Which sides are you trying to make parallel? These, these, which ones? Let's just try it, let's just try it. I don't think we have to prove this but let's just plug it in. How do we test it? With a compass? You want to test it with a compass to see if it works?

STUDENT: Or like, we can measure it from different points. Like from here to there and from here to there.

STUDENT: Wait one second. This kind of looks like a trapezoid doesn't it? Oh, that's not parallel. Nope, these sides are not parallel. So this is not a trapezoid.

STUDENT: That's a…

STUDENT: Trapezium!

STUDENT: So yeah, I don't think we even need to prove those. She said that it's a problem within itself.

STUDENT: We made a trapezium.

STUDENT: We made a trapezium, yeah.

STUDENT: So do we want to find out how to make a right angle…

STUDENT: Trapezoid? We could. How about this, how about we prove – I'll write down each one...we get...I got square, I got rhombus and I'm going to do, I'm going to do a parallelogram, then I have to do a kite and trapezoid. After that we'll try to prove...we'll try to find a right angle trapezoid. Okay? But first make sure you have every single one.

STUDENT: I don't have a rhombus.

STUDENT: Here, I have a rhombus.

STUDENT: Only one side at the intersection is congruent. So this is the...not a midpoint but a point that segments and only this part and this part must be congruent. So then the other sides of these are parallel.

CATHY HUMPHREYS: Okay, stop for just a second. Dorothy, you are at a really good place. You were at an AHA and you kind of had that flash of insight and then it kind of vanished right?

STUDENT: Yeah.

CATHY HUMPHREYS: That's okay. That's good. So why don't you try to talk yourselves through it or talk yourself through it and you can all try to fiddle around with Dorothy's idea. But um, there is something about where you put those two together and what angle they are at because you are trying to create…

STUDENT: I think I got it again.

CATHY HUMPHREYS: Okay, you talk to your group about it then. I have complete confidence in you.

STUDENT: Okay. Because these aren't congruent so just pretend that they are. Then we would have to cut some of the blue ones off because the sticks need not be congruent and I don't want to do that. So pretend that these are congruent. This is congruent but this side and this side are not congruent; and these are parallel even though they don't look parallel.

STUDENT: He tried them like that and he didn't get one.

STUDENT: No, wait. So that means this triangle has to be perpendicular.

STUDENT: He made one like that and two different.

STUDENT: Is this perpendicular? Yes right? No?

STUDENT: No, it doesn't need to be perpendicular.

STUDENT: No, once it's perpendicular then these two lines can be parallel. If it's not perpendicular then it's not...

STUDENT: But if you shave off this, this side isn't congruent to that side.

STUDENT: No, I am saying that the diagonals have to be congruent. Okay wait, let's draw this out.

STUDENT: Well, I made a trapezium!