

**SPEAKER 1:** Samuel, I have something different I'd like to ask you to help me with. And you've already told me that you like math, and that you like solving math problems. So maybe you'll kind of enjoy this because it's like a little problem I'm going to ask you to solve. OK?

Here we have a piece of string. And I have some pieces of yarn that we've just attached to a paper clip. So you could hook it on the string. And look, I've got three different pieces of yarn-- a piece that's long, a piece that's medium, and a piece that's short. I also have three different clips. So I have a big clip that's heavy, a medium clip that's lighter, and a small clip that's tiny and pretty light. Do you know what a pendulum is?

**SAMUEL:** No.

**SPEAKER 1:** OK. It's easy for me to tell you. A pendulum is something that would swing back and forth. So if we take those strings, and we hang them here, and we put a clip at the bottom, you could try different combinations. And what I want you to do is to try to figure out which combination will swing the very fastest. Now, what do you think would make a difference in how quickly it might swing?

**SAMUEL:** The height and the weight.

**SPEAKER 1:** The height and weight. OK. So three pieces of string, three different clips. You go ahead and try out whatever you would like. And when you think you have an answer, which one swings the fastest, you can tell me what your answer is. And these clips should just grab onto the string there at the end so that they can swing. OK?

**SAMUEL:** OK. Then do I attach it here?

**SPEAKER 1:** Mm-hmm. So, like a little experiment, you try that out until you think you have a good answer.

**SAMUEL:** Wait, do I swing it?

**SPEAKER 1:** Mm-hmm. And what you want to pay attention to is how quickly is it swinging, because you want to find the one that will swing the fastest. You might want to hold it up a little bit further to give it a nice big swing. OK.

**SAMUEL:** So it would be like these two-- wait-- Yeah. I'm going with these two.

**SPEAKER 1:** OK. So we ended up with-- which string is that? Is that the medium?

**SAMUEL:** Mm-hm.

**SPEAKER 1:** Medium string and the biggest paper clip. Good. Thank you.

Maya, I have a little scientific experiment for you to conduct. We have a string suspended here. And I have three pieces of yarn-- a long piece, medium piece, and a short piece. And each of them has a paper clip on the end. So you could take it and hang it on the string.

And I have three different clips that are different weights. I've got a small clip, a medium clip, and a large clip. And any of the clips could be attached to the string like that. Now, what I'd like you to try to do is to figure out which combination will swing the quickest when you suspend it from the string and let it go.

**MAYA:** Just one of them?

**SPEAKER 1:** You can put those together in any way that you would like. And you should test them out. And test out enough of them until you're ready to make a decision. And tell me what is the combination that swings the fastest.

**MAYA:** OK. No idea. I think this one swings the fastest.

**SPEAKER 1:** OK. So you think the shortest string? Is that the shortest string?

**MAYA:** Yeah. I think so.

**SPEAKER 1:** With the heaviest weight?

**MAYA:** Yeah.

**SPEAKER 1:** Is the combination. OK. Thank you.

So I'm here with Isaiah who is 15 and is in 10th grade. And we're going to take a look at what Piaget has called the pendulum problem. Isaiah, do you know what a pendulum is?

**ISAIAH:** Yes.

**SPEAKER 1:** Oh, OK. That's a good start for us. So you know when something is a pendulum it swings back and forth. And it could swing back and forth very quickly, or it could swing back and forth very slowly. I have here three different pieces of string. And there's a long one, a medium one, and a short one. And we've put them on little hooks so that they could hook onto this piece of string. And I have three clips here that are just different sizes. We have to a big, a medium, and a small clip. Now, if the problem was for you to figure out what you had to do to make a pendulum that would swing back and forth very quickly, what do you think you would try?

**ISAIAH:** Do they have to be three different types, or--

**SPEAKER 1:** No, out of all the possibilities you could put together, I want you to find the one combination that would swing the very fastest.

**ISAIAH:** The fastest I would put the biggest clip with the longest piece of string.

**SPEAKER 1:** OK. So you're going to do some experimenting with both the size of the clip and the length of the string.

**ISAIAH:** Yes.

**SPEAKER 1:** Now, what I'd like you to do is just take a few minutes. You can try any combinations that you want. And you tell me when you think you've come up with the answer of which combination is going to swing the fastest. Oh, and I didn't show you this, but we're using these clips because you can take them and snap them onto the end the string like that. So hopefully that will be nice and easy for you to do. So you try and

combinations you want, and you tell me when you have an answer.

**ISAIAH:** So it would be, actually, the opposite. It would be the biggest with the smallest.

**SPEAKER 1:** OK. The biggest clip with the shortest string.

**ISAIAH:** Yes.

**SPEAKER 1:** Good. Good answer. Thank you for that.