

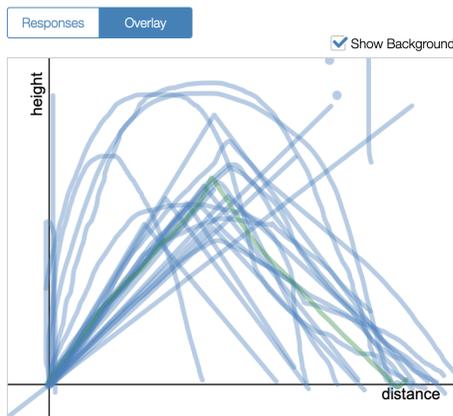
Facilitation Guide for Cannon Man

1. Set Teacher Pacing

After students sketch their own graphs, they can see a computer graph. To give students opportunities to reflect on their graphs, set up [teacher pacing](#). To begin, restrict students to Screens 1-5, so students cannot rush through the activity. If students finish their graphs early, tell them to share their graphs with other students.

Reasoning is more important than answer finding.

2. Use Graph Overlay



Show students an overlay of all of the graphs. From the teacher dashboard, go to Screen 5. Select "Overlay" to show all of the graphs. A sample overlay for Screen 5 is on the left. Next, ask discussion questions to allow students to think about the relationships and justify their reasoning. You may write questions on the board and tell students to discuss in small groups first. Then, students can share in whole group. Here are some sample questions:

"What do you notice about the overlay?"

"What do you wonder when you see the overlay?"

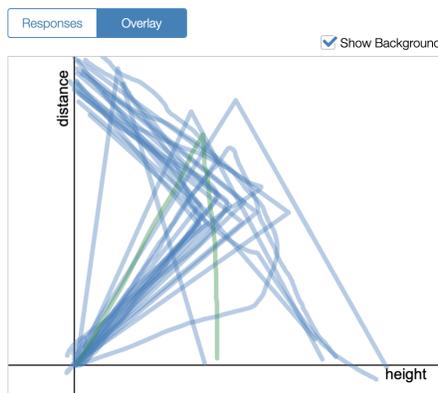
"Describe what the single 'dots' on the graph represent?"

3. Promote Student Reasoning

Now restrict students to Screens 1-11. When students see the computer graph on Screen 6, they may want to fix their graph. Tell students not to erase the graph they drew first. Encourage students to explain their thinking in the box on Screen 7. Focus more on students' reasoning than on their graph accuracy.

Amplify student voices.
Empower students to reflect.

4. Allow Classroom Discourse



Once students have sketched a second graph, show another overlay. A sample overlay for Screen 11 is below. Vary the discussion questions to promote student talk. Below are more sample questions:

"What patterns do you notice?"

"Why do you think there is more uniformity present in this graph versus the graph on Screen 5?"

"Does anyone want to change their graph after viewing the class results? Why? How?"

5. *Debrief the Techtivity*

After students discuss Screen 11, turn off teacher pacing, so students can see all screens. On Screen 14, students respond to the following question: *Chris says this graph shows HEIGHT as a function of DISTANCE. Do you agree? Why or why not?*

Students will see other students' responses in real time. From the teacher dashboard, teachers can view the total number of students in each response category. Before projecting responses, anonymize student names. This can allow students to feel less anxious about having their responses and explanation on display to the whole class.

Chris says this graph shows HEIGHT as a function of DISTANCE. Do you agree? Why or why not.

I agree



Maryam Mirzakhani, Cathleen Morawetz, Scott Williams, Sophie Germain, John Wallis, Eugenia Cheng, Heisuke Hironaka, James Maxwell, Ada Lovelace

I disagree



Mary Jackson, Karl Weierstrass, Shing-Tung Yau, Shiing-Shen Chern, Terence Tao, Siméon Poisson, Albert Einstein, Marian Pour-El, Joseph-Louis Lagrange, Archimedes

If students change their minds, ask them what convinced them to do so. Select a few students to share their ideas with the whole group. Use an asset-based approach to facilitate the debrief. Highlight ideas from students, focusing on what they know, notice and wonder. Avoid focusing on who was "wrong" and who was "right." Explain how Chris's statement is different from the more typical question, "Is this a function?" which typically means "Is Y a function of X?" When interpreting graphs, it is important to analyze the variables on each axis.

6. *After the Techtivity*

After the techtivity, give students an opportunity to reflect on their work. This is a good time to solicit feedback about any further questions the students may have. An exit ticket is a great way to accomplish this.

Focus on what students know.

Many students may choose to disagree with Chris. They may use the Vertical Line Test as a reason. Even though the graph in Screen 14 is not typical, height is a function of distance, because each value of distance corresponds to exactly one value of height. Debrief the activity, with a focus on students' reasoning. Have students turn and talk to a partner first, so they can explain why they agree or disagree. Allow students the opportunity to change their mind if they are convinced to do so. While students are talking, walk around the room and listen to what students are saying.

Quick Tip
Listen to students' small group discussions.
Notice interesting observations or thought-provoking comments.
Ask students if they would be willing to share with the whole group.

What do you think?
How do you feel?