Polygraph: Lines, Part 2

CLASS CODE

30-45 minutes | Development

This activity follows up on Polygraph: Lines, using the discussions (and students' informal language) in that activity to develop academic vocabulary related to the graphs of linear functions.

https://teacher.desmos.com/polygraph-lines

French translation courtesy of Maryse LeBouthillier:
https://teacher.desmos.com/activitybuilder/custom/58eb9f5c77a5c906115c4871

Made in collaboration with CPM.

Activity Checklist

- [ ] Complete the activity using student preview.
- [ ] Identify your learning targets for the activity.
- [ ] Determine the screens where you'll bring the class together using Teacher Pacing and Pause Class. What will you discuss on those screens?
- [ ] Anticipate screens where students will struggle, then plan your response.
- [ ] Plan a challenge for students who finish the activity quickly and successfully.
- [ ] Make yourself available during the activity to students for individual help and questions when appropriate.
- [ ] Write out your summary of the activity's main ideas. How will you pull student work into that summary? Which parts of the activity can you skip to ensure that summary receives sufficient time?

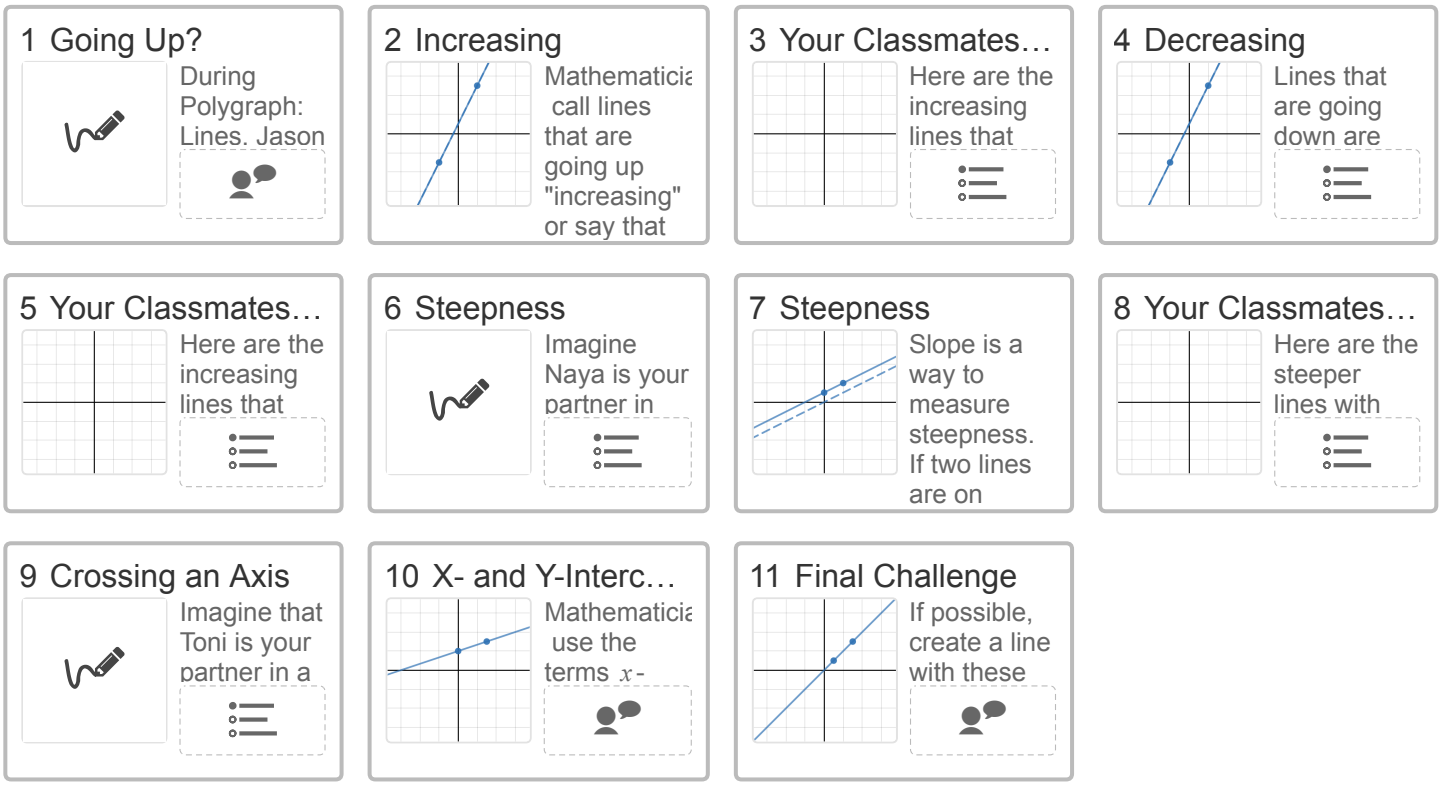
My Learning Targets:

Activity Screens: Teacher Pacing and Pause Class

Use this page to plan your use of Teacher Pacing and Pause Class. Teacher Pacing lets you restrict students to a single screen or a range of screens. Pause Class keeps students from interacting with whatever screens they are currently viewing. Use these two tools to create conversations in your classroom.

Consider these questions as you plan:

- Which screen(s) should everyone work on at the same time? Why?
- Which screen(s) do you want to keep students from seeing until you're ready for the class to see them together? (Perhaps because they reveal answers or require a whole class conversation for introduction.)
- Are there any points in the lesson where you will want to make sure students aren't playing with the screens while you discuss something as a class?



1 Going Up?

During Polygraph: Lines, Jason picked this

During Polygraph: Lines, Jason picked this graph. His partner asked:

"Is your line going up?"

(1) Do you think Jason answered "Yes" or "No"?

(2) What other word or phrase could we use for "going up"?

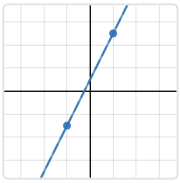
Use the sketch tools if they help to show your thinking.

Teacher Tip:

This is a great place to check student progress. Offer individual support where needed, or lead a brief whole-class discussion if enough students are struggling.

My Notes:

2 Increasing



Mathematicians call lines that are going up "increasing" or say that they "have positive slope"

Mathematicians call lines that are going up "increasing" or say that they "have positive slope".

Use the movable points to create a different increasing line.

(Try to make a line you think no one else will.)

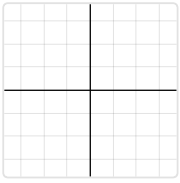
Teacher Tip:

Use overlay mode in the dashboard to check the understanding of the class, and responses mode to quickly identify which students are struggling with the ideas or the interface.

Dashboard Note: ✓ indicates that the student adjusted at least one of the two movable points.

My Notes:

3 Your Classmates' Inc…



Here are the increasing lines that your classmates…

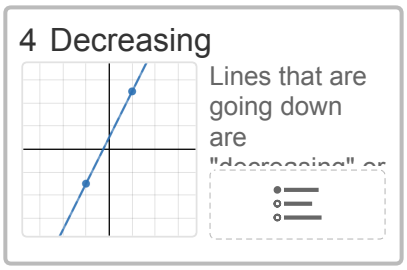
Here are the increasing lines that your classmates created. (Your line is orange.)

Are all of these lines really increasing?

Teacher Tip:

Highlight several student responses for the class. Start with informal math language and reasoning, then move to more formal responses.

My Notes:



Lines that are going down are "decreasing" or "have negative slope."

On the graph, use the movable points to create any line that has a negative slope.

(Try to make a line you think no one else will.)

Are all lines either increasing or decreasing, or is it possible for a line to be neither of these? Explain.

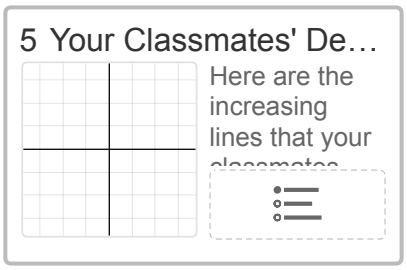
Teacher Tip:

Use overlay mode in the dashboard to check the understanding of the class, and responses mode to quickly identify which students are struggling with the ideas or the interface.

Sample Answer: Horizontal lines are neither increasing nor decreasing; same for vertical lines. But they have to be EXACTLY horizontal or vertical—even a tiny bit of tipping one way or the other makes it increasing or decreasing.

Dashboard Note: ☒ indicates that either the multiple choice selection is incorrect, or the line doesn't have a negative slope.

My Notes:



Here are the increasing lines that your classmates created. (Your line is orange.)

Are all of these lines really increasing?

Teacher Tip:

Highlight several student responses for the class. Start with informal math language and reasoning, then move to more formal responses.

My Notes:

6 Steepness

Imagine Naya is your partner in Polygraph: Lines, and you

Imagine Naya is your partner in Polygraph: Lines, and you have chosen the graph furthest to the left.

Naya is trying to distinguish between these two graphs. She asked:

"Is your line steep?"

How would you answer?

Use the sketch tool if it helps to illustrate your thinking.

Teacher Tip:

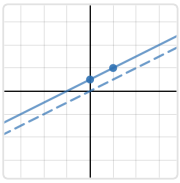
"Steepness" is a messy and imprecise term that roughly means "absolute value of the slope". Use the dashboard to look for students expressing some version of this idea on this screen and the next one, then have a conversation with the class about steepness and its relationship to slope.

Sample Answers

• Yes. These lines are both fairly steep.
• Yes. But the line on the right is steeper than the one on the left.
• Yes. But the line on the left has greater slope than the one on the right, so it is steeper. (This answer should lead to a discussion of whether all upward-going lines are steeper than all downward-going ones.)

My Notes:

7 Steepness



Slope is a way to measure steepness. If two lines are on identical grids, a steeper line

Slope is a way to measure steepness. If two lines are on identical grids, a steeper line will have a slope that is further from zero.

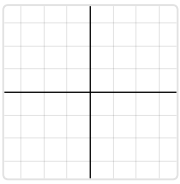
Create a line that has negative slope, and that is steeper than the dashed blue line.

Teacher Tip:

Use overlay mode in the dashboard to check the understanding of the class, and responses mode to quickly identify which students are struggling with the ideas or the interface.

My Notes:

8 Your Classmates' Ste…



Here are the steeper lines with negative slopes that

Here are the steeper lines with negative slopes that your classmates created. (Your line is orange.)

Are all of these lines actually steeper with negative slopes?

Teacher Tip:

Steepness refers to the absolute value of the slope, assuming two lines are on axes with the same scale. The line $y = 2x$ will have a different steepness if you change the scale on y-axis, but the slope will remain the same. This idea may be relevant to your students' thinking. If so, have a discussion of it here. Otherwise save it for another day.

My Notes:

9 Crossing an Axis

Imagine that Toni is your partner in a different round

Imagine that Toni is your partner in a different round of Polygraph: Lines.

Toni asks you:

"Does your line cross the positive part of the axis?"

How would you answer?

Use the sketch tool if it helps to illustrate your thinking.

Teacher Tip:

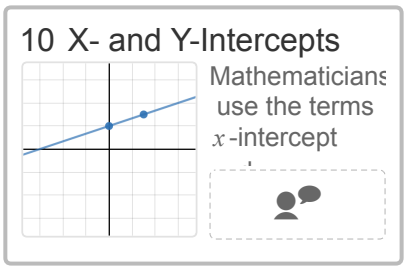
Help students notice the ambiguity in Toni's question.

Sample Answers

• I don't know because I don't know which axis my partner is asking about.
• Yes, because it has a positive y-intercept.
• No, because it crosses the x-axis at -6.

(Note that only the first takes into account the ambiguity that could mislead the fictional partner.)

My Notes:



Mathematicians use the terms x-intercept and y-intercept to describe the places where a graph crosses or touches the x-axis or y-axis.

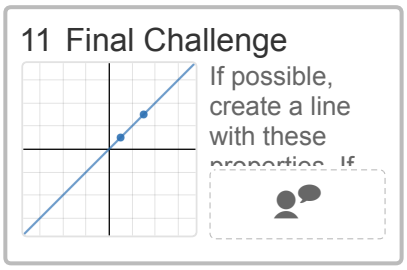
The graph on the previous screen had a positive y-intercept and a negative x-intercept.

If possible, create a line with a negative y-intercept and a negative x-intercept. If that is not possible, explain why below.

Teacher Tip:

Display this screen for the class in overlay mode to emphasize the range of responses.

My Notes:



If possible, create a line with these properties. If that is not possible, explain why below.

(1) Positive y-intercept
(2) Negative x-intercept
(3) Decreasing

Teacher Tip:

Use this screen as an opportunity to have students work to build a careful argument that this is not possible. Play the role of skeptic and force the class to convince you.

My Notes:

Summary Notes: