

Hold the Line... or Don't

Linear vs. Nonlinear Functions

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Grade Level	8th – 9th Grade	**Time Frame**	1-2 class period(s)
Subject	Mathematics	**Duration**	70 minutes
Course	Algebra 1, Pre-Algebra		

Essential Question

Why are tables, graphs, and equations useful for representing relationships?

Summary

This lesson invites students to see linear and nonlinear functions—here, represented by tables, graphs, and equations—in a real-world context. Students will work to find relationships between real-world data points based on the situation at hand. Students will also identify linear and nonlinear relationships, create their own scenario-based functions, and generate equivalent representations through equations, tables, and real-world situations.

Snapshot

Engage

Students construct a graph based on the real-world scenario of walking to a friend's house.

Explore

Students participate in a Card Sort activity to match functions, tables, and graphs to their real-world scenarios.

Explain

Students discuss their Card Sort answers to justify their reasoning and connect their explorations to academic language.

Extend

Students construct their own scenarios, including writing a short narrative, plugging data points into a table, inserting a function, and graphing out data points.

Evaluate

Students participate in a Card Sort to match classmates' scenarios, tables, functions, and graphs. Then, students use the What Did I Learn Today? learning strategy to assess their own learning.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

F504: Attend to the difference between a function modeling a situation and the reality of the situation

Oklahoma Academic Standards Mathematics (Algebra 1)

A1.A.4.5: Analyze and interpret associations between graphical representations and written scenarios.
A1.F.3.1: Identify and generate equivalent representations of linear functions, graphs, tables, and real-world situations.

Attachments

- Card Sort—Hold the Line... or Don't - Spanish.docx
- Card Sort—Hold the Line... or Don't - Spanish.pdf
- Card Sort—Hold the Line... or Don't.docx
- Card Sort—Hold the Line... or Don't.pdf
- Lesson Slides—Hold the Line... or Don't.pptx
- Make Your Own Scenario—Hold the Line... or Don't - Spanish.docx
- Make Your Own Scenario—Hold the Line... or Don't - Spanish.pdf
- Make Your Own Scenario—Hold the Line... or Don't.docx
- Make Your Own Scenario—Hold the Line... or Don't.pdf
- Walking to a Friend's House—Hold the Line... or Don't - Spanish.docx
- Walking to a Friend's House—Hold the Line... or Don't - Spanish.pdf
- Walking to a Friend's House—Hold the Line... or Don't.docx
- Walking to a Friend's House—Hold the Line... or Don't.pdf
- What Did I Learn Today—Hold the Line... or Don't - Spanish.docx
- What Did I Learn Today—Hold the Line... or Don't - Spanish.pdf
- What Did I Learn Today—Hold the Line... or Don't.docx
- What Did I Learn Today—Hold the Line... or Don't.pdf

Materials

- Card Sort (attached; one set per pair of students)
- Lesson Slides (attached)
- Make Your Own Scenario handout (attached; one physical or digital copy per student—link below)
- Walking to a Friend's House handout (attached; one per student)
- What Did I Learn Today handout (attached; one half-page per student)
- Scissors (one pair per student)

Engage

Use the attached **Lesson Slides** to follow along with the lesson. Begin with slide 2. Hand each student a copy of the attached **Walking to a Friend Scenario** handout. Ask students to create a graph using the graph on the handout or piece of scratch paper piece of paper. The graph should be based on this real-world scenario, also shown on the slide:

- *You leave your house to meet up with a friend. You must stop and tie your shoe. Then, you sprint to make it to your friend's house on time. When you get there, your friend wants to go back to your house because you have better Internet. You and your friend turn around and go back home.*

Once students have a graph that they believe represents the scenario, have them discuss what their graph looks like with a partner. Give pairs the following prompts to help them guide discussion:

1. Are both of your graphs the same? Why or why not?
2. How did you distinguish between the walking, stopping, and sprinting in the scenario on your graphs?

Explore

Teacher Note: Card Sort Preparation

Before you begin this phase, print and cut out the attached **Card Sort** activity. You will need one set per pair of students. Prepare each set by cutting out all four cards on each page.

Move to slide 3. Pass out one of the prepared Card Sort sets to each pair, and introduce students to the Card Sort learning strategy. Invite students to match up all four complete units of complementary scenarios, functions, tables, and graphs. In other words, students should find one function that matches one other scenario, table, and graph to form a complete unit. While the students are working, ask them to think about why the graphs and tables look the way that they do. While students work through the scenarios, walk around the room and help as needed.

Explain

This phase creates time to determine what the students may not fully understand. This is also the time to eliminate misconceptions. Move to slide 4. Have the students answer the following questions as you move from slide 4 through slide 5, slide 6, and slide 7:

- *What key components tell you how to match the graph?*
- *What makes the function linear?*
- *What makes the table linear?*
- *How did you match the scenario?*

Move to slide 8 to reveal the correct matches for the first unit in the Card Sort. Have students check their answers. Repeat with slide 9, slide 10, and slide 11.

Extend

Move to slide 12. Ask students if there are other situations in their lives that could be represented as linear or nonlinear functions. Pass out a copy of the attached **Make Your Own Scenario** handout to each student, and invite students to graph a personal scenario. This includes completing the handout's section for writing the scenario like a narrative, the table in which to put data points, the section in which to insert a function, and the graph to chart out data points.

Teacher's Note: Student Card Sorts

In the next phase of the lesson, students will turn their Make Your Own Scenario handouts into Card Sorts, similar to those used in the Explore phase. For this reason, you may consider distributing digital copies of the handout instead (see below, "Optional: Technology Integration," for instructions). This may help if you are concerned about students using handwriting to match their peers' Card Sorts instead of the content of the cards. If you decide to use this technology integration option, display **slide 13**, which displays the links for students to access these sites. (Slide 13 is hidden by default. To change this setting, navigate to the editing view of the lesson slides. Then, in the left-hand column, right-click on slide 13 and deselect "Hide Slide" in the menu.)

Optional: Technology Integration

If the necessary resources are available, you might consider having students instead work on digital versions of the handout. You can find a copy of the handout in Google Docs at this link: http://bit.ly/MakeYourOwnScenario (when prompted, have students select "Make a copy"). Students can also use Desmos to create, copy, and paste a custom graph into Google Docs. You'll need to print these digital Card Sorts off for students before the next phase of the lesson.

Evaluate

Move to slide 14**.** Have students cut their Make Your Own Scenario handouts along the dotted lines, separating all four components. Sort students into groups of four or five and give each group a workspace. Ask students to mix all their pieces together in the center of their workspace. Invite students to revisit the Card Sort strategy, with each group member taking a scenario card to begin participating in the activity. Be sure groups do not let one person match all the cards together. Have students pull the other three types of cards from the center to check and see if they match the cards in-hand. While students are matching the cards, encourage them to talk about why the cards match the way they do.

Once students have finished the Card Sort activity, move to slide 15. Hand each student a copy of the **What Did I Learn Today?** handout (a half-page for each student). Using the What Did I Learn Today? learning strategy, have students answer the following questions:

1. What did you learn today?
2. How are functions connected to the outside world?

Have students hand their answers in for evaluation.

Resources

- K20 Center. (n.d.). Card Sort. Strategies. https://learn.k20center.ou.edu/strategy/147
- K20 Center. (n.d.). Desmos. Tech Tools. https://learn.k20center.ou.edu/tech-tool/1081
- K20 Center. (n.d.). What Did I Learn Today? Strategies. https://learn.k20center.ou.edu/strategy/169