

Where's the Beef

Linear Functions

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Grade Level	8th Grade	**Time Frame**	2-3 class period(s)
Subject	Mathematics	**Duration**	90 minutes
Course	Pre-Algebra		

Essential Question

How can we use data to make predictions? What are the limitations to using collected data to make decisions?

Summary

This lesson takes students through an exploration of what they already know about slopes and develops their understanding of lines, especially the linear equation, y=mx+b. Students interact with the lesson in an easy-to-do activity that allows students to gather real data and then use those data to effectively predict an outcome.

Snapshot

Engage

Students activate prior knowledge and allow the teacher to see what understanding they have of slope in a card sort of several liner graphs.

Explore

Students conduct an experiment and collect data on the rate of a beef bouillon cube dissolving.

Explain

Students graph their data, write equations based on the data, and use the information to make predictions. They will also tie the experiment back to using data and equations to make predictions about other similar situations.

Extend

Once the initial experiment is complete, students look at the accuracy of their solution and then re-design re-do the experiment to improve the accuracy.

Evaluate

Assess for understanding in the students graphs, equations, and predictions. In addition, informal assessment should be ongoing as the students discuss and work.

Standards

Oklahoma Academic Standards for Mathematics (Grade 8)

PA.A.2: Recognize linear functions in real-world and mathematical situations; represent linear functions and other functions with tables, verbal descriptions, symbols, and graphs; solve problems involving linear functions and interpret results in the original context.
PA.A.2.2: Identify, describe, and analyze linear relationships between two variables.
PA.A.2.4: Predict the effect on the graph of a linear function when the slope or y-intercept changes. Use appropriate tools to examine these effects.
PA.A.2.5: Solve problems involving linear functions and interpret results in the original context.

Attachments

- Print for Engage Card Sort - Spanish.pptx
- Print for Engage Card Sort .pptx
- Print for Engage Card Sort 2 - Spanish.pptx
- Print for Engage Card Sort 2.pptx
- Questions Handout - Spanish.docx
- Questions Handout.docx

Materials

- A writing utensil and paper (graph paper and notebook paper)
- Cards for Engage Card Sort - One of each set for each pair of students (print on two different colors of paper).
- 1 stopwatch for each pair of students (or you can use one for the whole class like an online countdown timer)
- 1 ruler for each pair of students
- 2 Beef Cubes or “Instant Bouillon” for each pair of students (Wyler’s brand seems to work the best. Make sure you test it first because some brands are so compacted that they do not dissolve quicklyenough for this activity)
- Hot water (out of a tap or coffee machine without grounds or even microwave in aplastic container). Use care not to overheat the water.
- 1 bowl and strainer for each pair of students (for example, the small dishes that come in the Café Steamers that you can find your frozen section)

Engage

Print the power points slides from the two lesson attachments as handouts with 4 or 6 per page (or make your own).

Prepare the Card Sort activity. In pairs, have students order the first set of cards (linear graphs, no labels) from least to greatest. Have them justify their order to another pair of students. You should hear terms such as: positive slope, negative slope, steeper, less steep, etc.

Once students have successfully ordered the first set, have them sort the second set (linear graphs, with labels) in the same way. This time, they need to justify their order mathematically and share that with another pair.

Have several pairs share out to the whole group to make sure the entire class has the basic understanding of the concept of slope.

Teacher's Note

Slope should be a learned skill before having students do this lesson. Students may or may not have covered writing equations, although experience with y=mx would be helpful.

To prepare students for the next phase of the lesson, engage them in a whole class discussion using the following questions and talking points (or similar) to get students thinking about using data to make predictions.

- Have you ever thought about how much you waste?
- How much trash do you create? Your family? Do you fill up an entire trash bin every week?
- Where does it go?
- At these dumps and landfills, how long does it take for all that trash todisappear or biodegrade?
- What if I told you that paper, like the kind you're writing on, can take 2-5months and years longer depending on the conditions? A sock can take more than 5 years. A plastic bag can take more than 20 years!
- How did someone figure out how long that takes?
- Did you know that in ideal conditions, a baby's diaper can take anywhere from500 to 800 years?How could we possibly know this?

Explore

Distribute material to groups, saving the Beef Cube for last. When everything is passed out, bring out the beef cubes. Before passing one to each pair, hold one up and ask students if anyone knows what it is or knows how long it takes to dissolve.

After students have their cubes, use a Think-Pair-Share with their partner to have students answer the following questions: How long will it take to dissolve? How could we graphically represent the process?

Once students have shared out some predictions, in their pairs, have students brainstorm a process to measure the cube. Tell them the cube will be in the water for 5 minutes. Some things to think about are:

- What measurements are worthwhile? What needs to be measured?
- How do you plan to measure the cube before you place it in the water?
- How do you plan to measure it after the 5 minutes?

Teacher's Note

In general, it is a good idea to let students decide if they would rather measure the surface area or volume of the cube. (SAcube=2lw + 2lh + 2wh and Vcube=lwh). For differentiation purposes, you can suggest volume for groups who need a simpler method/calculation).

Once all groups have a written plan and have taken their initial measurements, have students drop their cube in the water and begin the 5-minute countdown.

Teacher's Note

You may want to consider a number puzzle or other brain break activity the pairs can do during the five minutes. Depending on your class size, make-up, and resource, you can also have all students drop the cube in at the same time and do a class countdown. This would require that all students are ready at the same time, but it would also allow you to do a quick game of "What's My Rule" or show a short 3-4 minute video on landfills and waste to tie into the lesson (see resources for a possible video) during the experiment.

After 5 minutes, each pair will remove their cube from the water and find the after measurement, using the same process as the first measurement.

Teacher's Note

Depending on the needs of your students, provide appropriate scaffolding during the explore phase without providing too much structure. For example, most students can keep track of their own data and create a graph without a graphic organizer or example. Other students may need a blank graph with the axis labeled on that question. Provide an appropriate level of scaffolding, but provide for as much ownership of the process as possible.

Explain

Provide students with the Where's the Beef Handout. Give pairs time to complete the questions.

Most students will have used their graph to predict when the cube's size will be at zero. In a think-pair-share, ask students to brainstorm a more exact way to find the answer. During the share out, guide student to think about an equation to get a specific answer. Discuss what the x- and y-intercepts are in this problem and on their graph.

Once they agree that an equation would be more exact, have the pairs figure out an equations using their rate of change and y-intercept (initial size of the cube) and use that equation to find the x-intercept (time to dissolve completely.

Teacher's Note

If students are struggling to find an equation, they are probably not realizing what the y-intercept is and how they can use it to find the equation and then the x-intercept. Try not to just tell them the answer, but ask them guiding questions, using previous activities or lessons to remind them what the variables in y=mx+b stand for.

Have pairs of students join to make groups of four. Have each pair share their equation and work with their new group members. Encourage them to ask questions and make sure that everyone agrees that the work is correct.

Extend

Once all students have successfully found an equation and the x-intercept, pose the question: How accurate is your answer? What would our equation/experiment need to be more accurate?

Use the "I Think, We Think" strategy to have students brainstorm what would be needed to make it more accurate.

1. Begin by having participants divide a piece of paper into two columns. The left hand column should be titled “I Think” and the right hand column should be titled “We think.”
2. Provide students time to think about the question and then give them time to record their thoughts in the “I Think” column.
3. Tell them to leave the “We Think” column alone.
4. Once the participants have had sufficient time to record their thoughts, have them get with their group of four to share what they have recorded.
5. After sharing out, have the partners/groups record their common understanding of the concept/topic in the “We Think”column. Optional: Whole class share out/discussion.
6. As a group, have the students write a description of the new experiment to be turned it. Remind them to make detailed enough that another group or class could actually conduct the experiment.

Teacher's Note

Depending on your time and how elaborate you want the experiment designs to be (multiple variables like time, temperature, etc. or just collecting more data points) , the extend activity can either be just a plan students create or you can actually have them try out their reworked experiment. This would be a mathematical extension about accuracy, but it can also be a science connection to experimental design.

Evaluate

Evaluate students understanding on the Handout and the equation/work from the Explain section.

Resources

- Peller, Clara. "Where's the Beef". (1984). Wendy's International catchphrase.
- K20 Center. (n.d.). Card Sort. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f506976b
- K20 Center. (n.d.). Think-Pair-Share. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5064b49
- K20 Center. (n.d.). I Think, We Think. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f5065bfd
- Jordan, Chris. "Trash-a-Thon/Midway Island". Copyright 2016 Discovery Communications, LLC. Retrieved from http://www.discovery.com/tv-shows/other-shows/videos/midway-journey-clips-trash-a-thon/