

STRAND 2: LINEAR FUNCTIONS**TOPIC 2.6: FILL IT UP****Topic Notes****Mathematical focus**

To study rates of change through a data gathering activity.

Terms: slope, y -intercept, x -intercept, rate of change, domain, range

Topic overview

This topic contains two tasks:

Task 2.6.1: Fill It Up Part 1: Height vs. Ounces

Task 2.6.2: Fill It Up Part 2: Height vs. Ounces

In the first task, students will fill different size rectangular prisms or cylinders with water. They will record the height and number of times liquid is added. Using this data, students will study rates of change, graphing, slope, relationships between graphs and actual physical occurrence.

In the second task, students will repeat the process with irregular containers.

TE_xES standards focus

TE_xES Standard II.005 Patterns and Algebra. The teacher understands attributes of functions, relations, and their graphs. The beginning teacher:

(B) Identifies the mathematical domain and range of functions and relations and determines reasonable domains for given situations.

(C) Understands that a function represents a dependence of one quantity on another and can be represented in a variety of ways (e.g., concrete models, tables, graphs, diagrams, verbal descriptions, symbols).

TE_xES Standard II.006 Patterns and Algebra. The teacher understands linear and quadratic functions, analyzes their algebraic and graphical properties, and uses them to model and solve problems. The beginning teacher:

(A) Understands the concept of slope as a rate of change and interprets the meaning of slope and intercept in a variety of situations.

TEKS/TAKS focus

TEKS A.1 Foundations for functions. The student understands that a function represents a dependence of one quantity on another and can be described in a variety of ways. The student is expected to:

(A) describe independent and dependent quantities in functional relationships;

(B) gather and record data and use data sets to determine functional relationships between quantities;

- (C) describe functional relationships for given problem situations and write equations or inequalities to answer questions arising from the situations;
- (D) represent relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities; and
- (E) interpret and make decisions, predictions, and critical judgments from functional relationships.

High School TAKS Objective 1: The student will describe functional relationships in a variety of ways.

TEKS A.5 Linear functions. The student understands that linear functions can be represented in different ways and translates among their various representations.

The student is expected to:

- (A) determine whether or not given situations can be represented by linear functions;
- (B) determine the domain and range for linear functions in given situations; and
- (C) use, translate, and make connections among algebraic, tabular, graphical, or verbal descriptions of linear functions.

High School TAKS Objective 3: The student will demonstrate an understanding of linear functions.

TEKS A.6 Linear functions. The student understands the meaning of the slope and intercepts of the graphs of linear functions and zeros of linear functions and interprets and describes the effects of changes in parameters of linear functions in real-world and mathematical situations.

The student is expected to:

- (A) develop the concept of slope as rate of change and determine slopes from graphs, tables, and algebraic representations;
- (B) interpret the meaning of slope and intercepts in situations using data, symbolic representations, or graphs;
- (C) investigate, describe, and predict the effects of changes in m and b on the graph of $y = mx + b$;
- (D) graph and write equations of lines given characteristics such as two points, a point and a slope, or a slope and y -intercept;
- (E) determine the intercepts of the graphs of linear functions and zeros of linear functions from graphs, tables, and algebraic representations;
- (F) interpret and predict the effects of changing slope and y -intercept in applied situations; and
- (G) relate direct variation to linear functions and solve problems involving proportional change.

Materials

| Task | #1 | #2 |
|---|----|----|
| 5 or 6 different size clear containers that hold at least 20 oz of liquid (graduated cylinders from the science lab work well or different size drinking glasses. The more varied the containers, the better the results) | x | |
| Rulers | x | x |
| Measuring cups | x | x |
| Graphing calculator | x | x |
| Chart paper | x | x |
| Markers | x | x |
| Water – adding food coloring to the water or using a dark cherry Kool-Aid™ will give a better visual picture. | x | x |
| One irregular shaped container per group that will hold at least 20 oz. of water | | x |
| Teacher-made scaled axes on chart paper (for students to compare graphs they all need to have the same scale markings. Do not label the axes – have the students do that. | x | x |

Procedure

(These steps will be the same for both tasks—Fill It Up Part 1 and Part 2.)

- Provide students with the “Fill It Up” activity.
- Divide students into groups of 2 or 3 and give each group a different size container to fill. You will need 5 or 6 different groups to be effective.
- Students will add two ounces of water to the container at a time. After each addition of water, students will use a ruler and measure the height of the water. They will continue to add water and measure until the container is full.
- Have students record their data and create a graph on chart paper. Do not include any other information on the chart paper.
- Students will label their chart paper graph with an assigned number and they will label their container with an assigned letter.
- When all students are finished, display the numbered charts on the wall, and place the lettered containers on a table. Have students match the graphs to the containers and explain their choices.

Summary

These activities were designed to provide participants with hands-on experiences and visual representations of changing slopes.

Extensions

Algebra I: 2000 and Beyond TEXTEAMS Institute contains several different activities that can be used as extensions or supplements to this task. Some activities that you might use from the institute are *Out for Stretch*, *Have You Lost Your Marbles*, *Unidentified Circular Objects*, *Going to Great Depths*, and *Height vs. Arm Span*.

Assessment/Transition to the Classroom

Algebra I: Strand 2. Linear Functions; Topic 6. Fill it Up; Topic Notes

Swimming Pools and *Bathing the Dog* from the *Algebra I Assessments* provide open ended assessments for this task.