

## **STRAND 2: LINEAR FUNCTIONS**

### **TOPIC 2.2: FORMALIZING SLOPE AND Y-INTERCEPT**

#### **Topic Notes**

#### **Mathematical focus**

Participants begin to formalize the concept of slope as rate of change and the  $y$ -intercept as the starting point. Participants have additional experiences translating among algebraic, tabular, graphical, and verbal representations of linear functions. Terms: independent variable, dependent variable, rate of change, constant rate,  $y$ -intercept, slope.

#### **Topic overview**

Four tasks are included in this topic:

Task 2.2.1: Cups, Cups, Cups

Task 2.2.2: Describe Stacking Cups

Task 2.2.3: What's the New Rental Cost?

Task 2.2.4: Slope and  $y$ -Intercept Summary

Each of these tasks provides the participant a different perspective of slope and the  $y$ -intercept. The participant will begin with a verbal description then translate it to a tabular, graphical, and algebraic representation. The other tasks are an undoing of this first task.

#### **TE<sub>x</sub>ES Standards focus**

**TE<sub>x</sub>ES Standard II.004 Patterns and algebra.** The teacher uses patterns to model and solve problems and formulate conjectures. The beginning teacher:

(A) Recognizes and extends patterns and relationships in data presented in tables, sequences, or graphs.

**TE<sub>x</sub>ES Standard II.005 Patterns and algebra.** The teacher understands attributes of functions, relations, and their graphs. The beginning teacher:

(A) Understands when a relation is a function.

(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<sub>x</sub>ES 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.

(B) Writes equations of lines given various characteristics (e.g., two points, a point and slope, slope and  $y$ -intercept).

**TEKS/TAKS focus**

**TEKS A.5 Linear functions.** The student understands that linear functions can be represented in different ways and translate among their various representations. The student is expected to:

- (A) determine whether or not given situations can be represented by linear functions; 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  $y=mx+b$ ; and
- (D) graph and write equations of lines given characteristics such as two points, a point and a slope, or a slope and  $y$ -intercept.

High School TAKS Objective 2: The student will demonstrate an understanding of the properties and attributes of functions.

**TEKS A.3 Foundations for functions.** The student understands how algebra can be used to express generalizations and recognizes and uses the power of symbols to represent situations. The student is expected to:

- (B) look for patterns and represent generalizations algebraically.

**Materials**

Task	Task 2.2.1 Cups, Cups, Cups	Task 2.2.2 Describe Stacking Cups	Task 2.2.3 What's the New Rental Cost?	Task 2.2.4 Slope and y- Intercept Summary
Handouts	x	x	x	x

**Procedure**

Arrange participants in groups of 3–4.

Task 2.2.1: Cups, Cups, Cups

Ask participants to complete Task 2.2.1. This task takes participants from a verbal description of a situation to a graphical, tabular, and algebraic representations of the situation. This task formalizes the concepts of  $y$ -intercept and slope.

After participants complete exercises 1-4 in their groups, discuss their results.

**Task 2.2.2: Describe Stacking Cups**

Ask participants to complete Task 2.2.2. In this task, a tabular or graphical representation is given to participants. Participants then translate the given representation of the situation to verbal, tabular, graphical, or algebraic representations of the situation.

After participants complete exercises 5-8 in their groups, discuss their results.

**Task 2.2.3: What's the New Rental Cost?**

This task requires participants to create an original table from limited information and create a new table for a change in slope. Participants compare the two function rules and interpret any differences identified from the table.

**Teacher notes**

In (3f), participants are asked to explain the concept of slope from the table, the graph, and the traditional function rule. Make sure the participants understand how the finite differences from the table relate to the traditional rule and how this change can be physically represented on the graph.

Discuss their results as a large group.

**Task 2.2.4: Slope and  $y$ -Intercept Summary**

This task asks participants to write a formal definition of  $y$ -intercept and slope in their own words and relate it to the standard form of a linear function,  $y = mx + b$ .

**Teacher notes**

By the end of this topic, participants should all be able to describe how to determine the slope and  $y$ -intercept from verbal, tabular, graphical, and algebraic representations and explain the effect of each in the different representations. Additionally, participants must identify both standard and  $y$ -intercept from the standard algebraic representation.

**Summary**

In these four tasks, participants formalized the concepts of slope and y-intercepts by translating with explanations functions among verbal, tabular, graphical, and algebraic representations.

**Extensions**

1.3 Exploring Rates of Changes (pp.153-164) in *TEXTEAMS Algebra I: 2000 and Beyond*

1.4 Discrete Differences (pp. 165-181) in *TEXTEAMS Algebra I: 2000 and Beyond*

**Assessments/Transition to the classroom**

Participants should complete the teacher's journal recording their responses and making any modifications necessary to make the task completely classroom ready.