

STRAND 2: LINEAR FUNCTIONS

TOPIC 2.7: CONNECTIONS — CHANGES IN M AND B GRAPHICAL, TABULAR, AND SYMBOLIC

Topic Notes

Mathematical focus

The student will recognize and interpret how the changes in symbolic, tabular, graphical, and verbal representations affect each other.

Topic overview

Students will be presented with different representations of linear data and will be asked to apply the changes to multiple functional representations.

This topic contains 4 tasks:

Task 2.7.1: Slopes and Intercepts

Task 2.7.2: And the Story Changes

Task 2.7.3: Change, Change, Change

Task 2.7.4: The A, B, C's of Graphing

- a. Activity 1. Equations are in $y =$ form and the y -intercept is an integer on the grid
- b. Activity 2. Equations are in standard form and the y -intercept is an integer of the grid
- c. Activity 3. The y -intercept is a non-integer rational number

TE x ES Standards focus

TE x ES 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).
- (E) Applies basic transformations (e.g., $kf(x)$, $f(x) + k$, $f(x-k)$, $f(kx)$, $|f(x)|$) to a parent function, f , and describes the effects on the graph of $y=f(x)$.

TE x ES 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 a slope, slope and y -intercept).

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.

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:

- (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.

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 a rate of change and determine slope 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 slope, or a point and a y -intercept;
(E) determine the intercepts of the graphs of linear functions and zeros of linear functions from graphs, tables, and algebraic representations; and
(F) interpret and predict the effects of changing slope and y -intercept in applied situations.

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

Materials

Task	#1	#2	#3	#4
copies of the tasks	X	X	X	X
Graphing calculator	X	X	X	X
Colored pencils	X			
Ruler	X			
ABC grid				X
Transparency lines				X

Procedure

2.7.1: Slopes and Intercepts. This activity can either be assigned to groups or to individuals. Give each participant a copy of the task. After each numbered problem has been completed, come back together as a whole group and have a discussion about what was found.

2.7.2: And the Story Changes. Provide the students a copy of Task 2.7.2 “And the Story Changes”. Have students work with a partner to create their stories. After giving them time to complete the assignment, ask students to share their stories. Make sure students correctly apply the changes in the critical aspects of the graph in their stories.

2.7.3: Change, Change, Change. The same process can be followed for the Task 2.7.3 “Change, Change, Change” as for Task 2.7.2. The teacher should assess the student’s ability to make the connection among the various representations of the problem situation.

2.7.4: The A, B, C’s of Graphing. This task is composed of five separate activities. The procedure for each is described below.

- Activity 1:

Provide each student with an A, B, C Grid and one transparency line. Allow one student to be at the overhead (turned off) with a transparency of the A, B, C grid and a 1 transparency line. This will allow the teacher freedom to monitor the rest of the students’ participation.

All the equations in this activity have been selected to ensure no mathematical manipulation is required. The slope can be counted on the grid and the y-intercept is an integer value that can be read from the grid.

For Activity 1, there are three possible variations.

- Given 2 lettered points, students will use their transparency line to create the line through the points and write the equation.

Questions for Students:

- How did you determine the equation?
- What did you do first? (If the student says counted slope – ask if they could have used the y-intercept first)
- What does this step tell you about the linear rule for these two points?
- Give the points A and E and have students determine the equation of the line. Ask them to find to other points that would create a line parallel to this one. Have students explain how they found the line. Is there only one lettered set of points that would create a line parallel to the line A, E?
- Is there another line through lettered points that would have the same y-intercept as the line A,E, but

a different slope? Have students demonstrate how they determined this.

- Give students the equation of a line and ask which points the line will include.

Questions for Students

- How did you determine the points?
- What did you do first?
- Could you start with the slope first? Explain

- Give students the slope and one point, have them create the line and write the equation.

Questions for Students

- How did you determine the equation?
- Could you determine the equation if you had a lettered point and the y-intercept? Explain

As the teacher observes students' progress, he/she can have the student at the overhead turn on the overhead and all students can discuss and check their work. Students can also check their work using the graphing calculator. They can graph the equation in $y =$ form and check for the given points.

- Activity 2:

This activity will provide students with an opportunity to change equations from standard form to slope intercept form.

Provide each student with an A, B, C Grid and one transparency line. Allow one student to be at the overhead (turned off) with a transparency of the A, B, C grid and a 1 transparency

In this activity teacher will give students the equation of a line in standard form and students will determine which points are included on the line.

Other than changing the form of the equation to graph, all information (slope and y-intercept) can be read off the grid.

Questions for students

- What did you do first? Why
- Is there another way to determine the points?
- Without changing from standard form, given a point can you determine if it will lie on the line? Explain.

As the teacher observes students' progress, he/she can have the student at the overhead turn on the overhead and all students can discuss and check their work. Students can also check their work using the graphing calculator. They can graph the equation in $y =$ and go to the graph and check for the given points.

- Activity 3:

This activity will require students to mathematically determine the y-intercept. The y-intercept is not an integer value and thus can't be read off the graph.

Questions for Students

- Given to lettered points, explain how you determined the equation of the line.
- Is there another way to determine the equation of the line?
- Can you find the lettered points on the line given the equation? Explain

The teacher will give students either two points or the slope of the line and a point. The students use their transparency line to graph the line and then will write the equation of the line.

Summary

These tasks emphasize verbal changes that correspond to parameter changes as shown in graphs, tables, or function rules.

Extensions

From *TEXTEAMS Algebra I: 2000 and Beyond, Exploring Slope and Exploring Vertical Shifts* are wonderful extension activities.