

STRAND 1: FOUNDATIONS OF FUNCTIONS

TOPIC 1.3: CHANGING PERIMETER (CAPSTONE)

Topic Notes

Mathematical focus

The focus of this topic is the integration of geometry concepts of dilations, area, and changing dimensions with the algebraic concepts of slope, y-intercept, and changing parameters.

Topic overview

There are 5 tasks included in this topic.

Task 1.3.1: Changing Perimeter–Teacher Activity

Task 1.3.2: Changing Perimeters x–Student Activity

Task 1.3.3: Changing Perimeters y–Student Activity

Task 1.3.4: Changing Perimeters x & y–Student Activity

Task 1.3.5: Changing Area–Student Activity

Task 1.3.1 is presented as a teacher task and the other four are the corresponding student tasks. In Task 1.3.1, participants are given a geometric drawing that they must change by multiplying the values of x by 2, 3, and 4. They will sketch each of the changed figures and plot the perimeter. Then they will do the same with the y value. Finally, they will change both dimensions at the same time. Through investigations of the tasks, participants are expected to discover the connection between $y = mx + b$, $y = kx$, dilations, and similar figures. Tasks 1.3.2–1.3.5 provide an example of how Task 1.3.1 can be modified for Algebra 1 students.

TE_xES standards focus

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

TE_xES Standard III.011 Geometry and measurement. The teacher understands measurement as a process. The beginning teacher:

- (B) Applies formulas for perimeter, area, surface area, and volume of geometric figures and shapes (e.g., polygons, pyramids, prisms, cylinders, cones, spheres) to solve problems.
- (C) Recognizes the effects on length, area, or volume when the linear dimensions of plane figures or solids are changed.

TEKS/TAKS focus

TEKS A.2 Foundations for functions. The student uses the properties and attributes of functions. The student is expected to:

- (B) identify mathematical domains and ranges and determine reasonable domain and range values for given situations, both continuous and discrete; and
- (D) collect and organize data, make and interpret scatterplots (including recognizing positive, negative, or no correlation for data approximating linear situations), and model, predict, and make decisions and critical judgments in problem situations.

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

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.

TEKS A.6 Linear functions. The student understands the meaning of 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; and
- (B) interpret the meaning of slope and intercepts in situations using data, symbolic representations, or graphs;

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

TEKS (8.10) Measurement. The student describes how changes in dimensions affect linear, area, and volume measures. The student is expected to:

- (A) describe the resulting effects on perimeter and area when dimensions of a shape are changed proportionally.

High School TAKS Objective 8: The student will demonstrate an understanding of the concepts and uses of measurement and similarity.

Materials

Task	Changing Perimeter	Changing Perimeters x	Changing Perimeters y	Changing Perimeters x and y	Changing Area
Copy of task	x	x	x	x	x
Colored pencils	x	x	x	x	x
Graphing calculator	x	x	x	x	x
Grid paper	x	x	x	x	x
Chart paper and markers	x	x	x	x	x

Procedure

For the participants' activity, allow the participants to work in pairs. When they have completed the assignment, have them join another pair to have a group discussion with two different predictions.

Ask students to work in groups or pairs. Give each group a copy of the task and ask them to complete the activity. Come together as a whole group and discuss and compare each group's results.

Summary

Investigations in these tasks will allow participants to develop the relationship between direct variation and the geometric concepts of dilations and similar figures, while emphasizing linear parameter changes.

Extensions

Algebra I: Strand 1. Foundations of Functions; Topic 3. Changing Perimeter; Topic Notes

Provide students with different regular shapes (triangles, hexagons, circles, etc.) on grid paper and have them follow the same process with a multiplier. Ask participants to discuss and compare their results on this task.

Assessments/transitions to the classroom

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