STEMscopes™ TEXAS
MATH
POWERED BY ACCELERATE LEARNING

Grade 8

Teacher Guide Sample

Made for Teachers, by Teachers

Built for
Texas Math

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THE LEADER in STEM EDUCATION
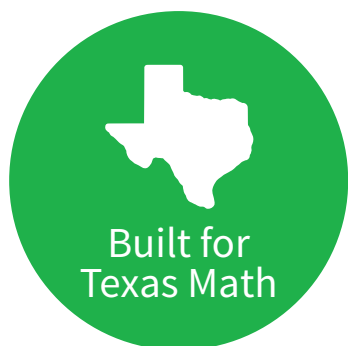
STEMscopes Texas Math™ Teacher Guides

As educators and math experts, we understand the demands of teaching math, so we've designed our teacher guides to provide you with the support you need. Whether you're a seasoned veteran or at the start of your journey as a math teacher, we equip you to create engaging, impactful learning experiences.

Our Teacher Guides are printed supplementary resources that support high-quality, meaningful math instruction.

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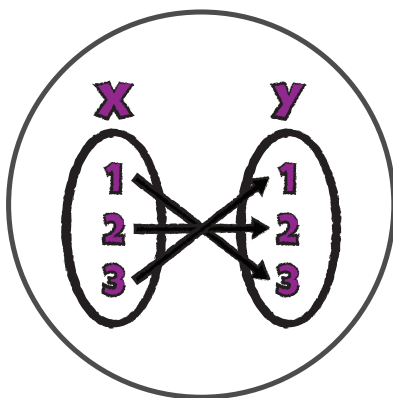
Functions

Scope Introduction

Scope Summary

In this scope, students understand that in a function, a rule is created that assigns every input to exactly one output. Students are able to determine whether a graph, table, mapping, or set of ordered pairs represents a function.

Student Expectations

8.5G
- Identify functions using sets of ordered pairs, tables, mappings, and graphs.

Vertical Alignment

Background Knowledge	Future Expectations
In previous grade levels, students learn how to plot points on a graph. They identify independent and dependent quantities from tables and graphs. They learn to represent the relationship between independent and dependent quantities using tables, graphs, and equations. All of these concepts tie together in order for students to understand the basics of functions.	In the coming years, students continue their work with linear and nonlinear functions. They expand this thinking into quadratic, exponential, logarithmic, and other types of functions. Students learn how to determine the domain and range of a function and express the inputs and outputs of functions in function notation.

Engage Activities

Accessing Prior Knowledge

In this activity, students work individually or in small groups to identify misconceptions about a previous standard by evaluating three statements to discern two truths and a lie. This critical thinking task is designed to assess students' understanding and uncover any misunderstandings before moving forward in the curriculum. Through discussion with peers and facilitated class dialogue, students justify their choices and clarify their understanding of the concepts involved, providing a diagnostic view of their grasp of previous material.

If your students are struggling with previously taught concepts, use the Foundation Builder activity in this scope to reinforce ideas presented in the APK.

Hook

In this activity, students engage with the concept of functions through the scenario of Haddie starting a cupcake business and using various data displays like graphs, tables, and mappings. They assess whether each representation is a function by determining if each input has a single output. The task encourages critical thinking and application of mathematical definitions to real-life contexts. Students debate and analyze the data to decide if Haddie or her brother Sherman is correct in their assertions about the functions.
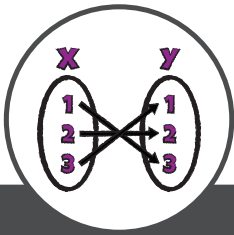
🚀 EXPLORE ACTIVITIES

Explore 1

Understand Functions on a Mapping and Graph

In this activity, students help Rosie, a boutique owner, analyze her financial graphs and diagrams to determine if they represent functions. Working in groups, students use Monthly Deposit Cards to compare various representations of Rosie's business data, identifying which are functions based on the criteria that each input (x-value) must have exactly one output (y-value). Through discussions and Math Chats, students apply their understanding of functions and non-functions, enhancing their skills in using diagrams and graphs to communicate mathematical ideas effectively.

Explore 2

Understand Functions on a Table

In this group activity, students assist Rosie in analyzing weekly inventory lists to determine if they qualify as functions by examining tables for repeating input values. They explore different aspects of inventory such as style, color, size, or cost, and discuss whether each list represents a function, where every input has only one output. This task enhances students' understanding of functions and non-functions using real-world contexts and develops their ability to communicate mathematical ideas clearly and justify their reasoning effectively.

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Functions

Accessing Prior Knowledge

Students identify two truths and a lie by reading statements about the prior standard. This element is designed to uncover student misconceptions; it should not be taken for a grade.

Materials

Printed

- 1 Two Truths and a Lie (per student or group)

Preparation

- Print the Student Handout for each student or each group.
- You may choose to put students in groups of two or three.

PROCEDURE AND FACILITATION

FACILITATION TIP

Working independently on a new or unfamiliar topic can be challenging. This is a great opportunity to discuss SMP #1: Make sense of problems and persevere in solving them.

FACILITATION TIP

Ensure that students are on topic and use guiding prompts as needed (Did you get the same answer, and why or why not?)

Procedure and Facilitation Points

1. Read the prompt aloud to the class.
2. Allow 2 minutes of thinking time for the students to read the three statements and determine which two statements are truths and which one is the lie.
3. Ask students to share with shoulder partners how they marked their sheets and why.
4. Allow 2–5 minutes of discussion.
5. Facilitate a discussion about the handout. This provides an opportunity to gather an understanding of prior student knowledge before beginning the lessons. Encourage students to support their answers, and check for understanding and misconceptions. Sample student responses include the following:
   a. The second statement is a lie. The equation should read $y = 30x + 75$.
6. If students are struggling to complete this task, do the Foundation Builder to fill the gap in prior knowledge before moving on to other parts of the scope.

Identifying Misconceptions
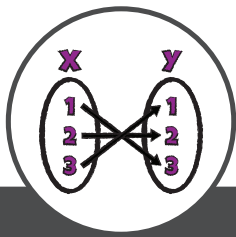
- Students may mix up independent and dependent variables.
- Students may not understand how relationships between variables work.

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Functions

Hook: Function or Malfunction?

Students identify functions using sets of ordered pairs, tables, mappings, and graphs.

Materials

Printed

- 1 Function or Malfunction? (per class)

Reusable

- 1 Phenomena (per class)

Preparation

- Plan to show the Phenomena.
- Prepare to project Function or Malfunction? for the whole class to view.
- Prepare to introduce the scenario and to encourage students to think about how to solve it. Be prepared to have students move to the Explore activities, returning to the Hook activity with newly gained knowledge after the Explores have been completed.
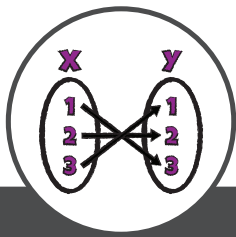

PROCEDURE AND FACILITATION

Part I: Pre-Explore

1. Introduce this activity toward the beginning of the scope. The class will revisit the activity and solve the original problem after students have completed the corresponding Explore activities.

2. Show the Phenomena. Ask students the following questions: *What do you notice? Where can you see math in this situation?* Allow students to share all ideas.

3. Explain the scenario to the class: *Sherman's older sister Haddie is starting a cupcake business. First, she baked in her kitchen for small events. People loved her cupcakes so much that she has saved enough money to buy a food truck! She has collected all sorts of data on flavors, prices, locations, times, expenses, ingredients, advertising, and other considerations. She has put a lot of information into graphs, tables, and diagrams to make the information easy to interpret. Haddie believes that all her displays of information are functions. Sherman says they are not. Which sibling is correct?*

FACILITATION TIP

Poll the class to find out with whom students agree. Polls can be as simple as indicating with thumbs up/down or by raising hands to vote. There are also a variety of free online polls that allow students to enter answer choices while graphically displaying the results.

4. Allow the students to ask questions and clarify the context as needed. Encourage them to share their thoughts and experiences with the class using the following questions:

    a. Have you ever made cupcakes in your kitchen?

    b. Have you ever been to a food truck?

5. Project Function or Malfunction?

6. Explain to students that Sherman is looking at four representations of data and says that some are not functions. He can tell by looking at them.

    a. DOK-1 What do you think a function is? Accept all reasonable answers.

    b. DOK-1 How did Haddie display her data? Tables, ordered pairs, graphs, and diagrams

FACILITATION TIP

Explain that they will revisit this question at the end of the scope, at which point they should have a more comprehensive and defined answer.

7. Move on to complete the Explore activities.

Part II: Post-Explore

1. After students have completed the Explore activities for this topic, show the Phenomena again and repeat the scenario.

2. Refer to Function or Malfunction? and discuss the following questions with the class:

   a. **DOK-1** What is a function? A function is a special relationship where each input has a single output.

   b. **DOK-2** If something is a function, how many *y* values exist for each *x* value? Only one y value exists for each x value.

   c. **DOK-2** How can you determine whether something is NOT a function? It will have more than one y value for an x value.

   d. **DOK-2** Can something be a function if a *y* value has more than one *x* value? Yes, it can be a function.

   e. **DOK-2** In square number one, is there more than one *y* value for each *x* value? Is it a function? No, each x value has only one y value, so it is a function.

   f. **DOK-2** In square number two, is there more than one *y* value for each *x* value? Is it a function? No, each x value has only one y value, so it is a function.

   g. **DOK-2** Determine whether square number three is a function. No, it is not, because there are two y values for the x value of 8.

   h. **DOK-1** Determine whether square number four is a function. No, square number four is not a function because the x value of 1 has y values of both 20 and 25.

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Functions

Explore 1: Understand Functions on a Mapping and Graph

Students determine which graphs are functions and which are not by looking at them. They will be able to compare the graphs of functions and nonfunctions to one another.

Mathematical Process Standards

- **(D)** Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.
- **(F)** Analyze mathematical relationships to connect and communicate mathematical ideas.
- **(G)** Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Materials

Printed
- 1 Student Journal (per student)
- 1 Set of Monthly Deposits Cards (per group)
- 1 Exit Ticket (per 2 students)

Reusable
- 1 Quart-sized resealable bag (per group)

Preparation

- Plan to have students work in groups of 4 to complete this activity.
- Print a Student Journal for each student.
- Print a set of the Monthly Deposits Cards for each group. Cut out and place each set of cards in a quart-sized resealable bag. If desired, print them on card stock, and laminate them for future use.
- Print an Exit Ticket for every 2 students. Cut apart the half-page Exit Tickets so each student has one.

FACILITATION TIP

Review applied financial terms (deposit, revenue, expenses/spending, budget, allowance, taxes, accountant).

Part I

1. Read the following scenario to the class: *Rosie is the sole owner of Rosie's Boutique. As owner, she has the job of making sure that all of the store's finances are well documented. It is almost tax season, and her accountant has asked her to gather together important documents and send them over to him. Before she can do that, she must create monthly and quarterly graphs of her deposits and revenues. Help Rosie analyze her diagrams to determine whether they are functions or not.*

2. Help students access the task using the following guiding questions:
   a. Have you tried budgeting your allowance? How did you keep track of your spending and saving?
   b. How do you think running a business and budgeting are similar or different?

3. Distribute a Student Journal to each student.

4. Have students use the diagrams to determine if they are functions.

5. Monitor students, and check for understanding as needed using the following guiding questions:

   a. **DOK-2** In Diagram 1, why are three different arrows pointing to $1,550? Three inputs all have the same output.

   b. **DOK-2** In Diagram 2, why are there two different arrows coming from 5? 5 has two different outputs.

6. Allow students enough time to complete Part I.

7. After Part I, invite the class to a Math Chat to share their observations and learning.

Math Chat

   o **Choose a Structured Conversation routine to facilitate the following question:**

   DOK-2 How many outputs were there for each input in Diagram 1? Each input has exactly one output in Diagram 1.

   o Explain the following to the class: *Mathematicians call this type of diagram a function. A function is when each input has exactly one output.*

   o **DOK-2** How many outputs were there for each input in Diagram 2? In Diagram 2, 1, 2, 3, and 4 each had exactly one output, but 5 and 6 each had two outputs.

   o **DOK-2** Is Diagram 2 showing a function? No, Diagram 2 does not show a function because there are two inputs that have more than one output.

Part II

1. Read the following scenario to the class: *At the end of each week, Rosie counts all of the revenue from the store and writes it down. On particularly busy weeks, she may count the money more than once. She then creates a monthly graph to compare her weekly revenue. Help decipher Rosie's graphs in order to help answer questions for her accountant.*

2. Help students access the task using the following guiding questions:

   a. **DOK-2** What experience do you have working with money?

   b. **DOK-2** What experience do you have working with graphs?

3. Distribute a set of Monthly Deposits Cards to each group.

4. Explain to the students that they will be analyzing the graphs and maps of each month to determine whether they are functions or not. They will be discussing the different inputs and outputs and how they can be arranged in order to make functions.

5. Monitor students, and check for understanding as needed using the following guiding questions:

   a. **DOK-1** How do you know when there is more than one output? There is more than one output for one input if there are multiple y values for the same x value.

   b. **DOK-1** Which value determines whether the graph is a function, the input or the output? The input determines if the graph is a function.

   c. **DOK-1** How can inputs and outputs be written as coordinates on a graph? Inputs are the x values, and outputs are the y values.

6. Allow students enough time to complete Part II and answer the reflection questions.

FACILITATION TIP

Consider having students create a life-size function machine. Provide them with a double sided sheet protector. Put the input on one side and the output on the other. Students could work in teams to form the physical structure for their machine. One the machines are created, one person holds the sheet protector with the input facing outward, steps through the machine and exits with the output facing outward.

FACILITATION TIP

Ask students to point to various parts of the graph. (Show me where the x-axis/y-axis is. Show me the axis that represents the inputs/outputs.)

Functions

Explore 1: Understand Functions on a Mapping and Graph

7. Ask students to share their strategies and encourage students to ask each other questions and make connections. Encourage students to notice the similarities and differences between the strategies used to determine functions from diagrams and graphs.

8. After Part II, invite the class to a Math Chat to share their observations and learning.

Math Chat

- **DOK-2** When Rosie counts her money more than once a week in Part II, does this represent a function? Why or why not? It does not represent a function. When she counts her money more than once, it creates two different outputs for the same input.

- **DOK-1** Define a function in your own words. A function is when one x value does not have multiple y values.

- **Choose a Structured Conversation routine to facilitate the following question:**

  DOK-1 Do duplicate output values with different input values affect whether a graph is a function or not? Why or why not? No, they do not. A function only focuses on the uniqueness of the input.

Post-Explore

1. Have students complete the Exit Ticket to formatively assess their understanding of the concept.

2. Complete the Anchor Chart as a class.

3. Have each student complete their Interactive Notebook.

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Functions

Explore 2: Understand Functions on a Table

Students determine which tables are functions and which are not by looking at them. They will be able to compare the tables of functions and nonfunctions to one another.

Mathematical Process Standards

- **(D)** Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.
- **(F)** Analyze mathematical relationships to connect and communicate mathematical ideas.
- **(G)** Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Materials

Printed

- 1 Student Journal (per student)
- 1 Set of Weekly Count Cards (per group)
- 1 Exit Ticket (per student)

Reusable

- 1 Resealable bag (per group)

Preparation

- Plan to have students work in groups of 4 to complete this activity.
- Print a Student Journal and Exit Ticket for each student.
- Print a set of Weekly Count Cards for each group. Cut out and place each set in a resealable bag. If desired, print them on card stock, and laminate them for future use.

1. Read the following scenario to the class: *Every week Rosie takes an inventory of her products. She needs to know how many items she has sold so she can order more from the warehouse. To ensure she has the correct items in stock, she counts her inventory many different ways. These include by style, color, size, or cost. On busy weeks, she takes inventory twice. Your job is to help Rosie analyze her inventory lists to determine whether they create functions.*

2. Help students access the task using the following guiding questions:
   a. Have you helped your parents make a grocery list? Have you made your own list?
   b. How do you determine what goes on the list? How do you determine the number of items you need to buy?

3. Distribute a Student Journal to each student.

4. Distribute a set of Weekly Count Cards to each group.

5. Explain to students that they will be analyzing tables and written information to determine whether the inventory lists create functions. They will be discussing the different inputs and outputs and how they can be arranged in order to make functions.

FACILITATION TIP

Ask students to point to various parts of the handout (Show me a list/table. Show me an input/output.)

6. Monitor students, and check for understanding as needed using the following guiding questions:

   a. **DOK-1** How do you know when a table is a function or not? If there are no repeating values in the input column, then the table is a function.

   b. **DOK-1** How can you create a table from coordinates? The x values go into the input column, and the y values go into the output column.

   c. **DOK-1** What happens if you have repeating outputs? Repeating outputs do not affect whether a relationship is a function.

7. Ask students to share their strategies and encourage students to ask each other questions and make connections. Encourage students to notice the similarities and differences between the strategies used to determine functions from tables.

8. After the Explore, invite the class to a Math Chat to share their observations and learning.

Math Chat

- **DOK-1** Do functions always have to be number values for their inputs or outputs? No, they can be anything.

- **DOK-2** What is the significance of inputs when determining a function? The inputs cannot repeat. If they repeat, it is not a function.

- **DOK-2** Does it matter where the inputs and outputs are placed in the table? Why or why not? Yes, inputs determine the outputs.

- **DOK-2** Which coordinate does the input represent? Which coordinate does the output represent? Inputs represent x values. Outputs represent y values.

- **Choose a Structured Conversation routine to facilitate the following questions:**

   DOK-3: Where might you see functions being used in the real world? Functions can be used to determine how far you have traveled after a certain amount of time, the amount of profit earned from sales, or expected growth.

FACILITATION TIP

Generate a list of examples of how functions are used in the real world. Revisit this list in the days ahead and see if students have encountered more examples.

Post-Explore

1. Have students complete the Exit Ticket to formatively assess their understanding of the concept.

2. Complete the Anchor Chart as a class.

3. Have each student complete their Interactive Notebook.

4. Return to the Hook and instruct students to use their newly acquired skills to successfully complete the activity.

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Functions

Additional Scope Resources

ELEMENT USE KEY   ● Can be assigned digitally   ■ Contains printable handouts   ★ Can be done independently

Picture Vocabulary

A slide presentation of important vocabulary terms along with a picture and definition

● ■ ★

Anchor Chart

A guide to facilitating the creation of a chart with students for each scope.

● ■

Interactive Notebook

A cut-and-glue activity to process learning that can be added to a notebook for future reference

■ ★

Interactive Vocabulary

Students form definitions of mathematical vocabulary words used throughout the scope.

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Show What You Know, Part 1

Understand Functions on a Mapping and Graph

Independent practice assignment that gives students an opportunity to demonstrate their learning

● ■ ★

Show What You Know, Part 2

Understand Functions on a Table

Independent practice assignment that gives students an opportunity to demonstrate their learning

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Language Connections

Language Connections

An opportunity to use linguistic and cultural background knowledge to support connections to new skills, vocabulary, and concepts at different proficiency levels and linguistic domains.

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ELABORATE ELEMENTS

Spiraled Review

To the Moon

A quick story to engage student interest along with four problems over previously learned skills.

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Fluency Builder

Functions

Independent and partner games and other activities that provide students with an engaging way to practice the new concept

PhET

Function Builder: Ordered Pairs Basics

Student activities using the PhET Interactive Simulations from the University of Colorado Boulder.

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PhET

Function Builder: Two Variables

Student activities using the PhET Interactive Simulations from the University of Colorado Boulder.

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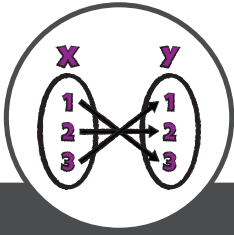
Functions

Intervention and Assessment

1 Use the Skill Review and Practice under the Intervention section to assess student mastery after this scope's content has been taught. Distribute a copy of Quick Check to each student. Each student should complete the Quick Check independently.

How to Use the Review	Students	Notes & Comments
Students who are still acquiring the concept and need remediation ❑ *Distribute a copy of the Review to these students.* ❑ *Meet with students individually or in a small group to assist them in working through the Review's concepts.* ❑ *Talk individually with each student about their thoughts in order to highlight strengths and roadblocks.* ❑ *Look out for possible misconceptions.*		
Students who are approaching mastery and need review ❑ *Distribute a copy of the Review to these students.* ❑ *Meet with students in a small-group to answer questions and identify areas where students are struggling.* ❑ *Look out for moments of possible reteaching.* ❑ *Release students to work independently once you see they're nearing mastery of the concept.*		
Students who have mastered the concept and need extension ❑ *Distribute a copy of the Review to these students.* ❑ *Confirm that students are on the right track.* ❑ *Direct students to work on materials in the Acceleration section, such as the Choice Board, while you work with the other students.*		

3 Distribute a copy of Checkup to each student. Students should complete the Checkup independently. Watch out for students who need additional help.

ASSESSMENT PLANNER

Evaluate Resources
- ❏ *Standards-Based Assessment*
- ❏ *Skills Quiz*
- ❏ *Mathematical Modeling Task*
- ❏ *Technology-Enhanced Questions*
- ❏ *Heat Map*

Use this template to decide how to assess your students for concept mastery. Depending on the format of the assessment, you can identify prompts and intended responses that would measure student mastery of the expectation. See the beginning of this scope to identify standards and grade-level expectations.

Fundamental Questions	*What prompts will be used?*	*What does mastery look like?*
I can identify functions using sets of ordered pairs.		
I can identify functions from tables.		
I can identify functions from mappings.		
I can identify functions from graphs.		

STEMscopes™ TEXAS MATH
POWERED BY ACCELERATE LEARNING

MADE FOR TEXAS

Our lessons and resources:

- Prioritize ease of use.
- Cater to the unique needs of Texas classrooms.
- Prepare students to become successful STEM leaders.

Everything you need is all in one place.

ASSESSMENTS AND REPORTING

- Make data-driven instructional decisions with various TEKS-aligned assessments and report types.

- Provide meaningful insight and feedback.

PROVEN RESULTS

The data speaks for itself.

- Research shows that implementing our program boosts math proficiency and overall performance.

- User testimonials reveal that Texas teachers and students *love* us.

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