MISSISSIPPI DEPARTMENT OF EDUCATION

Ensuring a bright future for every child

MISSISSIPPI

EXEMPLAR

Units & Lessons

MATHEMATICS

Grade 7

Grant funded by:

W.K. KELLOGG FOUNDATION

Lesson 2: Proportionality in a Table

Focus Standard(s): 7.RP.2a, 7.RP.2b, 7.RP.2c

Additional Standard(s): 7.RP.2d

Standards for Mathematical Practice: SMP.1, SMP.3, SMP.8

Estimated Time: 90 minutes

Resources and Materials:

- Anchor Chart Paper
- Markers (4 colors/team)
- Post-It Notes (1 pad/team)
- Handout 1.2: Table as a Tool (return to students)
- Handout 2.1: Poster Session Task Cards
- Handout 2.2: Exit Ticket

Lesson Target(s):

- Students will determine whether two quantities are in a proportional relationship by identifying equivalent ratios in a table.
- Students will identify the constant of proportionality using tables and verbal descriptions of proportional relationships.

Guiding Question(s):

- How can I determine whether two quantities are in a proportional relationship?
- How can I identify the constant of proportionality (unit rate) in tables?
- How do I describe the proportional relationship?

Vocabulary

Academic Vocabulary:	Instructional Strategies for Academic Vocabulary:
● Constant of Proportionality ● Proportional ● Rate ● Unit Rate ● Ratio ● Origin ● y-intercept	☐ Introduce words with student-friendly definition and pictures ☐ Model how to use the words in discussion ☐ Read and discuss the meaning of word in a mathematical context

Symbol	Type of Text and Interpretation of Symbol
	Instructional support and/or extension suggestions for students who are EL, have disabilities, or perform well below the grade level and/or for students who perform well above grade level
✓	Assessment (Pre-assessment, Formative, Self, or Summative)

Instructional Plan

Understanding Lesson Purpose and Student Outcomes: Students will work with real-world scenarios to determine proportionality. Students will explore the importance of the origin in a proportional relationship and develop an understanding of linear equations.

Anticipatory Set/Introduction to the Lesson: Generalizing Patterns

Return **Handout 1.2: Table as a Tool** to students. Challenge teams to look at the tables from the day before and generalize how they can find the y-value in the tables given any x-value. Have students look for repeated regularity in the tables to formulate an understanding algebraically (SMP.8). Lead students to understand a rule or equation is written in the form of $y=kx$.

Note: Students may say "*x* multiplied by unit rate gives you *y*" instead of formulating an algebraic equation. This basic understanding is acceptable for the first part of the day.

As students work with teams, ask questions to help them solidify their understanding:

- Did you use the same method on every table?
- What do the tables have in common?
- Can we say it in an easier way?
- How can we represent the method using variables?
- Would rearranging the x-values help you find a pattern?

✓ Monitor responses to check for understanding. Determine which students identified the structure of a proportional relationship in the form of $y=kx$.

Lead a whole group discussion and elaborate on how to write the rules for each table. Instruct students to write the rule for every table in the form $y=kx$.

For students who are EL, have disabilities, or perform well below grade-level:

- Students share ideas with groups before sharing with the class.

Extensions for students with high interest or working above grade level:

- Have students verify their rule with a variety of rational numbers, e.g., negatives, fractions, decimals.

Activity 1: Determining Proportionality

Display all the tables and their equations on board. Have students discuss with their teams how the tables are the same and how they are different. Verify the understanding that the tables all share a common point, (0,0), the origin. Return the class to whole group and define origin and refer to the Graffiti Wall, reinforcing vocabulary words from the unit.

Facilitate the conversation through questioning. Ask the following questions to prompt students:

- How does the origin affect the unit rate?
- Does each table have a different equation?
- How would you graph the tables?
- How do the equations relate to the table and graph?
- Would putting the x-values in order help you compare the tables?

✓ Monitor discussions to check for understanding. Determine how well students identify the origin as a characteristic of proportionality. While monitoring discussions, encourage students to explain reasons for agreement with others (SMP.3).

Review how to graph from a table. Instruct students to graph Table 1. Reinforce academic vocabulary related to graphing, especially the terms linear, origin, y-intercept.

Note: Make connections between tables, graphs, and equations throughout the unit. Take advantage of any opportunity to build on their knowledge of commonalities between these representations.

For students who are EL, have disabilities, or perform well below grade-level:

- Have students only compare tables to tables at this time.
- Give students a teacher copy of table to ensure they have all correct answers and assist when comparing.
- Provide students with a partially completed and labeled graph or sample.
- Provide students with a multiplication fact sheet to assist in identifying the unit rate of the table.

Extensions for students with high interest or working above grade level:

- Have students graph all the tables on a coordinate plane.
- Encourage students to use more efficient scales on their graphs to reflect the rate of change.

Activity 2: Poster Session

Provide each team with a task from **Handout 2.1: Poster Session Task Cards** and a piece of anchor chart paper. Assign each team a different task. Give a marker to each student to use on the poster. Instruct students to only use their assigned color during the poster session.

Note: This strategy allows teachers to see the contributions of each individual student simply by looking at color distribution.

Tasks require students to copy their original representation and to create either a table or a scenario to accompany it. Have students complete the task with their team and determine whether the scenario shows proportionality or not (SMP.1). Teams hang up their posters upon completion to prepare for Gallery Walk.

For students who are EL, have disabilities, or perform well below grade-level:

- Assign a task card providing a table, so the material is familiar.
- Provide students with a Checklist to make the task more manageable.

Extensions for students with high interest or working above grade level:

- Assign a task card providing a graph or a scenario, which requires students to interpret a situation.

Activity 3: Gallery Walk

Note: The Gallery Walk can be done inside the classroom, hallway, or anywhere space provides. Posters need to be spread out so teams can rotate. Each team will need a pack of Post-It Notes.

- ✓ Provide the following questions to each team for students to provide feedback for other teams:
  - Do you agree with the team's response to whether the scenario was proportional? Why or why not?
  - If the poster shows a proportional relationship, what is the constant of proportionality?
  - If the poster does not show a proportional relationship, what can be changed in the table or scenario to make it one?

Have teams stand in front of their poster. Instruct teams to rotate to the next poster and provide feedback based on the prompting questions, continuing the process until they have seen the different task cards and critiqued the reasoning of other teams (SPM.3). Teams discuss each poster, and write their thoughts on a Post-It Note to place behind the poster.

Monitor team discussions and ask the following clarifying questions to deepen understanding:

- How do you think this team came to their conclusion?
- Can you show me where they used unit rate?
- Where can you see the origin on the poster?
- How can you relate this scenario to what we have already done in class?
- How do you know it is/isn't proportional?

After teams visit every poster, have teams return to their poster to review the Post-It Notes others left behind their poster.

Reflection and Closing:

Facilitate a discussion about the Gallery Walk. Make notes about students' understanding and/or misconceptions based on their answers to the following questions:

- Did any comment make your team change your minds?
- Did you see any methods different from your teams?
- Would you have worked the other tasks differently or the same as the other teams did?
- What are some ways to know if a relationship is proportional?
- Did you notice any common traits between the graphs, tables, and equations?

✓ Students complete **Handout 2.2: Exit Ticket**.

✓ Collect these to verify the students' understanding of the characteristics of proportionality before moving deeper into graphical representations the next day. Review strategies identified on the exit ticket to prepare for clearing up misconceptions the following day.

Homework
Have students complete **Handout 2.3: Homework**.

Handout 2.1: Poster Session Task Cards

Team 1: A bag of Laffy Taffy contains 2 pieces of strawberry taffy for every 3 green apple taffy.

Task: On your poster, write your team's scenario, create a table of values comparing different amounts of green apple and strawberry Laffy Taffy a bag could contain, and determine if the relationship between strawberry and green apple Laffy Taffy is proportional. Explain your response using at least two facts about the situation.

Team 2:

Parts of Red Paint	**1**	**2**	**4**	**1/2**	**3**
Parts of White Paint	**4**	**8**	**16**	**2**	**12**

Task: On your poster, copy the table of values comparing the parts of red and white paint, create a real-world scenario to accompany the table, and determine if the relationship between parts of red paint and parts of white paint is proportional. Explain your response using at least two facts about the situation.

Team 3: Vash plans to order some new games online. The site charges a rate of $25.00 per game for one game, $35 for two, and $40 for three.

Task: On your poster, write your team's scenario, create a table of values comparing different costs for Vash to order up to ten games, and determine if the relationship the number of games ordered and the total cost is proportional. Explain your response using at least two facts about the situation.

Team 4:

Miles	**0**	**30**	**60**	**90**	**120**
Gallons	**20**	**19**	**18**	**17**	**16**

Task: On your poster, copy the table of values comparing the miles to gallons, create a real-world scenario to accompany the table, and determine if the relationship between miles and gallons is proportional. Explain your response using at least two facts about the situation.

Team 5: A 28-centimeter-tall candle burns at a rate of 2 centimeters per hour.

Task: On your poster, write your team's scenario, create a table of values comparing different lengths of time the candle burns and the height of the candle, and determine if the relationship between the candle height and the time is proportional. Explain your response using at least two facts about the situation.

Team 6: A local restaurant serves 5 hamburgers every 30 minutes they are open.

Task: On your poster, write your team's scenario, create a table of values comparing different lengths of times the restaurant is open and number of hamburgers served, and determine if the

relationship between the candle height and the time is proportional. Explain your response using at least two facts about the situation.

Student Checklist for Poster

- ☐ I have created a scenario for my task or copied the one I was given.
- ☐ I have created a table for my task or copied the one I was given.
- ☐ I have determined whether my task was proportional.
- ☐ I have identified 2 facts to help me determine why my task was either proportional or nonproportional.
- ☐ I organized my information clearly for others to understand.

Answer Key

Team 1: A bag of Laffy Taffy contains 2 pieces of strawberry taffy for every 3 green apple taffy.

Task: On your poster, write your team's scenario, create a table of values comparing different amounts of green apple and strawberry Laffy Taffy a bag could contain, and determine if the relationship between strawberry and green apple Laffy Taffy is proportional. Explain your response using at least two facts about the situation.

Green Apple	**0**	**3**	**6**	**9**
Strawberry	**0**	**2**	**4**	**6**

This is an example of a proportional relationship. The table contains the origin, (0, 0). It has a constant growth rate, because for every 3 green apple pieces it has 2 strawberry pieces. The strawberry taffy amount is always 2/3 of the green apple amount.

Team 2:

Parts of Red Paint	**1**	**2**	**4**	**1/2**	**3**
Parts of White Paint	**4**	**8**	**16**	**2**	**12**

Task: On your poster, copy the table of values comparing the parts of red and white paint, create a real-world scenario to accompany the table, and determine if the relationship between parts of red paint and parts of white paint is proportional. Explain your response using at least two facts about the situation.

Scenarios will vary. This is a proportional relationship. If the painter added 0 parts of red paint, then he/she would not add any white, which means the table would contain the origin, (0, 0). The white paint is always four times the amount of the red paint, meaning it has a unit rate/constant of proportionality. The equation would not contain any addition or subtraction. It would just be y = 4x.

Team 3: Vash plans to order some new games online. The site charges a rate of $25.00 per game for one game, $35 for two, and $40 for three.

Task: On your poster, write your team's scenario, create a table of values comparing different costs for Vash to order up to ten games, and determine if the relationship the number of games ordered and the total cost is proportional. Explain your response using at least two facts about the situation.

Number of Games	**0**	**1**	**2**	**3**
Total Cost	**0**	**$25**	**$35**	**$40**

This is not an example of a proportional relationship. The situation does not have a constant rate of change.

Team 4:

Miles	**0**	**30**	**60**	**90**	**120**
Gallons	**20**	**19**	**18**	**17**	**16**

Task: On your poster, copy the table of values comparing the miles to gallons, create a real-world scenario to accompany the table, and determine if the relationship between miles and gallons is proportional. Explain your response using at least two facts about the situation.

This is not proportional. Even though it seems to have a constant rate of change (30 mpg), the graph does not begin at the origin (0, 0). The gallons and the miles both need to be at (0, 0) for this situation to work. This graph is linear, but not proportional.

Team 5: A 28-centimeter-tall candle burns at a rate of 2 centimeters per hour.

Task: On your poster, write your team's scenario, create a table of values comparing different lengths of time the candle burns and the height of the candle, and determine if the relationship

between the candle height and the time is proportional. Explain your reasoning using at least two facts about the situation.

Number of Hours Burning	0	1	2	3
Height of the Candle (cm)	28	26	24	22

This is not a proportional relationship. The candle is burning at a constant rate of 2 cm per hour; however, proportionality requires it go through the origin (0, 0) and this situation does not. This is linear, but not proportional.

Team 6: A local restaurant serves 5 hamburgers every 30 minutes they are open.

Task: On your poster, write your team's scenario, create a table of values comparing different lengths of times the restaurant is open and number of hamburgers served, and determine if the relationship between the candle height and the time is proportional. Explain your reasoning using at least two facts about the situation.

Time Opened (minutes)	0	30	60	90
Number of Hamburgers Served	0	5	10	15

This is a proportional relationship. It begins at (0, 0). It has a constant growth rate of 5 hamburgers/30 minutes.

Handout 2.2: Exit Ticket

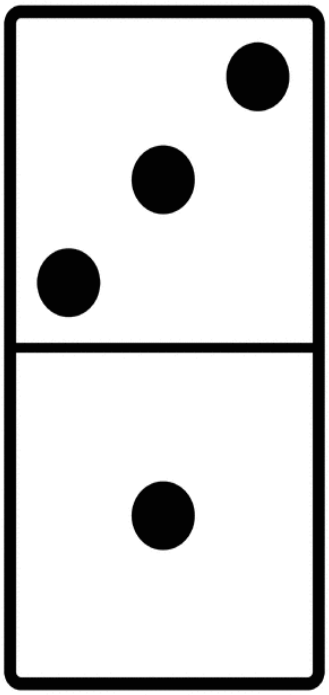
Name: _____ Date: _____

List three ways to determine proportionality:

_____

_____

_____



Explain one strategy to find the constant of proportionality:

_____

Handout 2.3: Homework

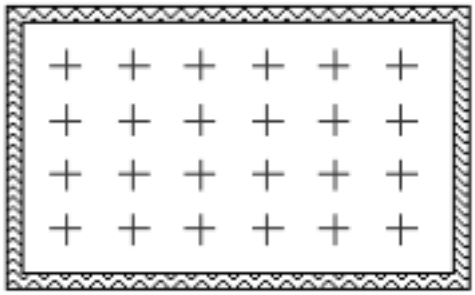
Name: _____ Date: _____

Part 1

1. Tim grows sunflowers from seeds, but not all of his seeds start to grow. He has found that for every 100 seeds he sows, only about 75 start to grow.

   a. Tim sows 20 sunflower seeds. How many should he expect to grow? Explain your reasoning.

   b. Tim sows 24 seeds in a box. Each mark on the box below shows the position of a seed.



   Guess which of the seeds start to grow. Draw circles around the seeds that do *not* start to grow. (Note: There is more than one correct way to show your answer to this question.)

   Explain your reasoning.

Part 2

2. a. Fill in the table showing the number of seeds planted compared to the number of seeds that start to grow. Provide an equation for the table.

Number of Seeds Planted (*x*)	0	20		60		100	
Number of Seeds That Grow (*y*)			30			75	

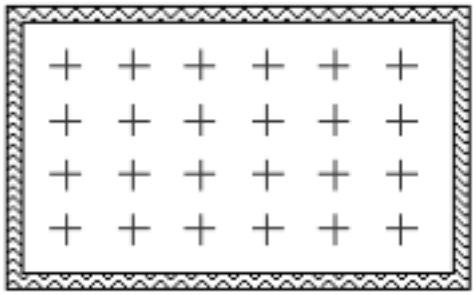
Answer Key

Part 1

1. Tim grows sunflowers from seeds, but not all of his seeds start to grow. He has found that for every 100 seeds he sows, only about 75 start to grow.

   a. Tim sows 20 sunflower seeds. How many should he expect to grow? Explain your reasoning.
   Tim should expect 15 sunflowers to grow.
   Students may set up a proportion to solve for the unknown, or they may find the unit rate (constant of proportionality) is ¾ and multiply it to 20, the total number of seeds.

   b. Tim sows 24 seeds in a box. Each mark on the box below shows the position of a seed.



   Guess which of the seeds start to grow. Draw circles around the seeds that do *not* start to grow. (Note: There is more than one correct way to show your answer to this question.) Explain your reasoning.
   Circles and reasoning may vary, but it is important for students to have 6 marks circled to indicate the ¼ of the seeds that will not grow based on the constant of proportionality.

Part 2

2. a. Fill in the table showing the number of seeds planted compared to the number of seeds that start to grow. y = 3/4x

Number of Seeds Planted (*x*)	0	20	40	60	80	100	120
Number of Seeds That Grow (*y*)	0	15	30	45	60	75	90

Although it makes it easier to follow the pattern, students do not have to provide the pairs (80, 60) and (120, 90). They may provide any pair that satisfies the rule.

For training or questions regarding this unit,
please contact:

exemplarunit@mdek12.org