MISSISSIPPI DEPARTMENT OF EDUCATION

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EXEMPLAR

Units & Lessons

MATHEMATICS

Grade 7

Grant funded by:

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Lesson 4: Multiple Representations

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

Additional Standard(s): 7.RP.1

Standards for Mathematical Practice: SMP.1, SMP.3, SMP.4, SMP.6, SMP.7

Estimated Time: 50 minutes

Resources and Materials:

- Color Tiles
- Handout 4.1: What's the Proportion?
- Handout 4.2: Units of Proportionality
- Handout 4.3: Reynaldo's Trip
- A Family Guide for Student Success: http://mdek12.org/ESE/links/response-to-intervention-teacher-support-team/family-guides-for-student-success

Lesson Target(s):

- Students will create a proportional scenario and prove proportionality using a variety of representations.
- Students will compare constants of proportionality in multiple representations.

Guiding Question(s):

- How can you determine whether two quantities are in a proportional relationship by testing for equivalent ratios in a table?
- How can you identify the constant of proportionality in tables and verbal descriptions of proportional relationships?

Vocabulary

Academic Vocabulary:	**Instructional Strategies for Academic Vocabulary:**
• Constant of Proportionality • Proportional • Ratio • Unit Rate	☐ Model how to use the words in discussion ☐ Create pictures/symbols to represent words ☐ Write/discuss using the words

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 create a situation, table, graph, and equation when provided with a unit of measurement. Students will compare unit rates in a real-world context of fuel efficiency.

Anticipatory Set/Introduction to the Lesson: Tile Patterns

Distribute **Handout 4.1: What's the Proportion?** and color tiles. Provide time for students to represent the tile patterns using the color tiles if needed to make sense between the pattern and the unit rate (SMP.4).

✓ Actively monitor students and ask the following prompting questions to deepen understanding of a constant rate (SMP.7):

- How many tiles does your Figure 0 contain? Why is this important to know?
- Can you build the pattern with your color tiles?
- How many new tiles do you need to build the next figure?
- Are you always adding the same number of tiles to build the next figure?

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

- Students can display information in the representation they find easiest to work with (table or graph).

Activity 1: Units of Proportionality

Note: Cut **Handout 4.2: Units of Proportionality** into strips before the lesson.

Assign a strip containing units to each team. Instruct students to work as a team to create a table, graph, equation, and real-world scenario using the units provided. Reinforce important elements of graphs (title, labels, and scale) and the proportional equation being written in $y = kx$ form. Encourage students to model the unit rate in each representation (SMP.4).

- ✓ Actively monitor group progress and engage all team members in conversation to gauge their understanding of proportionality with the following questions:
  - What are the variables in your problem?
  - How can you see the y-intercept in your representations?
  - How did you determine the unit rate?
  - How did you select a scale for your graph?
  - What is your unit rate and how is it represented?

Return to whole group and facilitate team sharing. Allow teams to give feedback (SMP.3).

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

- Provide teams with units they have familiarity with in a real-world context (miles per gallon).
- Scaffold by having teams first discuss where they've experienced the units before, then move into putting that experience into words for the scenario.

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

- Encourage students to provide rational numbers as their constant of proportionality.
- Allow time for students to research realistic figures to use with their scenario.

Activity 2: Reynaldo's trip

Distribute **Handout 4.3: Reynaldo's Trip**. Instruct students to independently complete the task (SMP.6).

Note: Do not split the task in two days. If the students do not have ample time to complete on day one, save the activity for the next day.

Reflection and Closing:
T: "How well can you use multiple representations to determine if a relationship is proportional?" Effective learners assess their own learning to help them determine their level of understanding.

- ✓ Have students rate on a scale of 1-5 (1 meaning "not at all" and 5 meaning "very well" on a sheet of paper or note card. Students must reveal this number to you on their way out the class.

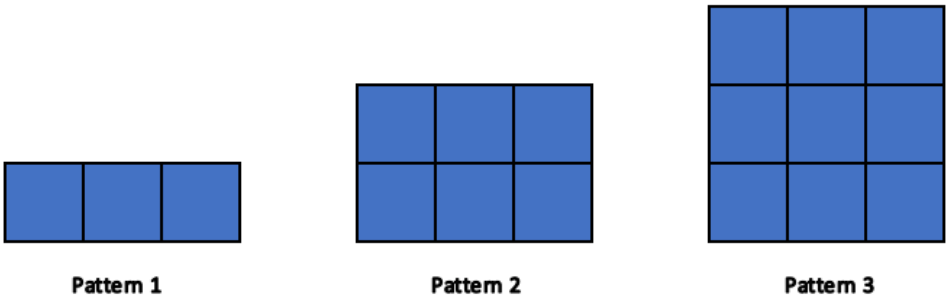
Note: This student self-assessment allows teacher to see which students are aware of their weaknesses and are owning their need for growth. If you notice students rating their ability higher than reality, make note of those students to provide extra assistance. Also make note of students who rate themselves on a 1-3 level. Determine a plan of action to help them grow.

Homework

Students will complete the "Help at Home" activity on the top of page 18 of the 7th Grade Family Guide for Student Success.

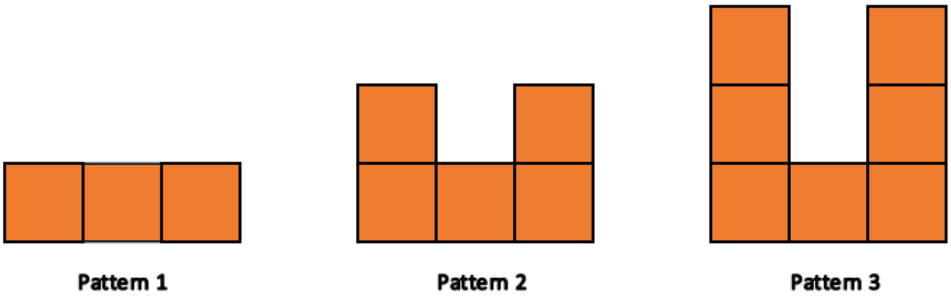
Handout 4.1: What's the Proportion?

Name: _____ Date: _____



1. **Describe how the pattern of blue tiles change from one pattern to the next.**

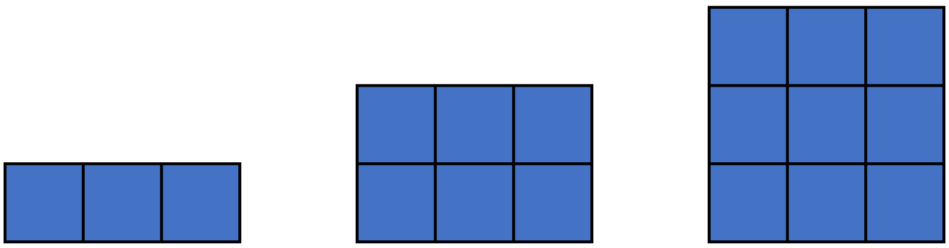
2. **For the patterns shown, is the number of blue tiles proportional to the pattern number? Explain your reasoning.**



3. **Describe how the pattern of orange tiles changes from one pattern to the next.**

4. **For the patterns shown, is the number of orange tiles proportional to the pattern number? Explain your reasoning.**

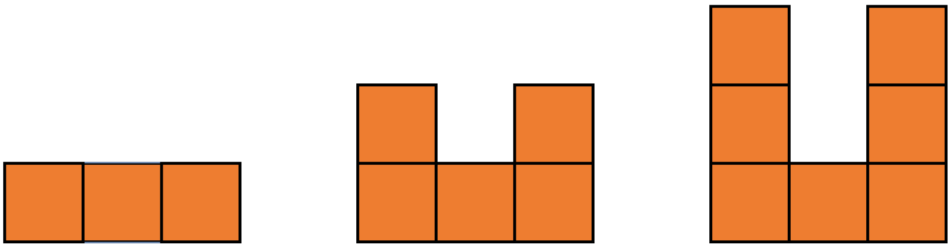
Answer Key



Pattern 1 Pattern 2 Pattern 3

1. **Describe how the pattern of blue tiles change from one pattern to the next.**
   The number of tiles is increasing by 3 each time.

2. **For the patterns shown, is the number of blue tiles proportional to the pattern number? Explain your reasoning.**
   Yes, it has a constant growth rate (constant of proportionality) of 3 and its initial value (Figure 0) has zero tiles, meaning it crosses through the origin. The equation would be y = 3x.



Pattern 1 Pattern 2 Pattern 3

3. **Describe how the pattern of orange tiles changes from one pattern to the next.**

   The pattern has a growth rate of 2 tiles.

4. **For the patterns shown, is the number of orange tiles proportional to the pattern number? Explain your reasoning.** No. Even though the pattern has a constant growth rate of two, it would not pass through the origin, since the y-intercept (Figure 0) would be 1.

Handout 4.2: Units of Proportionality

Directions: Cut the following units of measurement out along the dotted lines and fold in half. Allow teams to randomly select one from the list below.

miles per hour
miles per gallon
height per year In first 10 years
weight per year In first 10 years
degrees per month
steps walked per hour
Calories burned per minute of workout

Handout 4.3: Reynaldo's Trip

Name: _____ Date: _____

Reynaldo's Trip

Reynaldo and his friend Katie are planning to drive from New York to San Francisco in his car. Reynaldo started to complete the table below showing how far in miles he can travel for each gallon of gas he uses in his car. After seeing his table, Katie suggested they take her car instead because she believes her car gets more miles per gallon. Use the information to determine which car they should take on their trip.

Reynaldo's Car

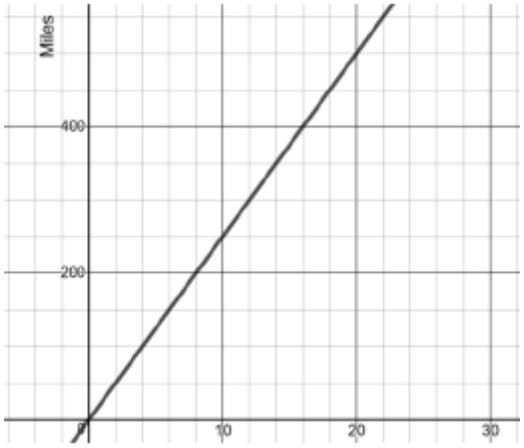
1. Complete the table representing Reynaldo's Car.

Gallons	2	4		8	10	
Miles	56		168	224		

2. Based on the table, how many miles per gallon does Reynaldo's car get? How did you use the table to solve?

3. Is the relationship on the table proportional? Explain how you know.

4. Katie's car is represented using the graph below. How many miles per gallon does Katie's car get?



5. Is the relationship represented on the graph proportional? Explain how you know.

6. Using the information gathered, whose car should Reynaldo and Katie take to San Francisco? Explain your reasoning using an equation for both cars.

Answer Key

Reynaldo and his friend Katie are planning to drive from New York to San Francisco in his car. Reynaldo started to complete the table below showing how far in miles he can travel for each gallon of gas he uses in his car. After seeing his table, Katie suggested they take her car instead because she believes her car gets more miles per gallon. Use the information to determine which car they should take on their trip.

Reynaldo's Car

Gallons	2	4	**6**	8	10	**12**
Miles	56	**112**	168	224	**280**	**336**

*Answers vary for last field, but must be proportional to the relationship demonstrated in the table.

Use the information in Reynaldo's table to answer the questions below.

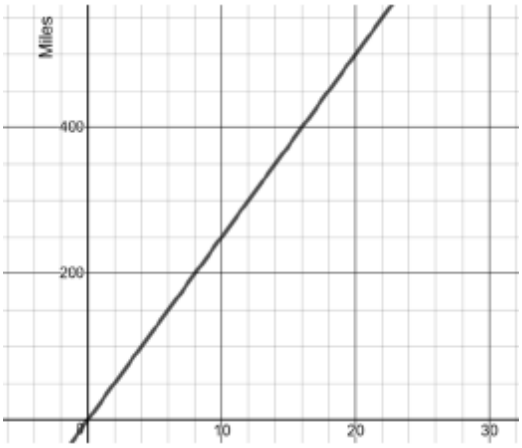
2. Based on the table, how many miles per gallon does Reynaldo's car get? How did you use the table to solve?

Reynaldo's car gets 28 miles per gallon. I was able to divide miles by gallons and all the pairs simplified to 28.

3. Is the relationship on the table proportional? Explain how you know.

Yes. Reynaldo's car has a constant of proportionality of 28, which means it is a linear relationship. If he drives 0 miles he uses 0 gallons, so that means it crosses through the origin. This makes it proportional.

4. Katie's car is represented using the graph below. How many miles per gallon does Katie's car get?



Katie's car gets 25 miles per gallon.

7. Is the relationship represented on the graph proportional? Explain how you know.

Yes. It has a constant of proportionality of 25, it is linear and it begins at the origin.

8. Using the information gathered, whose car should Reynaldo and Katie take to San Francisco? Explain your reasoning.

Reynaldo's car gets 28 miles to the gallon or y = 28x, while Katie's car only gets 25 miles to the gallon or y=25x, so they should take Reynaldo's car.

For training or questions regarding this unit,
please contact:

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