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Units & Lessons
MATHEMATICS

**Grade 7**

## Lesson 6: Solving Proportional Relationships

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

**Additional Standard(s):** 7.RP.1

**Standards for Mathematical Practice:** SMP.1, SMP.6

**Estimated Time:** 90 minutes

**Resources and Materials:**
- Stop Watch
- Anchor Chart Paper
- Markers
- Handout 6.1: Pump It Up
- Unit Rates Video: https://www.youtube.com/watch?v=SpZQFKU5P70
- How to Take a Pulse: https://www.youtube.com/watch?v=W5K_HR6hxMY

**Lesson Target(s):**
- Students will summarize their understanding of proportionality through the Graffiti Wall.
- Students will solve problems pertaining to unit rate and proportionality.

**Guiding Question(s):**
- How are proportional relationships used to solve real-world and mathematical problems?
- How do you identify the constant of proportionality in tables, equations, and graphs?

## Vocabulary

| Academic Vocabulary: | Instructional Strategies for Academic Vocabulary: |
|---|---|
| • Constant of Proportionality<br>• Rate<br>• Unit Rate<br>• Proportional<br>• Ratio | ☐ Read and discuss the meaning of words in a mathematical context<br>☐ 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 be assessed on their understanding of proportionality and unit rates through the Pump It Up Performance Task.

**Anticipatory Set/Introduction to the Lesson: Reflection on Proportionality**
Deconstruct Graffiti Wall and return sheets to their groups. Allow teams time to add any additional information to their sheet. This provides students an opportunity to discuss the material before the performance task.

Replay the video viewed in Lesson 1:  Unit Rates Video.

Give students time to work with their team to answer the question in the video using all the information they have received throughout the unit (SMP.1).

✓ Actively monitor teams and ask the following guiding questions to actively engage all students and determine student understanding:
- What representations will help you find your solution?

- Did you receive enough information to solve this problem?
- Would this represent a proportional relationship?

> **For students who are EL, have disabilities, or perform well below grade-level:**
> - Allow teams to use Graffiti Wall to connect understanding between all material.
>
> **Extensions for students with high interest or working above grade level:**
> - Students research whether this a realistic scenario and how understanding this may impact them in the real-world.

**Activity 1: Pump It Up Performance Task**

T: "Knowing about unit rate and proportionality will help you with a very important task: calculating your heart rate. You will follow the directions provided on **Handout 6.1: Pump It Up** to complete the activities. Then, analyze your data using tables, graphs, and equations, as well as the heart rates of others. After examining the data, you will apply reasoning when responding to questions using the multiple representations as they pertain to unit rate and proportionality."

Show students the video How to Take a Pulse. Pair students and distribute **Handout 6.1: Pump It Up**. Have all students take and record their resting pulse as shown in the video. Time students as they complete each of the activities indicated on **Handout 6.1: Pump It Up**. Allow students 1-2 minutes of rest before starting the next activity. Ensure students are recording their heart rate after each activity. Distribute posters, markers, and **Handout 6.2: Student Rubric for Performance/Culminating Task** to pairs.

✓ Instruct students to complete **Handout 6.1: Pump It Up** (SMP.1 and SMP.6).

✓ Actively monitor students as they work on **Handout 6.1: Pump It Up**. Encourage students to self-assess using **Handout 6.2: Student Rubric for Performance/Culminating Task**.
**Note:** Use the same rubric for final grading.

**Reflection and Closing:**

Facilitate a conversation about topics covered in the unit. Ask the following guiding questions to encourage student reflection:

- How has your understanding of proportionality grown?
- Can you teach others how to find unit rate?
- Which representation is your favorite to work with?
- How does knowing the y-intercept help you determine proportionality?
- When do we encounter proportionality in our daily lives?
- Did you have a favorite strategy for solving proportional equations for a missing value?
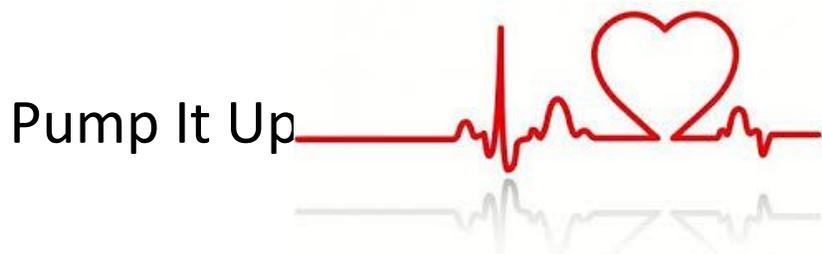
## Homework

Students will not have homework.

**Handout 6.1: Pump It Up!**

Name: _____     Date: _____

# Pump It Up

After each activity, measure your pulse for 30 seconds and record your heart rate in beats per second.

Activity 1: Rest for 1 minute (Sit or lie down)

Activity 2: Stand for 1 minute

Activity 3: Walk in place for 1 minute

Activity 4: 10 squats

Activity 5: 25 jumping jacks

Use your measurements to find the unit rate for beats per minute for each activity, then complete the following tasks and create a poster to display.

On your poster:

- Create a table for each activity representing at least 5 different increments of time.
- Graph all activities on the same graph in different colors.
- Write the equation for each activity.
- Explain whether heart rate measurement represents a proportional relationship in terms as it relates to the situation.

# Analyzing Heart Rates

Name: _____          Date: _____

Whose heart rate are you analyzing? _____

1.  What activity causes their heart rate to be the highest?

    a.  How do you know? Provide at least two reasons.

    b.  In which representation is it easiest to see? Why?

2.  What is their unit rate after 10 squats?  (Include the equation in your answer)

    a.  At this rate, how long would it take their heart to beat 500 times?

3. Write and solve a proportion showing their heart rate after 25 jumping jacks and after 10 jumping jacks.

4. Complete the coordinate for each activity.

Activity 1: (4, ___)

Activity 2: (6, ___)

Activity 3: (2, ___)

Activity 4: (1, ___)

Activity 5: (8, ___)

5. Doctors suggest that a healthy heart rate while resting for teenagers is 98 beats per minute. What is the healthy heart rate per second?

    a. Is your heart rate above or below the below the healthy resting heart rate?

    b. Explain how you know.

**Handout 6.2: Student Rubric for Performance/Culminating Task**

| | Tables | Graphs | Equations | Reasoning and explanation |
|---|---|---|---|---|
| **Novice (1)** | a) I created 1-2 tables. | a) I graphed 1-2 situations. | a) I wrote 1-2 equations. | a) I provided little explanation. |
| **Apprentice (2)** | a) I created 3 tables.<br>b) The tables had minimal errors. | a) I graphed 3 situations<br>b) The graph was scaled correctly but difficult to read. | a) I wrote 3 equations.<br>b) I showed little evidence of how to use an equation while answering questions. | a) I provided some explanation.<br>b) I used few examples when explaining. |
| **Practitioner (3)** | a) I created 4 tables<br>b) The tables had minimal errors.<br>c) The tables were clear and precise. | a) I graphed 4 situations.<br>b) The graph was scaled correctly.<br>c) I used my graph correctly when answering questions about coordinates. | a) I wrote 4 equations.<br>b) I used equations to support my answers.<br>c) I used equations to correctly answer unit rate questions. | a) I provided explanations.<br>b) I used examples.<br>c) I reasoned and compared unit rates. |
| **Expert (4)** | a) I created 5 tables.<br>b) The tables had no mistakes.<br>c) Tables were clear and precise.<br>d) I used the coordinates from the table to correctly make ratios and justify answers. | a) I graphed 5 situations.<br>b) My graph was scaled correctly.<br>c) I used my graph correctly when answering questions about coordinates.<br>d) I used my graph correctly when comparing unit rates to determine proportionality. | a) I wrote 5 equations.<br>b) I used equations to correctly justify answers.<br>c) I used equations to correctly find unit rate.<br>d) I correctly solved equations when given values for the variable. | a) I provided clear explanations.<br>b) I used strong examples.<br>c) I reasoned and compared unit rates to determine proportionality.<br>d) I supported my answers with ratios, tables, and equations. |

For training or questions regarding this unit,
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