



## Lesson 4: Identifying Proportional and Non-Proportional Relationships in Tables

### Student Outcomes

- Students examine situations to decide whether two quantities are proportional to each other by checking for a constant multiple between measures of  $x$  and measures of  $y$  when given in a table or when required to create a table.
- Students study examples of relationships that are not proportional in addition to those that are.

### Classwork

#### Example 1 (20 minutes): Which Team Will Win the Race?

Students will work on the following example independently for 10 minutes. Then students may collaborate with a partner or small group of classmates to discuss answers for 5 minutes. During this time students are to compare, critique the work that was done individually, and work together to come up with a presentable solution. If all students completed the task individually, then they should check each other's work for accuracy and completeness. Lastly, students share their solutions with the class for 5 minutes. Many times there are multiple ways that the problem may have been completed or explained. Circulate during the collaboration time and select students that utilized different approaches. If the same approach was used throughout, select different students for different parts of the problem to present.

#### Example 1: Which Team Will Win the Race?

You have decided to walk in a long distance race. There are two teams that you can join. Team A walks at a constant rate of 2.5 miles per hour. Team B walks 4 miles the first hour and then 2 miles per hour after that.

**Task:** Create a table for each team showing the distances that would be walked for times of 1, 2, 3, 4, 5, and 6 hours. Using your tables, answer the questions that follow.

Team A	
Time (h)	Distance (miles)
1	2.5
2	5
3	7.5
4	10
5	12.5
6	15

Team B	
Time (h)	Distance (miles)
1	4
2	6
3	8
4	10
5	12
6	14

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MP.1

- a. For which team is distance proportional to time? Explain your reasoning.

*Distance is proportional to time for Team A since all the ratios comparing distance to time are equivalent. The value of each ratio is 2.5. Every measure of time can be multiplied by 2.5 to give the corresponding measures of distance.*

- b. Explain how you know the distance for the other team is not proportional to time.

*For Team B, the ratios are not equivalent. The values of the ratios are 4, 3,  $\frac{8}{3}$ ,  $\frac{5}{2}$ ,  $\frac{12}{5}$ , and  $\frac{7}{3}$ . Therefore, every measure of time cannot be multiplied by a constant to give each corresponding measure of distance.*

- c. At what distance in the race would it be better to be on Team B than Team A? Explain.

*If the race were fewer than 10 miles, Team B is faster because more distance would be covered in less time.*

- d. If the members on each team ran for 10 hours, how far would each member run on each team?

*Team A = 25 miles*

*Team B = 22 miles*

- e. Will there always be a winning team, no matter what the length of the course? Why or why not?

*No, there would be a tie (both teams win) if the race were 10 miles long. It would take each team 4 hours to complete a 10 mile race.*

- f. If the race were 12 miles long, which team should you choose to be on if you wish to win? Why would you choose this team?

*I should choose Team A because they would finish in 4.8 hours compared to Team B finishing in 5 hours.*

- g. How much sooner would you finish on that team compared to the other team?

*$\frac{2}{10}$  of an hour or  $\frac{2}{10}(60) = 12$  minutes*

**Scaffolding:**

The teacher may be able to extend the concept to derive the formula  $d = rt$  followed by a class discussion on how to transform the formula where rate can be found in terms of distance and time. Also, time can be transformed in terms of distance and rate. Lastly, distance and time can be related to  $y$  and  $x$  variables.

**Exercises (10 minutes)**

1. Bella types at a constant rate of 42 words per minute. Is the number of words she can type proportional to the number of minutes she types? Create a table to determine the relationship.

Minutes	1	2	3	6	60
Number of Words	42	84	126	252	2520

*This relationship is proportional because I can multiply the number of minutes by the constant to get the corresponding number of words. The value of the ratio is 42. The constant is also 42.*

2. Mark recently moved to a new state. During the first month he visited five state parks. Each month after he visited two more. Complete the table below and use the results to determine if the number of parks visited is proportional to the number of months.

Number of Months	Number of State Parks
1	5
2	7
3	9
10	23

*This relationship is not proportional. There is no constant value that can be multiplied times the number of months to get the corresponding number of parks visited.*

3. The table below shows the relationship between the side length of a square and the area. Complete the table. Then determine if the length of the sides is proportional to the area.

Side Length (inches)	Area (square inches)
1	1
2	4
3	9
4	16
5	25
8	64
12	144

*This relationship is not proportional. There is no constant value that can be multiplied by the side length to get the corresponding area.*

**Closing (5 minutes)**

- A student notices in the table below that as the  $x$ -value increases by 3 the  $y$ -value increases by 4. Because there is a pattern, the student has determined that  $x$  is proportional to  $y$ . Do you agree with the student’s claim? Why or why not?

$x$	$y$
4	1
7	5
10	9
13	13
16	17

- No, this table does not show that  $x$  is proportional to  $y$ . A pattern is not enough proof that a proportional relationship exists. There is no constant that could be multiplied by the  $x$ -value to get the corresponding  $y$ -value. Therefore, the table does not represent a proportion.*

**Exit Ticket (10 minutes)**



Name \_\_\_\_\_

Date \_\_\_\_\_

## Lesson 4: Identifying Proportional and Non-Proportional Relationships in Tables

### Exit Ticket

The table below shows the relationship between the side lengths of a regular octagon and its perimeter.

Side Lengths, $s$ (inches)	Perimeter, $P$ (inches)
1	8
2	16
3	24
4	32
9	
12	

Complete the table.

If Gabby wants to make a regular octagon with a side length of 20 inches using wire, how much wire does she need? Justify your reasoning with an explanation of whether perimeter is proportional to the side length.



Exit Ticket Sample Solutions

The table below shows the relationship between the side lengths of a regular octagon and its perimeter.

Side Lengths, $s$ (inches)	Perimeter, $P$ (inches)
1	8
2	16
3	24
4	32
9	72
12	96

Complete the table.

If Gabby wants to make a regular octagon with a side length of 20 inches using wire, how much wire does she need? Justify your reasoning with an explanation of whether perimeter is proportional to the side length.

*Gabby would need  $20(8) = 160$  inches of wire to make a regular octagon with a side length of 20 inches. This table shows that the perimeter is proportional to the side length because the constant is 8, and when all side lengths are multiplied by the constant, the corresponding perimeter is obtained. Since the perimeter is found by adding all 8 side lengths together (or multiplying the length of 1 side by 8), the two numbers must always be proportional.*

Problem Set Sample Solutions

- Joseph earns \$15 for every lawn he mows. Is the amount of money he earns proportional to the number of lawns he mows? Make a table to help you identify the type of relationship.

Number of Lawns Mowed	1	2	3	4
Earnings (\$)	15	30	45	60

*The table shows that the earnings are proportional to the number of lawns mowed. The value of each ratio is 15. The constant is 15.*

- At the end of the summer, Caitlin had saved \$120 from her summer job. This was her initial deposit into a new savings account at the bank. As the school year starts, Caitlin is going to deposit another \$5 each week from her allowance. Is her account balance proportional to the number of weeks of deposits? Use the table below. Explain your reasoning.

Time (in weeks)	0	1	2	3
Account Balance (\$)	120	125	130	135

*Caitlin's account balance is not proportional to the number of weeks because there is no constant such that any time in weeks can be multiplied to get the corresponding balance. In addition, the ratio of the balance to the time in weeks is different for each column in the table.*

*$120 : 0$  is not the same as  $125 : 1$ .*



3. Lucas and Brianna read three books each last month. The table shows the number of pages in each book and the length of time it took to read the entire book.

Pages Lucas Read	208	156	234
Time (hours)	8	6	9

Pages Brianna Read	168	120	348
Time (hours)	6	4	12

- a. Which of the tables, if any, represent a proportional relationship?

*The table shows Lucas's number of pages read to be proportional to the time because when the constant of 26 is multiplied by each measure of time, it gives the corresponding values for the number of pages read.*

- b. Both Lucas and Brianna had specific reading goals they needed to accomplish. What different strategies did each person employ in reaching those goals?

*Lucas read at a constant rate throughout the summer, 26 pages per hour, where Brianna's reading rate was not the same throughout the summer.*