Lesson 6: Identifying Proportional and Non-Proportional Relationships in Graphs

Student Outcomes

- Students examine situations carefully to decide whether two quantities are proportional to each other by graphing on a coordinate plane and observing whether all the points would fall on a line that passes through the origin.
- Students study examples of relationships that are not proportional as well as those that are.

Classwork

Today's Exploratory Challenge is an extension of Lesson 5. You will be working in groups to create a table and graph and to identify whether the two quantities are proportional to each other.

Preparation (5 minutes)

Place students in groups of four. Hand out markers, poster paper, graph paper, and envelopes containing 5 ratios each. (Each group will have identical contents.) Lead students through the following directions to prepare for the Exploratory Challenge.

MP.1 & MP.2

Have the recorder fold the poster paper in quarters and label as follows: Quad 1–Table, Quad 2–Problem, Quad 3–Graph, and Quad 4–Proportional or Not? Explanation.

Instruct the reader to take out the contents of the envelope (located at the end of the lesson), and instruct the group to arrange the data in a table and on a graph.

Instruct the reader to read the problem. The recorder should write the problem on the poster paper. Students use multiple methods to show whether the quantities represented in the envelope are proportional to each other.

Exploratory Challenge (20 minutes)

Give students 15 minutes to discuss the problem and record their responses onto the poster paper. For the last 5 minutes, have groups place their posters on the wall and circulate around the room, looking for the groups that have the same ratios. Have groups with the same ratios identify and discuss the differences of their posters.

Gallery Walk (10 minutes)

In groups, have students observe each poster, write any thoughts on sticky notes, and place them on the posters. Sample posters are provided below. Also, have students answer the following questions on their worksheets:

- Were there any differences found in groups that had the same ratios?
- Did you notice any common mistakes? How might they be fixed?
- Which posters were both visually attractive and informative?

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Poster Layout

Use for notes

Group 1 and 8

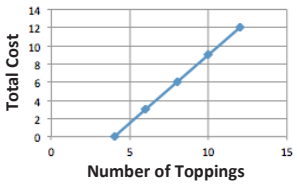
Problem:

A local frozen yogurt shop is known for their monster sundaes. Create a table, and then graph and explain if the quantities are proportional to each other.

Table:

Number of Toppings	*Total Cost of Toppings ($)*
4	0
6	3
8	6
10	9
12	12

Graph:



Explanation:

Although the points appear on a line, the quantities are not proportional to each other because the line does not go through the origin. Each topping does not have the same unit cost.

Group 2 and 7

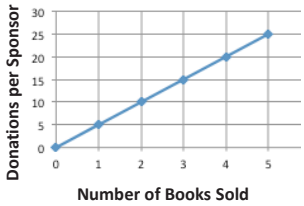
Problem:

The school library receives money for every book sold at the school's book fair. Create a table, and then graph and explain if the quantities are proportional to each other.

Table:

Number of Books Sold	*Donations per Sponsor ($)*
1	5
2	10
3	15
4	20
5	25

Graph:



Explanation:

The quantities are proportional to each other because the points appear on a line that goes through the origin. Each book sold brings in $5.00, no matter how many books are sold.

Group 3 and 6

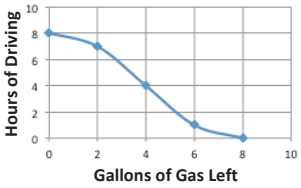
Problem:

Your uncle just bought a hybrid car and wants to take you and your siblings camping. Create a table, and then graph and explain if the quantities are proportional to each other.

Table:

Gallons of Gas Left in Tank	*Hours of Driving*
8	0
6	1
4	4
2	7
0	8

Graph:



Explanation:

The graph is not represented by a line passing through the origin, so the quantities are not proportional to each other. The number of gallons of gas varies depending on how fast or slow the car is driven.

Group 4 and 5

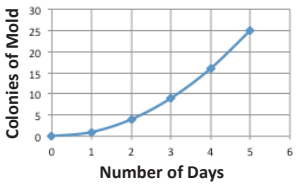
Problem:

For a science project, Eli decided to study colonies of mold. He observed a piece of bread that was molding. Create a table, and then graph and explain if the quantities are proportional to each other.

Table:

Number of Days	*Colonies of Mold*
1	1
2	4
3	9
4	16
5	25

Graph:



Explanation:

Although the graph looks as though it goes through the origin, the quantities are not proportional to each other because the points do not appear on a line. Each day does not produce the same amount of colonies as the other days.

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Gallery Walk

Take notes and answer the following questions:

- **Were there any differences found in groups that had the same ratios?**
- **Did you notice any common mistakes? How might they be fixed?**
- **Were there any groups that stood out by representing their problem and findings exceptionally clearly?**

Poster 1:

Poster 2:

Poster 3:

Poster 4:

Poster 5:

Poster 6:

Poster 7:

Poster 8:

Note about Lesson Summary:

Closing (5 minutes)

- Why make posters with others? Why not do this exercise in your student books?
  - *We can discuss with others and learn from their thought processes. When we share information with others, our knowledge is tested and questioned.*
- What does it mean for a display to be both visually appealing and informative?
  - *For a display to be both visually appealing and informative, the reader should be able to find data and results fairly quickly and somewhat enjoyably.*
- Suppose we invited people from another school, state, or country to walk through our gallery. What would they be able to learn about ratio and proportion from our posters?
  - *Hopefully, after looking through the series of posters, people can learn and easily determine for themselves if graphs represent proportional and non-proportional relationships.*

Lesson Summary

The plotted points in a *graph of a proportional relationship* lie on a line that passes through the origin.

Exit Ticket (5 minutes)

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Name _____ Date_____

Lesson 6: Identifying Proportional and Non-Proportional Relationships in Graphs

Exit Ticket

1. Which graphs in the gallery walk represented proportional relationships, and which did not? List the group number.

   Proportional Relationship Non-Proportional Relationship

2. What are the characteristics of the graphs that represent proportional relationships?

3. For the graphs representing proportional relationships, what does $(0, 0)$ mean in the context of the given situation?

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Exit Ticket Sample Solutions

1. **Which graphs in the art gallery walk represented proportional relationships, and which did not? List the group number.**

Proportional Relationship	Non-Proportional Relationship	
Group 2	*Group 1*	*Group 5*
Group 7	*Group 3*	*Group 6*
	Group 4	*Group 8*

2. **What are the characteristics of the graphs that represent proportional relationships?**

   Graphs of groups 2 and 7 appear on a line and go through the origin.

3. **For the graphs representing proportional relationships, what does $(0, 0)$ mean in the context of the situation?**

   For zero books sold, the library received zero dollars in donations.

Problem Set Sample Solutions

Sally's aunt put money in a savings account for her on the day Sally was born. The savings account pays interest for keeping her money in the bank. The ratios below represent the number of years to the amount of money in the savings account.

- **After one year, the interest accumulated, and the total in Sally's account was $\$312$.**
- **After three years, the total was $\$340$. After six years, the total was $\$380$.**
- **After nine years, the total was $\$430$. After 12 years, the total amount in Sally's savings account was $\$480$.**

Using the same four-fold method from class, create a table and a graph, and explain whether the amount of money accumulated and time elapsed are proportional to each other. Use your table and graph to support your reasoning.

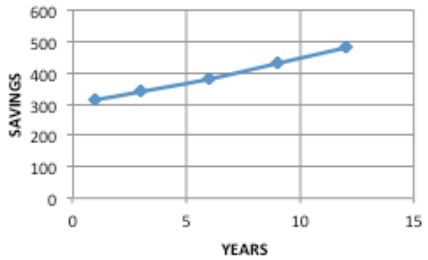
Problem:

Sally's aunt put money in a savings account for her on the day Sally was born. The savings account pays interest for keeping the money in the bank. The ratios below represent the number of years to the amount of money in the savings account. Create a table and a graph, and explain whether the quantities are proportional to each other.

Table:

Years	*Savings ($)*
1	312
3	340
6	380
9	430
12	480

Graph:



Explanation:

The graph is not a graph of a proportional relationship because, although the data appears to be a line, it is not a line that goes through the origin. The amount of interest collected is not the same every year.

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Ratios for Exploratory Challenge

Cut and place in labeled envelopes prior to instructional time.

Group 1	Group 2	Group 3	Group 4
A local frozen yogurt shop is known for its monster sundaes to be shared by a group. The ratios represent the number of toppings to the total cost of the toppings. Create a table, and then graph and explain if the quantities are proportional to each other.	The school library receives money for every book sold at the school's book fair. The ratios represent the number of books sold to the amount of money the library receives. Create a table, and then graph and explain if the quantities are proportional to each other.	Your uncle just bought a hybrid car and wants to take you and your siblings camping. The ratios represent the number of gallons of gas remaining to the number of hours of driving. Create a table, and then graph and explain if the quantities are proportional to each other.	For a science project, Eli decided to study colonies of mold. He observed a piece of bread that was molding. The ratios represent the number of days passed to the number of colonies of mold on the bread. Create a table, and then graph and explain if the quantities are proportional to each other.
4 to 0	1 to 5	8 to 0	1 to 1
6: 3	2 to 10	After 1 hour of driving, there are 6 gallons of gas left in the tank.	2 to 4
8: 6	The library received $15 for selling 3 books.	4: 4	3: 9
The total cost of a 10-topping sundae is $9.	4: 20	2 to 7	4: 16
12 to 12	5: 25	0: 8	Twenty-five colonies were found on the 5th day.

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Group 5	Group 6	Group 7	Group 8
For a science project, Eli decided to study colonies of mold. He observed a piece of bread that was molding. The ratios represent the number of days passed to the number of colonies of mold on the bread. Create a table, and then graph and explain if the quantities are proportional to each other.	Your uncle just bought a hybrid car and wants to take you and your siblings camping. The ratios represent the number of gallons of gas remaining to the number of hours of driving. Create a table, and then graph and explain if the quantities are proportional to each other.	The school library receives money for every book sold at the school's book fair. The ratios represent the number of books sold to the amount of money the library receives. Create a table, and then graph and explain if the quantities are proportional to each other.	A local frozen yogurt shop is known for its monster sundaes to be shared by a group. The ratios represent the number of toppings to the total cost of the toppings. Create a table, and then graph and explain if the quantities are proportional to each other.
1 to 1	8 to 0	1 to 5	4 to 0
2 to 4	After 1 hour of driving, there are 6 gallons of gas left in the tank.	2 to 10	6: 3
3: 9	4: 4	The library received $15 for selling 3 books.	8: 6
4: 16	2 to 7	4: 20	The total cost of a 10-topping sundae is $9.
Twenty-five colonies were found on the 5th day.	0 : 8	5: 25	12 to 12

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