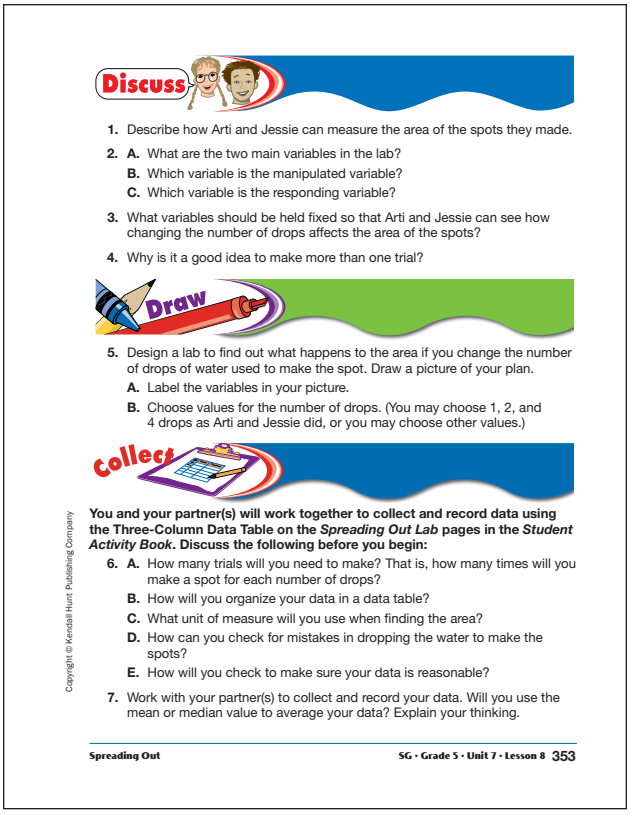
Student Guide

Spreading Out (SG pp. 353–355)
Questions 1–15

1. Arti and Jessie can trace their spot onto Centimeter Grid Paper and count out the whole and partial square centimeters to find the area.
2. **A.*** Number of drops (N) and Area (A)
   B. Number of Drops
   C. Area
3.* Students should use the same type of paper towel each time, use the same liquid, use the same eyedropper, drop each drop into the center of the spot, keep the eyedropper at the same level when dropping, and keep the paper towel off the desk.
4.* Making more than one trial helps to eliminate experimental error.
5. **A.*** A sample picture is shown in Figure 4 in the Lesson.
   B. Possible response: 2, 4, 8, 10 drops
6. **A.** You should do three trials for each number of drops you choose. That way you can use an average of the three trials.
   B. Possible response: Use the three-column data table. Remember to put a title on the table, label both of the variables, and name the values. Then fill in the data collected.
   C.* Possible response: Students will likely suggest using square centimeters and using Centimeter Grid Paper to help them find the area of each spot.
   D.* Make sure that each of the three spots for a number of drops is about the same size or has about the same area.
   E.* Look at the area of each of the spots for a specific number of drops and if they are close then the data is reasonable. If one is much bigger or much smaller, then make another spot.
7.* Responses will depend on the data. If the area is close for all three spots made with a specific number of drops both the mean and median should be close. If the areas for a given number of drops has a larger difference then the median is likely the most appropriate average to use.



Discuss

1. Describe how Arti and Jessie can measure the area of the spots they made.
2. **A.** What are the two main variables in the lab?
   B. Which variable is the manipulated variable?
   C. Which variable is the responding variable?
3. What variables should be held fixed so that Arti and Jessie can see how changing the number of drops affects the area of the spots?
4. Why is it a good idea to make more than one trial?

Draw

5. Design a lab to find out what happens to the area if you change the number of drops of water used to make the spot. Draw a picture of your plan.
   A. Label the variables in your picture.
   B. Choose values for the number of drops. (You may choose 1, 2, and 4 drops as Arti and Jessie did, or you may choose other values.)

Collect

You and your partner(s) will work together to collect and record data using the Three-Column Data Table on the *Spreading Out Lab* pages in the *Student Activity Book*. Discuss the following before you begin:

6. **A.** How many trials will you need to make? That is, how many times will you make a spot for each number of drops?
   B. How will you organize your data in a data table?
   C. What unit of measure will you use when finding the area?
   D. How can you check for mistakes in dropping the water to make the spots?
   E. How will you check to make sure your data is reasonable?
7. Work with your partner(s) to collect and record your data. Will you use the mean or median value to average your data? Explain your thinking.

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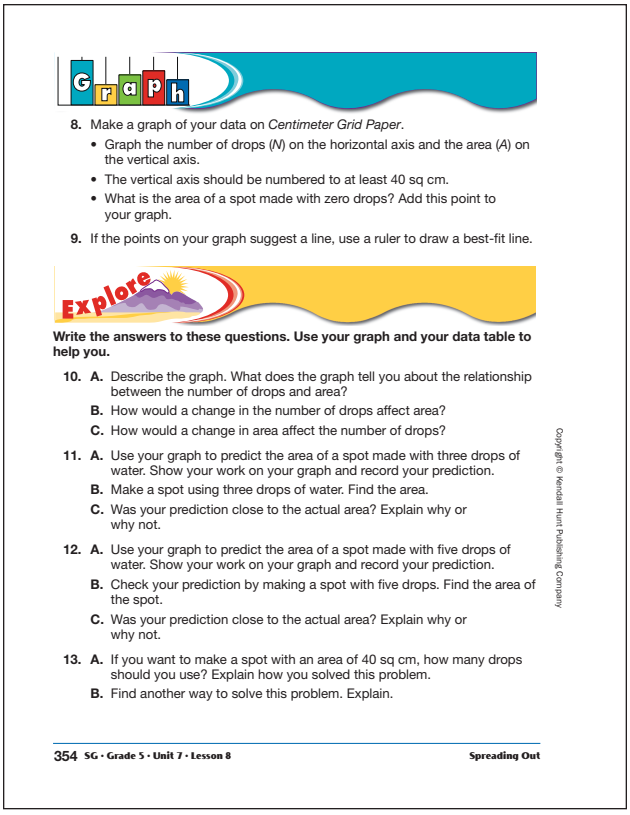
***Answers and/or discussion are included in the lesson.**



Graph

8. Make a graph of your data on *Centimeter Grid Paper*.
   - Graph the number of drops (*N*) on the horizontal axis and the area (*A*) on the vertical axis.
   - The vertical axis should be numbered to at least 40 sq cm.
   - What is the area of a spot made with zero drops? Add this point to your graph.
9. If the points on your graph suggest a line, use a ruler to draw a best-fit line.

Explore

Write the answers to these questions. Use your graph and your data table to help you.

10. **A.** Describe the graph. What does the graph tell you about the relationship between the number of drops and area?
    B. How would a change in the number of drops affect area?
    C. How would a change in area affect the number of drops?
11. **A.** Use your graph to predict the area of a spot made with three drops of water. Show your work on your graph and record your prediction.
    B. Make a spot using three drops of water. Find the area.
    C. Was your prediction close to the actual area? Explain why or why not.
12. **A.** Use your graph to predict the area of a spot made with five drops of water. Show your work on your graph and record your prediction.
    B. Check your prediction by making a spot with five drops. Find the area of the spot.
    C. Was your prediction close to the actual area? Explain why or why not.
13. **A.** If you want to make a spot with an area of 40 sq cm, how many drops should you use? Explain how you solved this problem.
    B. Find another way to solve this problem. Explain.

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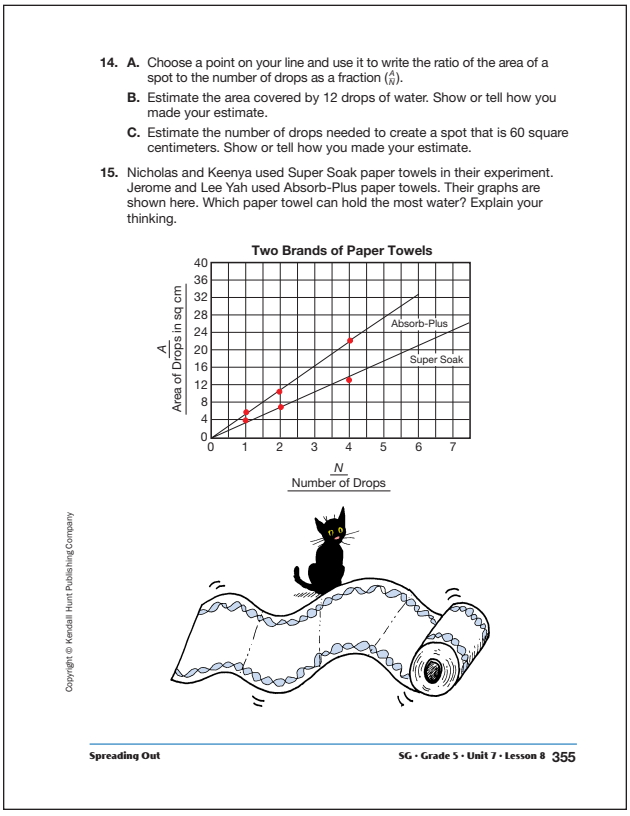

14. **A.** Choose a point on your line and use it to write the ratio of the area of a spot to the number of drops as a fraction ($\frac{A}{N}$).
    B. Estimate the area covered by 12 drops of water. Show or tell how you made your estimate.
    C. Estimate the number of drops needed to create a spot that is 60 square centimeters. Show or tell how you made your estimate.
15. Nicholas and Keenya used Super Soak paper towels in their experiment. Jerome and Lee Yah used Absorb-Plus paper towels. Their graphs are shown here. Which paper towel can hold the most water? Explain your thinking.

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***Answers and/or discussion are included in the lesson.**

8–9.* A sample graph is shown in Figure 7 in the Lesson. Zero drops makes zero area. The point (0 drops, 0 sq cm) is added to the sample graph in Figure 7.

10.* A. Answers may include: The best-fit line goes up at a steady rate; the more drops the larger the area.

B. If I drop more drops the area would be larger; if I drop fewer drops the area would be less.

C. The larger the area the more drops it took to make the spot; the smaller the area the few the drops it took to make the spot.

11. A.* Using the sample graph in Figure 7, 21 sq cm.

B–C. Answers will vary. Students check their predictions using their set up.

12. A.* Using the sample graph in Figure 7, 35 sq cm.

B–C. Answers will vary. Students check the accurary of their predictions using the lab set up.

13. A.* Using the sample graph in Figure 7, about 6 drops.

B. Strategies will vary. Students can use ratios.

14. A.* Using the sample graph in Figure 7, $\frac{14 \text{ sq cm}}{2 \text{ drops}}$. Answers will vary.

B.* Using the ratio in ***Question 14A,*** 84 sq cm. Possible strategy:

$$\frac{14 \text{ sq cm}}{2 \text{ drops}} \times \frac{6}{6} = \frac{84 \text{ sq cm}}{12 \text{ drops}}$$

C.* Using the ratio in ***Question 14B,*** about 8 or 9 drops. Possible strategy:

$$\frac{14 \text{ sq cm}}{2 \text{ drops}} = \frac{7 \text{ sq cm}}{1 \text{ drops}} \text{ and } \frac{14 \text{ sq cm}}{2 \text{ drops}} \times \frac{8}{8} = \frac{56 \text{ sq cm}}{8 \text{ drops}}$$

15.* Super Soak is more absorbent. It can hold the most water because more drops fit on a smaller area.

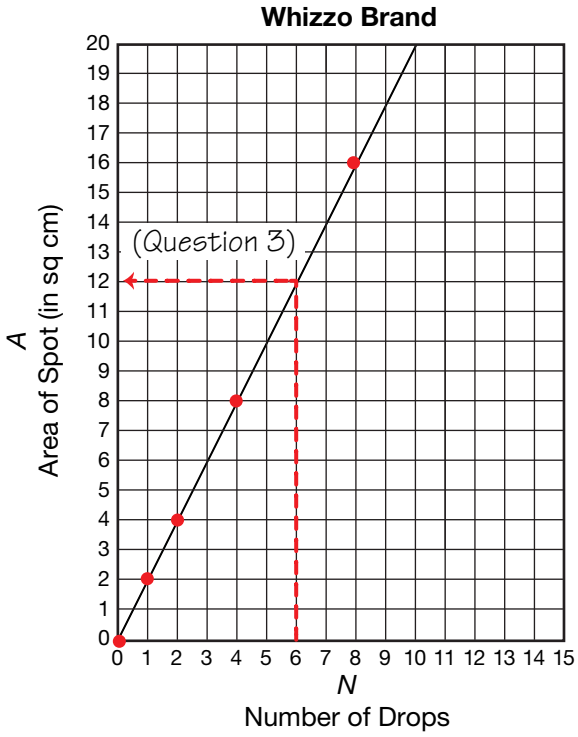
Homework (SG p. 356)
Questions 1–3

1. A.

Whizzo Brand

N Number of Drops	*A* Area of Spot in sq cm
1	2
2	4
4	8
8	16

B.



C. 0 sq cm

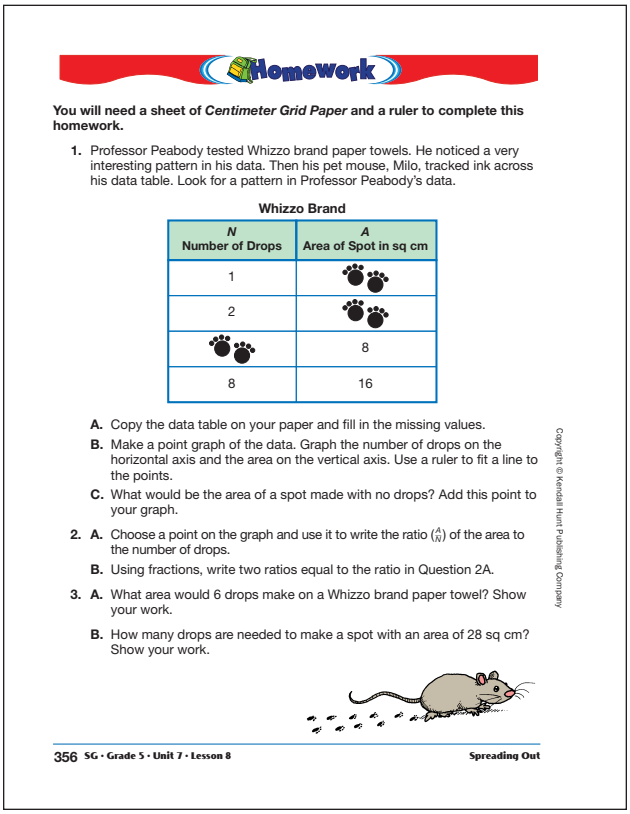
2. A. Answers will vary. $\frac{4 \text{ sq cm}}{2 \text{ drops}}$

B. Answers will vary. $\frac{16 \text{ sq cm}}{8 \text{ drops}}, \frac{20 \text{ sq cm}}{10 \text{ drops}}$

3. A. 12 sq cm; See the graph.

B. 14 drops; Possible response:

$$\frac{4 \text{ sq cm}}{2 \text{ drops}} \times \frac{7}{7} = \frac{28 \text{ sq cm}}{14 \text{ drops}}$$



Homework

You will need a sheet of *Centimeter Grid Paper* and a ruler to complete this homework.

1. Professor Peabody tested Whizzo brand paper towels. He noticed a very interesting pattern in his data. Then his pet mouse, Milo, tracked ink across his data table. Look for a pattern in Professor Peabody's data.

Whizzo Brand

N Number of Drops	*A* Area of Spot in sq cm
1	
2	
	8
8	16

   A. Copy the data table on your paper and fill in the missing values.
   B. Make a point graph of the data. Graph the number of drops on the horizontal axis and the area on the vertical axis. Use a ruler to fit a line to the points.
   C. What would be the area of a spot made with no drops? Add this point to your graph.

2. A. Choose a point on the graph and use it to write the ratio $(\frac{A}{N})$ of the area to the number of drops.
   B. Using fractions, write two ratios equal to the ratio in Question 2A.

3. A. What area would 6 drops make on a Whizzo brand paper towel? Show your work.
   B. How many drops are needed to make a spot with an area of 28 sq cm? Show your work.

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***Answers and/or discussion are included in the lesson.**