E X P L O R A T I O N S

Activity 15

Looking at Statistics Through Circles

Teacher Notes

Topics Covered

♦ Using two-variable statistics to discover relationships

♦ Determining circumference and diameter

♦ Understanding the relationship between circumference and diameter

Introduction

Where does π come from? Many important applications of statistics involve examining whether two or more variables are related to one another. For example, is there a relationship between high SAT scores and success in college? Or between the amount of hours spent studying per week for mathematics and the marking period grade? In this activity, we will explore two-variable statistics and how to use the calculator to compute them in discovering relationships between circumference and diameter. We also will discover how to write an equation which will be used to make a prediction.

Investigation

1. Have the students work in groups of three or four to measure the diameter and circumference for each of eight round items. Tell them to record the item and its measurements on the Student Activity page. (Note: The other rows and columns will be used later.)

2. Have the students plot the (*diameter*, *circumference*) data on the graph paper. Ask them to write a description of the points on the graph.

3. Tell them to lay a piece of spaghetti on the graph to illustrate the line that best describes the data points. Glue the pasta in place on the graph paper.

4. Have each group measure the diameter of a cardboard paper towel tube. Using their data, what do they think the measure of the circumference will be? Remind students that the graph may help them with their estimate.

5. Use the TI-30X IIS to find an equation for the line.

   Use this hypothetical data set of (diameter, circumference) ordered pairs: (3, 9.5) (5, 16) (8, 25) and (10, 32)

Press:	The calculator shows:
CLEAR 2nd [STAT] ⊙	1-VAR 2-VAR DEG
ENTER ENTER	$X_1=$ STAT DEG
3	$X_1= 3$ STAT DEG
⊙ 9.5	$Y_1= 9.5$ STAT DEG
⊙ 5 ⊙ 16 ⊙ 8 ⊙ 25 10 ⊙ 32 ⊙	$Y_4= 32$ STAT DEG
STATVAR ⊙ (12 times)	← Σxy a b r → 3.1810134483 STAT DEG
⊙	← Σxy a b r → ⁻0.051724138 STAT DEG

The equation for the line in y = ax + b form is: *y = 3.18x − 0.05*

6. Have the students use the equation to predict the circumference of the paper towel tube.

    Y = 3.18 x (diameter) − 0.05

7. Tell the students to measure the circumference of the tube and compare it to their estimate. Discuss their results: How close was your estimate? How close was the TI-30X IIS's estimate?

8. Measure the circumference of the oatmeal box. Using their data, what do they think the measure of the diameter will be?

    Remind students that the graph may help them with their estimate.

9. Ask the students what the TI-30X IIS would have predicted for the measure of the diameter.

10. Continue the investigation by exploring the relationship between C and D. Enter the information on the Student Activity page and complete the activity.

Wrap-Up

Have the groups share their results with the whole class.   Be sure to discuss the relationships between diameter and circumference and why these relationships exist.

Extension

Have students do a report on the origins of π and how it was used in the early days of mathematics. Who "discovered" this relationship first?

Solutions

   (Note: Answers will vary for this activity based upon the data collected.)

1. On the table below, record the diameter and circumference of eight round items. Then calculate the relationship between circumference and diameter and record in the last four columns.

Item	Diameter	Circumference	C + D	C−D	C x D	C ÷ D
cardboard paper towel tube						
oatmeal box						

2. Write a sentence or two to describe your observations about the relationship between C and D.

   The ratio of C/D is approximately the same for every object.

3. Write the equation of your spaghetti line using any method of your choice.

4. Use your calculator to determine the equation of the spaghetti line. How close was your calculator equation to the one in #3?

5. Do you observe anything unusual (or interesting) about the equation you found?
   (Hint: What do you observe about the slope? This is the **a** on the TI-30X ⅡS.)

   The slope (a) is approximately 3.14 units.

   Using your equation from #3 , find the circumference of a circular object if the diameter is 90 mm.

   Use the equation from #4 to confirm your result.

   The circumference is approximately 283 mm.

If the circumference were 468 mm, what would be the diameter of the circular object using the equation from #3?

Use the equation from #4 to confirm your result.

The diameter is approximately 149 mm.

Student Activity 15

Name _____

Date _____

Working with Circumference and Diameter—Looking at Statistics Through Circles

Objective: *You will measure objects to determine the circumference and diameter and will use the data in exploring geometric concepts with statistics.*

1. On the table below, record the diameter and circumference of eight round items. Then calculate the relationship between circumference and diameter and record in the last four columns.

Item	Diameter	Circumference	C + D	C – D	C x D	C ÷ D
cardboard paper towel tube						
oatmeal box						

2. Write a sentence or two to describe your observations about the relationship between C and D.

3. Write the equation of your spaghetti line using any method of your choice.

4. Use your calculator to determine the equation of the spaghetti line. How close was your calculator equation to the one in #3?

5. Do you observe anything unusual (or interesting) about the equation you found? (Hint: What do you observe about the slope? This is the **a** on the TI-30X IIS.)

6. Using your equation from #3, find the circumference of a circular object if the diameter is known to be 90 mm. Use the equation from #4 to confirm your result.

7. If the circumference were 468 mm, what would be the diameter of the circular object using the equation from #3? Use the equation from #4 to confirm your result.