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

Activity 11

3.14159265…

In this activity you will

♦ Discover Pi.

♦ Find the circumference of circles.

Introduction

What is Pi? Where did it come from? In this activity, you will discover more about the irrational number Pi.

Investigation

This investigation will help you to find the circumference of circles.

1. Clear **L1** and **L2** before you start the application.
   Press [2nd] [STAT] [▶] **3:ClrList** [2nd] [STAT] **1:L1** [,] [2nd]
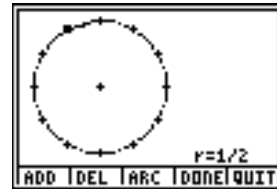   [STAT] **2:L2** [ENTER].

2. From the main Geoboard menu, move the cursor
   right to **CIR**. Select a **Rad** (radius) of ½ and **Pegs**
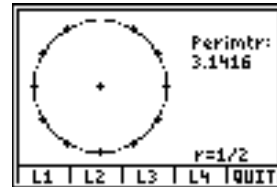   (number of pegs) of 12 as shown to the right.

3. Select **GOTO**.
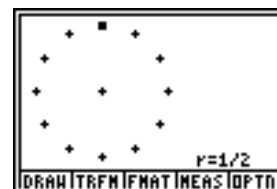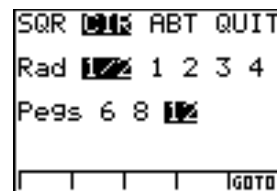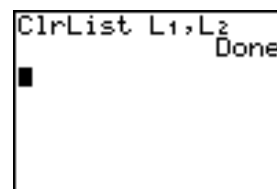
4. Draw a circle by selecting **DRAW, ADD** ▶ around the circle until you get to the point that is one point to the left of the starting point. Select **ARC** . To complete the circle, select **ADD** ▶ **ARC, DONE**. You should have a complete circle.

   Your geoboard should look like the screen at the right.

6. Draw the diameter from the left-most to the right-most peg on the circle. Move to the left-most point as shown at the right. Select **DRAW, ADD** ▶ around the circle to the right-most peg. Select **ADD, DONE**. You should see a horizontal diameter.

Radius = 1/2; Diameter = 1

5. Select **QUIT**. Measure the distance around the circle (the perimeter), which is normally called the circumference. Select **MEAS, 3:Perimeter** ENTER. Store this value in **L1** by selecting **L1**.
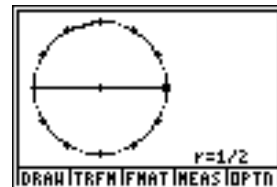
7. Select **QUIT**. Measure the diameter of the circle and store it in **L2**. Select **MEAS, 1:Length**. Press ENTER on each endpoint of the diameter segment to measure the length. Store this value in **L2** by selecting **L2** .
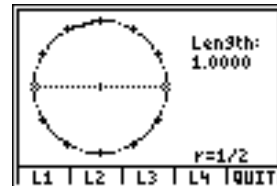
Diameter = 1

8. Repeat this process with four other circles with different radii:

   Radius = 1   Radius = 2   Radius = 3   Radius = 4

9. To change the radius, select:

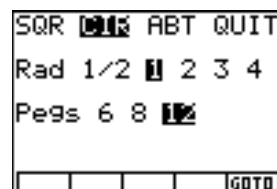   **OPTION**
   1:Main Menu

   Exit this board?
   2:YES

   Save this board?
   1:NO

   This will take you back to the main Geoboard menu, to change the radius press ▼ ▶ ENTER. Select **GOTO** to advance to the board.

Radius = 1

10. Draw a circle (see Step 4), measure the circumference, store it in **L1** (see Step 5), draw the diameter (see Step 6), measure the diameter and store it in **L2** (see Step 7).

11. Repeat Step 9 for each of the following boards:
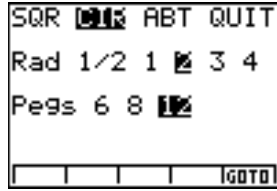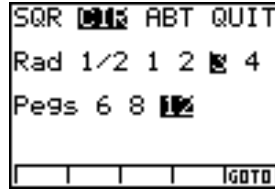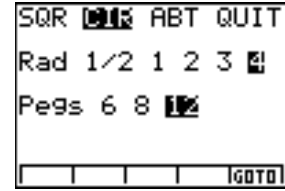
SQR **CIR** ABT QUIT	SQR **CIR** ABT QUIT	SQR **CIR** ABT QUIT
Rad 1/2 1 **2** 3 4	Rad 1/2 1 2 **3** 4	Rad 1/2 1 2 3 **4**
Pegs 6 8 **10**	Pegs 6 8 **10**	Pegs 6 8 **10**
|GOTO|	|GOTO|	|GOTO|
Radius = 2	Radius = 3	Radius = 4

Student Activity

Name _____

Date _____

Activity 11: 3.14159265…

Follow the instructions to complete the investigation.

1. Press [LIST] and verify that you have the same elements (numbers) in **L**1 and **L**2.

```
L1       L2       L3      1
3.1416   1        ------
6.2832   2
12.566   4
18.85    6
25.133   8
         ------
L1(6) =
```

2. What measurements did you store in **L**1 _____ and **L**2 _____ ?

3. Go to the home screen by pressing [2nd] [QUIT] and then [CLEAR] to clear the screen. Divide the **L**1 element by the corresponding **L**2 element as shown at the right and enter the values in the table below.

```
3.1416/1       3.1416
6.2832/2       3.1416
■
```

Radius	(Circumference) L1	(Diameter) L2	(Circumference/ Diameter)
½	3.1416	1	3.1416
1			
2			
3			
4			

4. Check your results by using a formula within the List Editor. Press [LIST] and move to the top of **L3** as shown at the right. It does not matter if there are elements in the list because the formula will overwrite the data.

   Notice the cursor is at the very top of **L3**.

L1	L2	◼3	3
3.1416	1	------	
6.2832	2		
12.566	4		
18.85	6		
25.133	8		
------	------		

L3 =

5. Enter the formula [2nd] [STAT] **1:L1** [÷] [2nd] [STAT] **2:L2**.

   Notice the formula at the right.

L1	L2	◼3	3
3.1416	1	------	
6.2832	2		
12.566	4		
18.85	6		
25.133	8		
------	------		

L3 =L₁/L₂

6. Press [ENTER] and compare the results to your table in Problem 3. What do you notice about this result?

   _____

   _____

7. Set up a Scatter Plot with **L2** (the diameter) as the **Xlist** value and **L1** (the circumference) as the **Ylist** value. Press [2nd] [PLOT] **1:Plot1** and set up as shown at the right.

```
Plot1 ▮▮ Off
Type: ▰▰ ⌐ ⋇⋇ ▮▮▮
     ⊕ ▭▭ ▮▮ ▮▮
Xlist:L₂
Ylist:L₁
Mark: ▫ + ·
```

8. Press [WINDOW] and set up with the values shown at the right.

```
WINDOW
 Xmin=-1
 Xmax=9
 ⊿X=.1063829787…
 Xscl=1
 Ymin=-5
 Ymax=30
 Yscl=5
```

9. Press GRAPH and sketch your results on the blank graph screen. Describe the path of the points.

Y = ? X
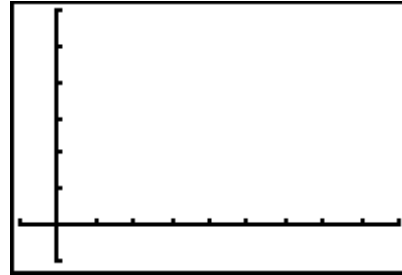
10. In Step 7 we defined the **Xlist** as **L2**, which is the _____, and the **Ylist** as **L1**, which is the _____. Use guess and check or some of your previous work to determine a value for the equation at the right.

? = _____

11. Test your results in the Y= Editor. Press Y= and enter your guess in **Y1**. Press GRAPH to see if the graph fits the points. Adjust it to make it fit. Enter your final result and write about your results.

_____

_____

_____
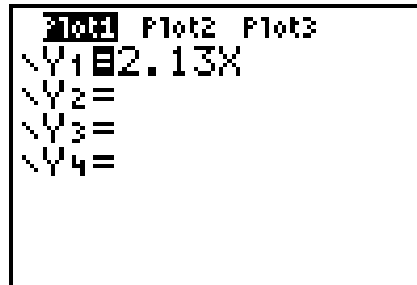
⑪

Set up a board with 24 pegs

⑪

If a full circle, the circumference would be about 12.6

⑪

The circle is divided into equal parts

⑪

Draw 1 radius from the highest point

⑪

The area of one part is about 4.2

⑪

This shape was popular in the 1960s

Teacher Notes

A c t i v i t y   1 1

3.14159265…

Investigation

When students are drawing the circle, they need to understand that the arc-draw
will not draw a complete 360-degree rotation. They must stop one peg before the
starting peg, select **ARC,** and then complete the circle by selecting **ADD** again and
drawing the last segment. They should not select **DONE** until they have completed
both segments of the circle; otherwise, the MEASURE tool will measure only the
first arc (11/12 of the circle), and the measurement that they obtain will be
incorrect.

Have students draw the circle and then measure the circumference (perimeter).
After that, they should draw the diameter and measure it. Drawing both and then
measuring them does not work.

Students should have some experience with graphing before completing the
student activity pages.

Answers to Student Activity pages

1. The elements should be the same as on the screen illustration on the Student
    Activity page.

2. What measurements did you store in **L**1? _____ **L**2? _____

3.

Radius	(Circumference) L1	(Diameter) L2	(Circumference/ Diameter)
½	3.1416	1	3.1416
1	6.2832	2	3.1416
2	12.566	4	3.1416
3	18.85	6	3.1416
4	25.133	8	3.1416

4. Verify the results.

5. N/A

6. The results are all 3.1416.

7. N/A

8.
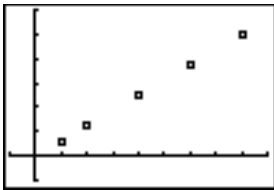
9. Diameter; Circumference; Y = 3.1416X

10. Answers will vary.

Group Problem Solving: The circumference of circles

The Group Problem Solving cards are challenge problems that can be used alone or with the individual sections of this book. The problems are designed to be used in groups of four (five or six in a group are possibilities using the additional cards) with each person having one of the first four clues. Students can read the information on their cards to others in the group but all should keep their own cards and not let one person take all the cards and do the work.

The numbers at the top of the cards indicate the lesson with which the card set is associated. The fifth and sixth clues (the optional clues) have the lesson number shown in a black circle.

The group problems can be solved using the first four clues. The fifth and sixth clues can be used as checks for the group's solution or they can be used as additional clues if a group gets stuck. Some problems have more than one solution. Any shape that fits all the clues should be accepted as correct.

One solution for this problem solving exercise: