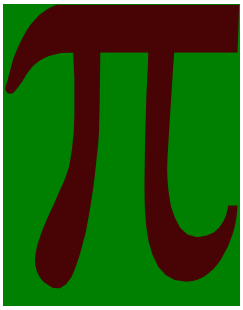
Algebra/Geometry Institute Summer 2009

Geometric Relationships

What is π?



Faculty Name: Laura Little

School: Cleveland School District

Grade Level: Grades 4 – 8

1 Teaching objective(s)

Develop measurement concepts and formulas through the use of geometry.

The student will:

- gather, organize, and display data in an appropriate chart.
- discover the value of the number π by measuring a circle's circumference and diameter.

2 Instructional Activities

Inform the students that they will be learning about measurements associated with circles. Write the terms *circumference, diameter,* and *radius* on the board. Start these activities by asking the students the definition of these terms. After you have allowed time for the students to respond, place the definitions of these terms on the overhead. (Transparency 1)

Activity 1

Read the book Sir Cumference and the Dragon of Pi (A Math Adventure) by Cindy Neuschwander. Sir Cumference drinks a potion which turns him into a fire-breathing dragon. His son Radius goes on a quest searching for the magic number that is the same for all circles which will restore him to his former shape. With the help of his mother, Lady Di of Ameter, he must "discover" the number known as pi.

After reading the story to the students, they will "discover" the number π for themselves. (Attachment 1) Students will measure the *circumference* and *diameter* of various round objects. They will record their data on the table provided, perform the required calculations, and analyze their results to find the ratio of the *circumference* to the *diameter* is approximately the number π.

Activity 2

Build a pi chain with loops of construction paper, each digit represented by a different color. This activity is a great way for students to visualize what randomness and irrational numbers mean.

Assign a color to each of the ten digits (0-9). Cut the 10 colors of construction paper into strips. Display a color/number key in the classroom. (Attachment 2)

Have an official "pi reader" call out the numbers as you assemble the chain. (Attachment 3)

As you begin to build the chain, instruct the students to find the color that relates to "3". Explain that they start with three because that is the first digit in pi. Have them take a strip of construction paper, roll it into a ring, and tape/staple it together. They have just begun the Pi Chain! Next, choose a very special 11th color (perhaps foil paper) to represent the decimal point and discuss its concept. Ask the class what is the next color they need to use. The next color is the color attributed to "1" since that is the next digit in pi. Repeat the process with them until they can self-pilot through the remaining digits of pi. Once they are finished, decorate the room with the Pi Chain.

Note: The teacher will need to decide before this activity is done how many digits of pi they would like to assemble into a Pi Chain since π goes on forever. The teacher will also need to decide if this activity will be done as a class activity or as a small group activity (a group of 4 or 5 students works the best), where each small group is responsible for a predetermined part of the Pi Chain. If small groups are used, you will need a "pi supervisor" that is responsible for making sure the parts of the Pi Chain are assembled in the correct manner.

3 Materials and Resources

Materials

- *Sir Cumference and the Dragon of Pi (A Math Adventure)* book
- Discovering π activity sheet
- measuring tape
- string
- ruler or meter stick
- objects to be measured (juice can, soup can, coffee can, oatmeal box top, cool whip container top, etc.)
- transparencies
- overhead projector
- construction paper, 10 different colors
- scissors

- tape or stapler
- color/number key activity sheet
- Digits of π activity sheet

Resources

Neuschwander, Cindy. Sir Cumference and the Dragon of Pi (A Math Adventure). Watertown, MA: Charlesbridge Publishing, Inc., 1999.

Adapted from "The Great Chain of Pi." Pi Across America. 20 June 2009. www.piacrossamerica.org

4 Assessment

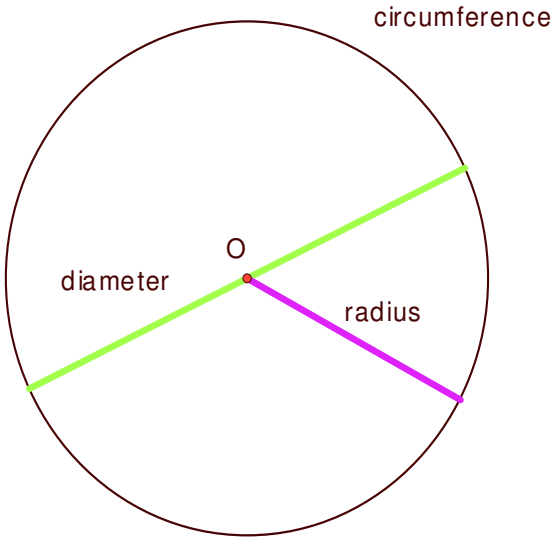
Students will be assessed for their understanding of circumference, diameter, radius, and pi from the "Discovering Pi" activity sheet. Students will also be assessed by monitoring and observing participation when constructing the Pi Chain.

"This value, represented by the symbol π (pi), has puzzled mathematicians for nearly four thousand years, generating more interest, consuming more brainpower, and filling more waste baskets with discarded theories than any other single number…you will never find an exact value for π." ***David Blatner,*** *The Joy of Pi*

The ***circumference*** of a circle is the distance around the circle. It is a special perimeter.

The ***diameter*** of a circle is any straight line segment that passes through the center of the circle and whose endpoints are on the circle.

The ***radius*** of a circle is any line segment from its center to its perimeter. The radius is half the diameter.



Attachment 1

Discovering Pi

Use the measuring tape or the string and ruler/meter stick to measure the circumference of the tops of the objects. Then measure the length of the diameter.

List these measurements in a table like the one below:

Object	Circumference	Diameter	Comparison
1)			
2)			
3)			
4)			
5)			

- How does the measurement of the circumference compare to the measurement of the diameter? Is it twice as large? Is it three times as large or more than three times as large?

  This comparison is the ratio of the circumference to the diameter of the circle. This ratio is called π.

- In the column marked COMPARISON, list the answer for the circumference divided by the diameter.

- The values we use for π are 3.14, 3.1416 or $\frac{22}{7}$. Now take your values of π and round them to the nearest hundredth.

- Compare your value to 3.14. Was your calculation greater or less than the 3.14 value of π?

- Are the values of π consistent? Why or why not?

- What reasons do you think would account for these differences?

Attachment 2

Color/Number Key

0 – yellow

1 – blue

2 – green

3 – purple

4 – white

5 – pink

6 – orange

7 – brown

8 – red

9 - black

Attachment 3

π
(10,000 digits)

$\pi \approx$ 3.14159 26535 89793 23846 26433 83279 50288 41971 69399 37510 58209 74944
59230 78164 06286 20899 86280 34825 34211 70679 82148 08651 32823 06647 09384
46095 50582 23172 53594 08128 48111 74502 84102 70193 85211 05559 64462 29489
54930 38196 44288 10975 66593 34461 28475 64823 37867 83165 27120 19091 45648
56692 34603 48610 45432 66482 13393 60726 02491 41273 72458 70066 06315 58817
48815 20920 96282 92540 91715 36436 78925 90360 01133 05305 48820 46652 13841
46951 94151 16094 33057 27036 57595 91953 09218 61173 81932 61179 31051 18548
07446 23799 62749 56735 18857 52724 89122 79381 83011 94912 98336 73362 44065
66430 86021 39494 63952 24737 19070 21798 60943 70277 05392 17176 29317 67523
84674 81846 76694 05132 00056 81271 45263 56082 77857 71342 75778 96091 73637
17872 14684 40901 22495 34301 46549 58537 10507 92279 68925 89235 42019 95611
21290 21960 86403 44181 59813 62977 47713 09960 51870 72113 49999 99837 29780
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34904 28755 46873 11595 62863 88235 37875 93751 95778 18577 80532 17122 68066
13001 92787 66111 95909 21642 01989 38095 25720 10654 85863 27886 59361 53381
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