



Pi Day: The Other Math Holiday!

Celebrate the circle!

Pi Day is March 14th! (3-14 get it?!?!?!)

Happy Pi Day

(To the tune of Happy Birthday)

Happy Pi Day to you,
Happy Pi Day to you,
Happy Pi Day everybody,
Happy Pi Day to you!

Activities:

Circle NIM
Name that Circle!
Circle Graphing
Digits of Pi
Buffon's Needle
Mono-*pi*-ly Board Game
Write about Pi

Quickies:

Chaos in Ius
Circle Darts
Pin the Radius on the Circle
Circle Drawing Contest
Pi Concentration
Pi Resources

SDCTM/SDSTA 2008 Annual Conference

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Montrose High School

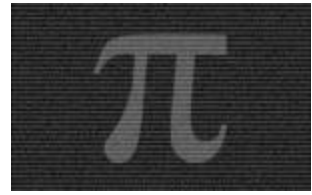
Huron Convention Center

cindy.kroon@k12.sd.us
<http://ck022.k12.sd.us>

Circle NIM

A problem-solving and strategy game for 2 players

Playing time: 5-10 minutes



Materials: 30 circles cut from tagboard or construction paper.

(2: 4-inch diameter, 4: 3-inch diameter, 8: 2-inch diameter, 16: 1-inch diameter)

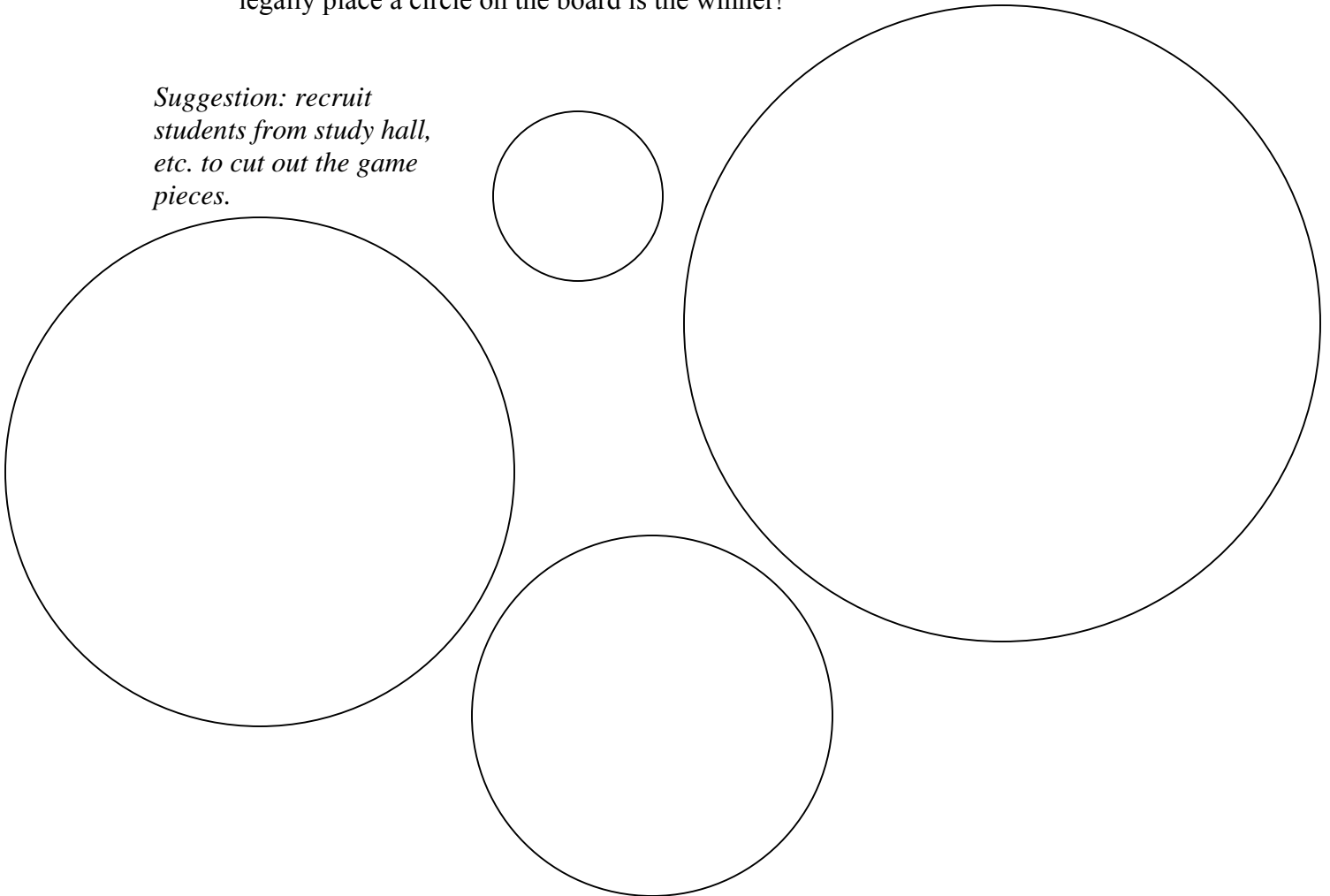
1 sheet of paper (8 1/2 x 11 inches) for a game board

Object of the game: To be the last player able to make a legal play.

Game play:

1. The person whose birthday is closest to Pi Day starts the game by placing a circular game piece anywhere on the game board. Any size circle may be played.
2. When played, a circle must be entirely on the game board, and may not be moved by any player during the course of the game.
3. Player 2 then places a circle on the board. A new circle can never touch a previously placed piece, and must always be entirely on the game board. Once a circle is played it may not be moved.
4. Play alternates until it is not possible to legally play another circle. The last player to legally place a circle on the board is the winner!

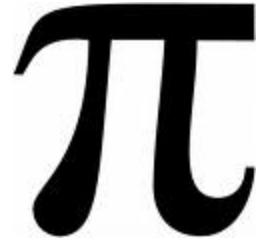
Suggestion: recruit students from study hall, etc. to cut out the game pieces.



Name that Circle!

A Jeopardy-style game for 3-4 teams of players

Playing time: approximately 30 minutes



Materials: Transparencies of circles (graphed on coordinate grid), one flashlight per team (for buzzer), scratch paper

Object of the game: To be the first to correctly name the equation of a circle displayed on a coordinate grid

1. Divide students into 3 or 4 teams.
2. Each team selects a person to play the first round; give this person a flashlight.
3. After each round, teams must rotate players (pass the flashlight.)
4. Display a graph of a circle on the overhead projector.
5. Each team representative writes the equation of the displayed circle in standard form. The equation must be completely written before buzzing in (flashlight.)
6. The first person to buzz in reads the equation that he/she has written. The equation must be correctly read and written. If correct, the team scores one point (round 1) or two points (round 2)
7. If incorrect, the remaining teams' players may buzz in to answer the question. Other team members may pass forward written hints, but only the person holding the flashlight may answer.
8. Play to a predetermined number of points, or for a predetermined time.

Round one graphs will have integral center coordinates and radii, and score 1 point for each correct answer.

$$\text{Example: } (x-2)^2 + (y-3)^2 = 25$$

Round two graphs will have integral center coordinates and irrational or integral radii; score 2 points for each correct answer.

$$\text{Example: } (x+3)^2 + (y-4)^2 = 7$$

$$\text{Example: } (x-1)^2 + (y+4)^2 = 16$$



Circle Graphing

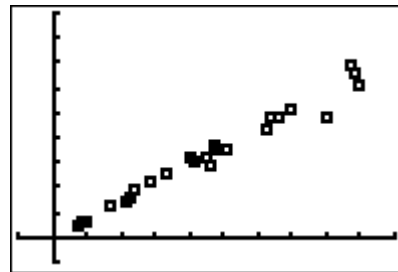
A whole-class graphing calculator statistics activity

Materials: Assorted circular objects (or have students bring from home), flexible tape measures (sewing-type works better than carpenter-type), graphing calculators

1. Students select or bring a circular object. (Note: Students can be assigned the previous day to bring objects from home. Offer a prize for the largest, most unusual, etc.)
2. Each student measures and records the circumference and diameter of his/her object. Emphasize the need to *measure*. Record this data in a table.
3. Enter data into graphing calculator: diameter in List-1, circumference in List-2. (Depending on students' calculator skills, this can be done individually, in teams, or large group.)

L1	L2	L3	3
80	240		
47	183.3		
64	236.8		
9	30.6		
87	348		
9	28.8		
23	78.2		

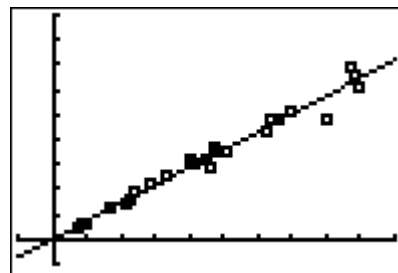
L3(1)=



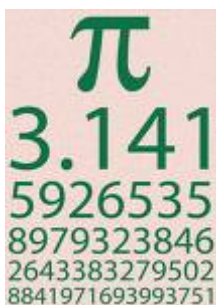
4. Create a scatterplot of diameter (x-axis) vs. circumference (y-axis).
5. Discuss and predict a possible line of fit.
6. Calculate and graph a linear regression equation for the data.

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LinReg
y=ax+b
a=3.602570055
b=-.7458020336
r²=.9757058843
r=.9877782566
  
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7. Discuss slope, y-intercept, and correlation.
8. Use the regression equation or trace to predict circumference given diameter of an object.
9. Use List-3 to generate circumference/diameter data (L-2/L-1). Discuss the values obtained, measurement error, etc.



Digits of Pi

A whole-class graphing calculator or spreadsheet activity with frequency distribution

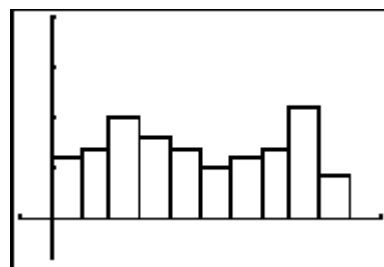
Materials: handout with 1000 digits of pi*, graphing calculators or spreadsheet

1. Assign students to tally the frequency of each digit (0-9) as it appears in pi. Use more or fewer rows, depending on the number of students in the class*
2. Each student tallies one row, then results are pooled.
3. Use the pooled data to enter digit# in List-1 and frequency in List-2 (Depending on students' calculator skills, this can be done individually, in teams, or large group.)
4. Calculate 1-variable stats (List-2) to discuss mean, median, mode, 5-number summary etc.
5. Construct a histogram of the data.

L1	L2	L3	Z
0	5	-----	
1	7		
2	10		
3	8		
4	8		
5	5		
6	5		
7	5		
8	5		
9	5		
L2(1)=6			

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1-Var Stats
x̄=7.1
Σx=71
Σx²=545
Sx=2.131770261
σx=2.022374842
↓n=10
  
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First 1000 digits of pi*

3.1415926535 8979323846 2643383279 5028841971 6939937510 5820974944 5923078164
0628620899 8628034825 3421170679 8214808651 3282306647 0938446095 5058223172
5359408128 4811174502 8410270193 8521105559 6446229489 5493038196 4428810975
6659334461 2847564823 3786783165 2712019091 4564856692 3460348610 4543266482
1339360726 0249141273 7245870066 0631558817 4881520920 9628292540 9171536436
7892590360 0113305305 4882046652 1384146951 9415116094 3305727036 5759591953
0921861173 8193261179 3105118548 0744623799 6274956735 1885752724 8912279381
8301194912 9833673362 4406566430 8602139494 6395224737 1907021798 6094370277
0539217176 2931767523 8467481846 7669405132 0005681271 4526356082 7785771342
7577896091 7363717872 1468440901 2249534301 4654958537 1050792279 6892589235
4201995611 2129021960 8640344181 5981362977 4771309960 5187072113 4999999837
2978049951 0597317328 1609631859 5024459455 3469083026 4252230825 3344685035
2619311881 7101000313 7838752886 5875332083 8142061717 7669147303 5982534904
2875546873 1159562863 8823537875 9375195778 1857780532 1712268066 1300192787
6611195909 2164201989

*<http://www.math.com/tables/constants/pi.htm>

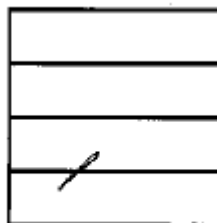
Buffon's Needle

Probability and Pi

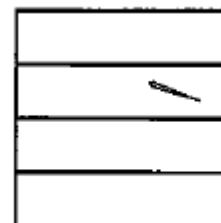
Materials: toothpicks, lined paper

Data Collection

1. Toss a toothpick randomly onto an array of parallel and equidistant lines. The length of the toothpick must be less than or equal to the distance between the lines.
2. If the needle intersects a line, it is a *hit*. Otherwise it is a *miss*. (If the toothpick misses the paper, it is a scratch. Repeat the sample.)
3. Perform the experiment 100 times. Record the number of hits and misses. (Suggestion: work with a partner, one person performs the experiment and the other records results.)



hit



miss

Hits	Misses

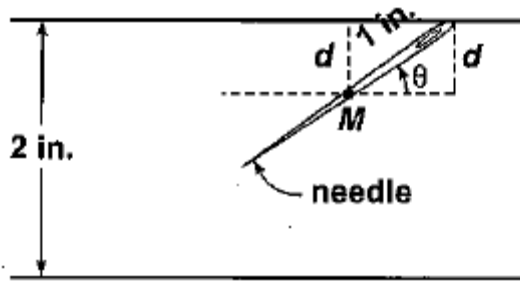
4. Pool the data collected from all groups.

Pooled data: Hits	Pooled data: Misses

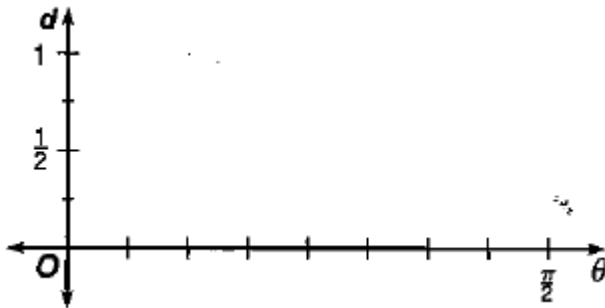
5. Compute the experimental probability of a hit. $P_e = (\text{\#hits})/(\text{\#trials})$

Analysis:

1. Assume that a 2-inch toothpick falls at an angle θ with the horizontal and that the top of the toothpick just touches a line. Find the distance d of the toothpick's midpoint M from the line.



2. Graph the function that relates θ and d for the interval $0 \leq \theta \leq \pi/2$.



3. Suppose that the toothpick lands at an angle θ but a distance less than d . Is the toss a hit or a miss? Shade the portion of the graph containing points that represent hits.
4. The area under the curve (definite integral) between $x=a$ and $x=b$ is given by $\int \sin x \, dx = -(\cos b - \cos a) = \cos a - \cos b$ when the angle is measured in radians. Find the area of the shaded region of the graph.
5. Draw a rectangle around the graph for $d = 0$ to 1 and $\theta = 0$ to $\pi/2$. What is the area of the rectangle?
6. The theoretical probability P_t of a hit is the area of the set of all hit points (#4) divided by the area of all possible landing points (#5). Compute the theoretical probability of a hit.

$$P_t = (\text{shaded area}) / (\text{total area})$$

7. An experimental value for π can be calculated since $P = 2/\pi$; $\pi = 2/P$. Use your experimental data to compute a value for π .

Student Assignment: Write about Pi Day!

In two or more paragraphs, discuss the following:

- Today's Pi Day activity:
What did you learn from today's activity? (at least two specific things)
Did you like the activity? (yes or no) Explain.
How could the activity be improved? Be specific.
- Propose a new activity for Pi Day next year.
The activity must involve pi or circles in some way.
It must be appropriate for use in the classroom. (Consider noise, mess, safety, etc.)
The activity may not involve food.
Provide rules, materials, game set-up etc. Be specific enough for your idea to be used for an activity next year.
- Anything else you have to say...?

Chaos in Ius—a Geometrical Fairy Tale

By Linda Cohen (6th grade student)

Once upon a time there was a knight and his name was Cir Cumference. Cir Cumference lived in a town called Ius. He was not a rich prince but a poor knight desperately in love with the lovely Maid *Minor Arc*. Her father was *Major Arc*, who fought against the invaders in a raid of their town, Ius, which was called the “raid of Ius” or “*Radius*.” But poor Cir Cumference! He could not marry Maid Minor Arc unless he showed he was worthy of her, and how could he do that? You see Cir Cumference was not really a knight of high honor. He had never even fought in a battle.) The only thing he did was play the piano. He wrote a lovely song for Maid Minor called “*Inscribed Angel*” (which by the way was made up of two *chords*), but she only laughed and said, “For this you believe you are worthy of me? Ha!”

One day while Cir Cumference was thinking of a new way to prove his worthiness to Maid Minor ac, he heard his mother calling him. (His mother’s name was *Semi-Circumference*, but her maiden name was *Semi-Circle*. Her father was *Full Circle*, a great blacksmith known throughout the land for his fine work.) “Come here dear, Major Arc is here to see you.” Cir Cumference bowed his head in honor of the great warrior. “Yes sir, you wished to see me?” “Yes I did!” Major Arc boomed. “That crazy dragon, Amiter, has captured my poor daughter in his cave and will not let her out. I would rescue her myself, but I am too old. I have heard that you wish to prove your worthiness to my daughter, and what better way than this!” Cir Cumference thought about this for a minute and said, “Yes, I believe I will try it.”

“Fine” said Major Arc and handed him a map of where to find Amiter’s cave. “If you succeed, you shall have the hand of my daughter in marriage.”

Cir Cumference started out at once, packing a bag with weapons and provisions. It was very hot out—in fact, it was *360 degrees*—and it was a hard journey. When he reached the cave he should “Amiter! I know you are in there! Give me the maiden at once, you coward!” When Amiter heard this he went off on a *tangent*. “A coward, I? Never!” He flew at Cir Cumference, but Cir Cumference was too quick for him. Cir Cumference pulled out his sword and stabbed the dragon, as he shouted “*Die Amiter!*” And of course Amiter did die. Cir Cumference then ran into the cave and scooped up Maid Minor Arc and took her back to her home. “Oh Cir Cumference I will be eternally grateful. How can I repay you?”

“By marrying me, fair maiden.”

“It is done then.”

And so the two lived happily ever after until they grew old and gray, but yet still cheerful, rosy, plump, and round!

Quickies

Circle Darts

1. Cut 8-inch diameter circles out of construction paper.
 2. Mark a start line on the floor with tape.
 3. Use a hula hoop or large circle on the floor for a target. Place a penny at the center of the circle for a bulls-eye.
 4. Students throw the circles Frisbee-style. Play one or more rounds.
- Scoring: Covering the bulls-eye 10 points
Touching the bulls-eye 5 points
Inside the hula hoop 3 points
Touching the hula hoop 1 point



Pin the Radius on the Circle

1. Draw a large circle on the board or poster.
2. Cut out strips of construction paper the length of the radius.
3. Blindfold students and spin them around a few times.
4. Students attempt to place the radius on the circle.

Circle Drawing Contest

1. Distribute scratch paper to students, or have students work at the board.
2. Students attempt to draw freehand the most perfect circle of a given diameter—no erasing allowed.
3. Hint: A coffee cup makes a good judging tool for a 3-inch diameter circle.

Pi Concentration

1. Provide students with a copy of the first 100 digits of pi.
2. Students will have 2 minutes to memorize as many digits as possible.
3. Supply students with scratch paper.
4. Give students 30 seconds to write down as many digits of pi as possible.

Pi on the Web

Pi Search <http://www.angio.net/pi/bigpi.cgi>

Teach Pi <http://teachpi.org/>

Joy of Pi <http://www.joyofpi.com/>

Digits of Pi <http://www.math.com/tables/constants/pi.htm>

Send a Pi Day e-Card http://www.123greetings.com/events/pi_day/

Pi Across America <http://www.piacrossamerica.org/>

The Mathematics of Pi <http://www.arachnoid.com/lutuspi/pi.html>

Mathematics Educators of Greater St. Louis <http://www.mobot.org/education/megsl/pi.html>

