Pi-Day Fun

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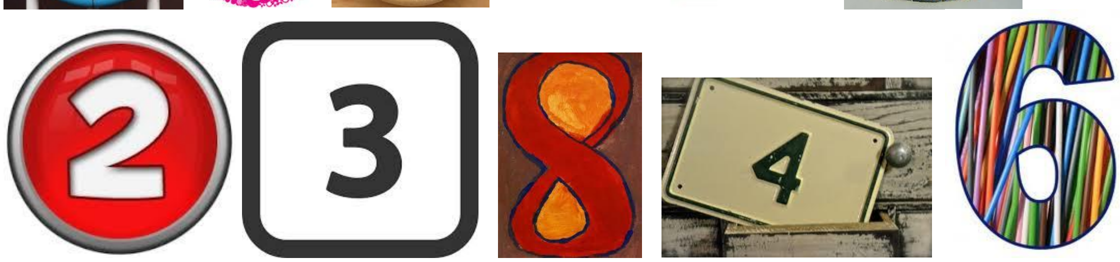
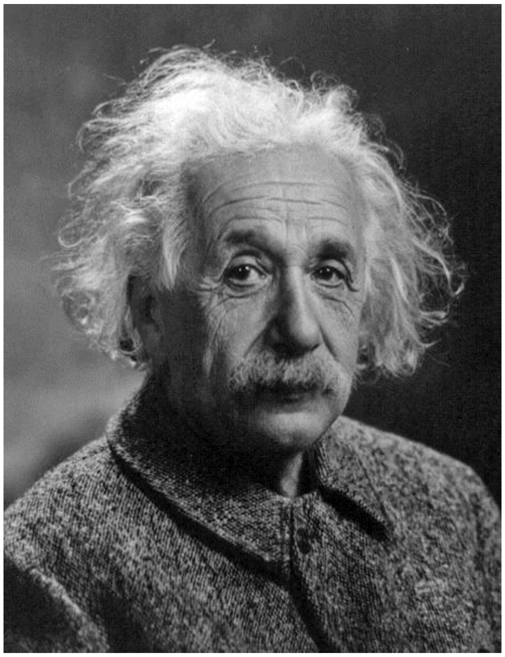
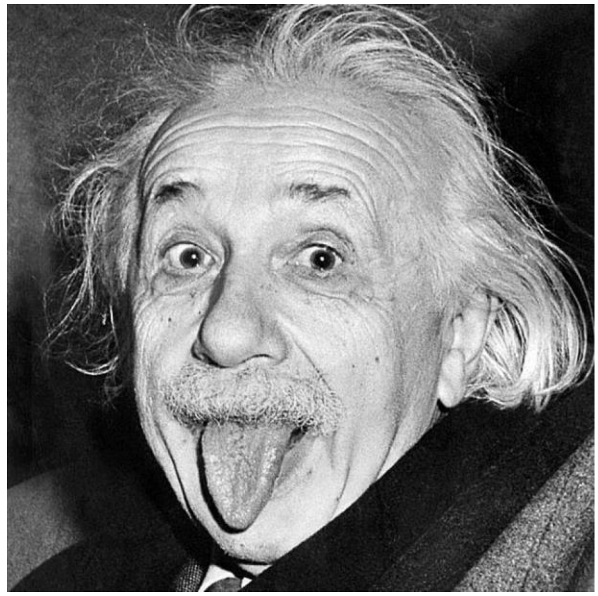
What Is Pi?

Pi is the circumference of a circle (the distance around the circle) divided by its diameter (the distance across). In other words, the circumference of any circle is approximately 3.14 times its diameter. Because pi is an irrational number, it has an infinite number of digits. No matter how many decimal places we calculate, pi will always be an approximation.

Because pi is the same for every circle, we can use it to determine the diameter if we know the circumference, or vice versa. And when we know the diameter, itõs easy to calcula
This gif (animated sequence) that "unrolls" pi will give your students a quick visual of how a circleõs diameter
related.



Albert Einstein

Albert Einstein õs Birthday is on March 14 th 1879 (3-14). He was born in Germany and was theoretical physicist who developed the general theory of relativity!

Introduce Albert Einstein
http://www.brainpop.com/science/famousscientists/alberteinstein/preview.weml

How does a scientist become a househol d name? In this BrainPOP movie, Tim and Moby introduce you to the astounding career of Albert Einstein, the physicist who revolutionized our understandin
learn where and when he was born and why no one thought he would grow up to be one of the smartest people ever! Youôll
a job after college and what he did in his sp
major accomplishment he made in 1905, and you
to his theory of relativity. Pl us, find out when he won the Nobel Prize, to what use he put his celebrity, and why he left Europe for the United States. They just donôt come any smarter!

Teaching Albert Einstein http://www.bookrags.com/lessonplan/albert-einstein/

The *Albert Einstein* lesson plan contains a variety of teaching materials that cater to all learning styles. Inside you'll find 30 Daily Lessons, 20 Fun Activities, 180 Multiple Choice Questions, 60 Short Essay Questions, 20 Essay Questions, Quizzes/Homework Assignments, Tests, and more. The lessons and activities will help students gain an intimate understanding of the text; while the tests and quizzes will help you evaluate how well the students have grasped the material.

Albert Einstein Labs & Activities: PBS NOVA ONLINE

http://www.pbs.org/wgbh/nova/education/activities/3213_einstein.html

Albert Einstein's famous equation, $E = mc^2$, is known to many people but understood by few. This guide ð which includes five lesson plans and a time line ð is designed to help you and your students learn more about the stories and science behind this renowned formula. Intended for middle and high school students, the lessons look into the lives of the innovative thinkers who contributed to the equation, investigate the science behind each part of the equation, and explore what the equation really means.

Each activity includes a teacher activity setup page with background information, an activity objective, a materials list, a procedure, and concluding remarks. Reproducible student pages are also provided. Most activities align with the National Science Education Standards' Physical Science standard, Structure of Atoms and Structure and Properties of Matter sections.

Following are a few interesting classroom activities to share with your students:

Pi Facts

On March 12, 2009 C ongress passed and denoted that March 14th i s o f f i c i a l l y N a t i o n a l ò P i ó D a y .

The record has been broken (again)!

It's hard to imagine a trillion of anything (it's a million million), but Shigeru Kondo calculated 5 trillion digits of pi in August of 2011... and then blew that away with 10 trillion digits!

It was only a couple of years ago that Fabrice Bellard had calculated 2.7 trillion (2.7 thousand thousand million) decimal digits of pi. It took over 130 days, but he did it with a single PC (running Linux) and a very powerful algorithm. You can read about it on his Web site or in this BBC news article. Unfortunately, the digits have not been fully verified with a second run using a different algorithm.

Previous records: In September, 1999, Dr. Kanada of the University of Tokyo calculated 206,158,430,000 decimal digits of pi (approx.3*2^36). In September 2002, he and his team broke their own world record, calculating 1.2411 trillion digits (over six times more than before). Click here for another news repo rt. And in August 2009, they calculated and verified 2.5 trillion digits.

For more on world records, see this Wikipedia entry.

Check out this amazing display of the first million digits of pi.

Pi Birthday

Here is a website that calculates your age in Pi Years
http://pidays.jtey.com/31/12/1968

ÙTrivia

1. Go to this site http://pamburke.wikispaces.com/Pi+Day It has three versions of "Are You Smarter Than a 5th Grader?" The format is the same for all three games, but they include different questions. There is also a pdf file with instructions for using and/or modifying the files.

2. Go to this site http://www.eveandersson.com/pi/trivia/?= and have students research and look up answers in one of these two books:
The Joy of Pi by David Blatner or A History of Pi by Petr Beckmann.

Name: ___________________________________ Period: ________ Date: _______

PI SCAVENGER HUNT

1) What is the CIRCUMFERENCE of a circle?

http://www.math. com/school/subject3/lessons/S3U1L6GL.html

2) What is the DIAMETER of a circle?

http://www.mathgoodies.com/lessons/vol2/circle_area.html

3) What is PI the ratio of?

http://mathcentral.uregina.ca/RR/glossary/middle/

4) Is PI a rational or irrational number? Explain wh y.

http://www.mathisfun.com/irrational -numbers.html

5) What is PI to 30 decimal places?

http://gc3.net84.net/pi.htm

6) What value of PI did the Egyptians obtain 2000 years before Christ?

http://facts.randomhistory.com/2009/07/03_pi.html

7) What value of PI did the Babylonians obtain?

http://facts.randomhistory.com/2009/07/03_pi.html

8) About 150 AD, what value of Pi di d Ptolemy of Alexandria (Egypt) figure?

http://www.ms.uky.edu/~lee/ma502/pi/MA502piproject.html

9) Find your birthday in PI. Type in your date of birth and record the location.

http://www.facade.com/legacy/amiinpi/

10) In the year 1997, D. Takahasi and Y. Kanada calculated PI to 51,539,600,00 decimal places. What type of computer did they use?

http://numbers.computation.free.fr/Constants/Pi/piCompute.html

11) Which fraction is closest to the actual value of PI... 337/120 or 22/7 or 355/113?
http://thestarman.pcministry.com/math/pi/pifacts.html

12) What does it mean to "Square a Circle"?

http://en.wikipedia.org/wiki/Squaring_the_circle

13) What is the symbol for pi? Who first used it and when? What Swiss mathematician was it popularized by?

http://www.ualr.edu/lasmoller/pi.html

14) Who were the first people known to find a value of pi? When was it?

http://thestarman.pcministry.com/math/pi/pifacts.html

15) In the first one million digits of pi, how man y threes are there? How many nines?
http://www.eveandersson.com/pi/precalculated -frequencies

16) You can memorize PI by using things called "mnemonics". What is a "mnemonic"?
http://dictionary.reference.com/

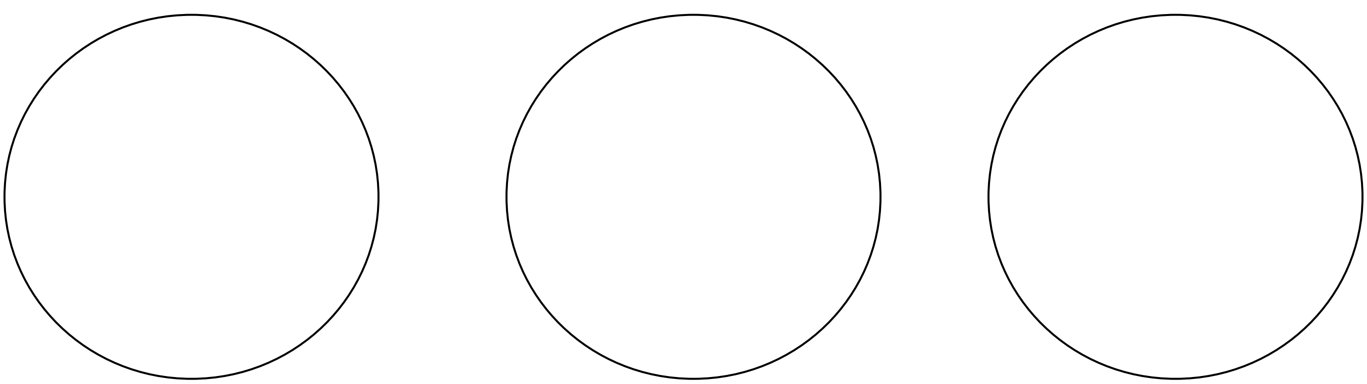
17) What was the mos t inaccurate version of PI? Explain who, when, and what the value was (sentence form). http://briantaylor.com/Pi.htm

18) Who memorized 42,195 digits of PI on Feb. 18, 1995? Where was the person from?
http://briantaylor.com/Pi.htm

19) What state in the US tried to pass a law to legislate the value of pi? When was it?
http://wwwmath.uc denver.edu/~wcherowi/courses/history2/quad2.pdf

20) Label the circle(s) with the following vocabulary words: radius, chord, diameter, arc, semi - circle, inscribed angle, and central angle

http://www.math.com/school/subject3/lessons/S3U1L6EX.html



Pi Day Scavenger Hunt

3 Geometric solids which have circular cross-sections (turn in pictures, labeled with the names of the solids)

.

1 US city with a ZIP code containing the first 5 digits of pi – beginning with the 3 (name the city and state)

4 Capital letters of the alphabet – in block style – with rotational symmetry (list the 4 letters)

1 US state which tried to legislate a value for pi (name the state and the year in which the action was taken)

5 Formulas which include π (give the formulas in symbols and tell what each formula represents)

9 Labels or advertisements for products which use circles in their name or logo (turn in the actual labels or pictures from advertisements in newspapers, magazines, or from the internet)

2 US cities with names that have references to something circular – cities should not both be in the same state (name each city and state)

6 US state flags which include circles in their design (turn in pictures of the flags)

5 Sports or games which use a circle or a sphere in their play (turn in pictures of the circles or spheres from the games, labeled with names of the games)

3 Famous people with birthdays on March 14 (give name and year of birth)

5 Movie titles with references to something circular (list the movie titles)

8 Kinds of candy that comes in circular pieces (turn in packages or pictures of candy from advertisements or internet)

9 Song titles with references to something circular (list the song titles)

7 Recipes for different kinds of pie (turn in complete recipes)

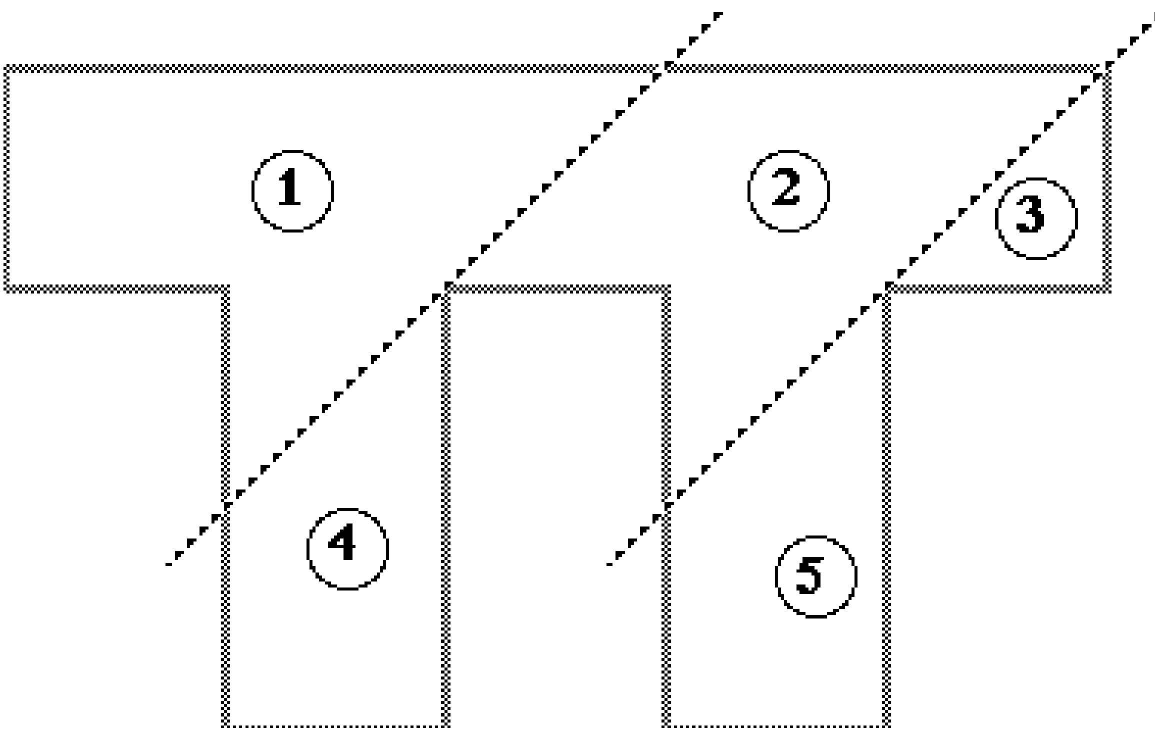
Warm-up problems

Roman Numeral

Review Roman numerals. Set up toothpicks like the problem below. Move only 1 toothpick to make the equation true. (Not allowed to make the equation unequal).

Pi Puzzle

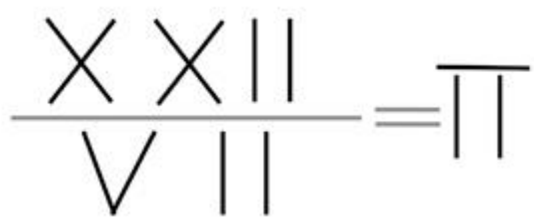
Cut up the Greek letter Pi into five pieces. Rearrange the pieces to form a square.



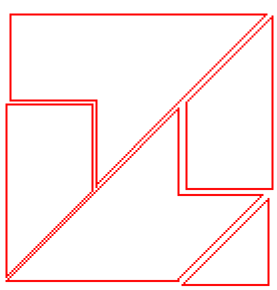
Puzzle Author: Stephen Froggatt

Answers:Warm- up problems

Roman Numeral



Pi Puzzle



Tossing

Materials

large sheet of drawing paper or cardboard
meterstick
pen
toothpicks (30 or more)
calculator

To Do and Notice

Draw a series of parallel lines on the paper or cardboard, as many as will fit, making sure that the distance between each line is exactly equal to the length of your toothpicks. Now, one by one, randomly toss toothpicks onto the li
toothpicks ñ or tired of tossing.

Itõs time to count. First, remove poke out beyond the p
paperõs edge. Then count up the total number
of toothpicks that cross one of your lines.

Now use this formula to calculate an approximation of pi:
Pi = 2 × (total number of toothpicks) / (number of line -crossing toothpicks)

Whatõs Going On?

This surprising method of calculating pi, known as *Buffonõs*, was first discovered in the late eighteenth century by French naturalist Count Buffon. Buffon was inspired by a then-popular game of chance that involved tossing a coin onto a tiled floor and betting on whether it would land entirely within one of the tiles.

The proof of why this works involves a bit of meaty math and makes a delightful diversion for those so inclined. (See links at bottom of page.) Increasing the number of tosses improves the approximation, but only to a point. This experimental approach to geometric probability is an example of a *Monte Carlo method*, in which random sampling of a system yields an approximate solution.

Cutting

Materials

circular object
string
scissors
tape

To Do and Notice

Carefully wrap string around the *circumference* of your circular object. Cut the string when it is exactly the same length as the circumfere stretch it across the *diameter* of your circular object. Cut a your òstring circumferenceó as you can. How data with that of others. What do you notice?

Whatõs Going On?

This is a hands-on way to divide a circleõs circumfere circle you use, youõll be able to cut 3 comp over. Estimate what fraction of the diameter this small piece could be (about 1/7). You have òcut pi,ó about 3 and 1/7 pieces of string, the circumference. Tape the 3 + pieces of string onto paper and explain their significance.

Wearing

Materials

cloth tape measures
calculators
hats with sizes indicated inside them

To Do and Notice

Most hat sizes range between 6 and 8. Brainstorm ideas for how such sizes could be generated. Then use measuring tape to measure people's heads. (As you do this, think of where a hat sits on a head). Use calculators to manipulate measurements. Now compare your results with the sizes written inside the hats. Do your numbers look like they could be hat sizes? (Hint: Try using different units of measurement.)

Whatõs Going On?

Hat sizes must be related to the circumference of the head. The head usually ranges between 21 and 25 inches us the hat size.

Seeing ʻ

Materials
can of three tennis balls
cloth tape measure

To Do and Notice
Which do you think is greater, the height or the circumference of the can? Measure to find out.

W h a t õ s G o i n g O n ?
If you were fooled (and we expect that most people are), blame pi.

You can see that the height of the can is approximately 3 tennis -ball diameters, o r $h = 3d$. But the circumference is pi times the tennis -ball diameter, or $c =$ d.ôPi ñ 3.14 ñ is a little greater than 3, so the circumference of the container is slightly greater than the height.

Measuring ʻ

Materials
C i r c u l a r H o u s e h o l d i t e m s : c a n s , j a r s , g l a s s e

To Do and Notice
Mea s u r e t h e d i a m e t e r a n d t h e c i r c u m f e r e n c e o f
t h e w a y a r o u n d) o f t h e c i r c l e b y t h e d i a m e t e
other).

C ö d = ô

W h a t õ s G o i n g O n ?
You should have a clear understand ing of the relationship between the circumference and the diameter. If you are giving other situations involving circles you should be able to apply this knowledge.

´Line Lab

Pi Line Lab http://illuminations.nctm.org/LessonDetail.aspx?id=L575

Students measure the diameter and circumference of various circular objects, plot the measurements on a
and relate the slope of the line tō Σ ű Ꮶ Ŝ ǸJ ŀ ű ƛ ƻ ƻ Ŧ Ŏ ƛ ǸJŎdzƳ Ŧ ŜǸJŜ ƴŎ Ŝ ű ƻ

Learning Objectives

Students will:

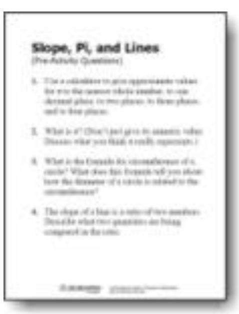
- Select appropriate scales to plot data collected.
- Write an equation of a line of the form $y = ax$.
- L ƴ ű ŜǸJLJǸJ Ŝ ű ˉ ŀ ă ŀ ǸJ ŀ ű ƛ

Materials

Circular objects of various sizes
Masking tape (preferably of bright color)
Scissors
Graph paper
Ruler or measuring tape
Graphing calculator (optional)

Instructional Plan

Display the first page of the Slope, Pi, and Lines overhead on the projector. Use these questions to conduct a
discussion. Note that these questions are merely to set the stage for the activity; it is not necessary that e
question be fully answered during the discussion.


Slope, Pi, and Lines
(Pre-Activity Questions)

Slope, Pi, and Lines Overhe

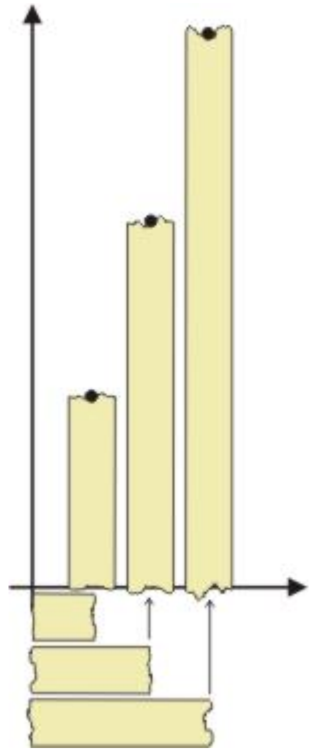
After the discussion, draw a coordinate plane on a whiteboard and label both axes with the same scale. (Actual measurements in centimeters or inches would be good, if the scale can go high enough to represent the circumference of the largest circle.) Points will only be plotted in the first quadrant.

Demonstrate the following process, which will be used during the lesson:

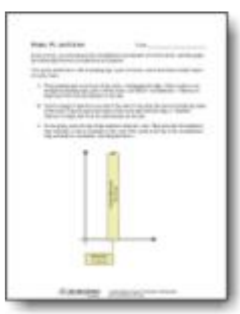
1. Wrap masking tape around the circle, overlapping the tape at the ends.
2. Cut the tape and put it on the whiteboard to display the circumference. Write the word *circumference* on the piece of tape.
3. Stretch another piece of masking tape across the widest part of the circle (the diameter) through t

center and cut off the ends. Write the word *diameter* on the strip of tape.

4. For each circle, stretch the tape for the diameter below the *x*-axis and parallel to it. At its end, position the tape for the circumference of that circle so that one end rests on the *x*-axis, and stretch the tape vertically. Plot and label the point at the top of the circumference strip. (See diagram below.)



Distribute the Slope, Pi, and Lines activity sheet. Students will answer the questions on this sheet as they proceed through the activity.



Slope, Pi, and Lines Activity Sh

Divide students into groups of three students each. Each group will need several circular objects of different sizes, a roll of masking tape, a pair of scissors, and a whiteboard. Allow them to measure and record the diameter and circumference of at least three objects. More items can be used if time permits.

After all groups have plotted several points, reconvene the entire class. Ask students to use their data to predict the circumference and diameters of various circles if the other piece is known. For instance, ask them to predict the circumference if the diameter is 22 centimeters [approximately 69.1 centimeters], and ask them to predict the diameter if the circumference is 12 centimeters [approximately 3.8 centimeters]. Students should recognize that the points form a straight line and that the line can be extended to make predictions.

Discuss where the y-intercept of the line is likely to occur. Students should recognize that the points seem to be on a line that will pass through the origin. To reinforce the idea, ask the following questions:

- What is the *y*-coordinate of the *y*-intercept for any line? [0]
- In the context of this problem, what does an *x*-value of 0 mean? [In the graph, *x*-values represent the

diameter, so an *x*-value of 0 indicates that the diameter is 0.]

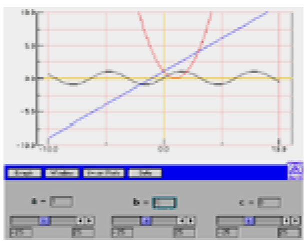
- For a circle with a diameter of 0, what is the circumference? [0]
- So, where *should* the *y*-intercept occur for the line in your graph? [At the origin.]

Have students estimate a line of best fit for their scatterplot. Note that this is best done *after* the discussion about the *y*-intercept. Although the masking tape measurements will give approximate points, students can be certain that the point (0,0) occurs along the line of best fit. Therefore, students can place a piece of uncooked spaghetti with one end at the origin, and move the other end to approximate the line.

Allow students to generate an equation that represents their line of best fit.

You may wish to have students enter the data that they gather into a graphing calculator and use the regression feature to find the line of best fit. Alternatively, students can use the Spreadsheet and Graphing Tool as follows:

- Choose the Data tab. The diameters can be entered in Column A, and the circumferences can be e in Column B.
- Select Y= or Plots and highlight *Plot 1: Column A, Column B*. A scatterplot of the data will appear when the Graph tab is selected. (The values in the Window tab may need to be adjusted to view all points in the scatterplot.)
- Return to the Y= or Plots tab. Students can estimate an equation for the line of best fit and return to the Graph to see how well their estimate approximates the data.

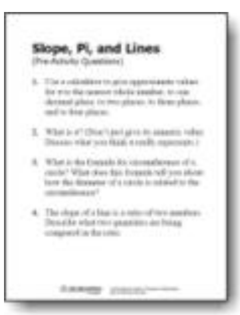


Spreadsheet and Graphing T

Discuss how the slope of the line relates to the circle. Ask, "What formula does the above equation of a line approximate; that is, what formula relates circumference to diameter?" Some students may know the answer to this question because they know the formula *C* = ´*d*, and this question was discussed in the Pre-Activity Questions. Others may not, and this is a good opportunity to discuss the concept of "constant rate of change." If students have difficulty recognizing that the slope of their line is approximately ´, it might be helpful to have them calculate the slope by hand using one of the data points and the *y*-intercept. Then, discuss what quantities are being compared.

Questions for Students

The following questions appear on the second page of the Slope, Pi, and Lines overhead.



Slope, Pi, and Lines Overhe

What does it mean to say that ´ is a ratio? What is being comp

[Circumference is compared to diameter. Specifically, ...]

What does it mean to say that the slope of a line is a ratio? In this activity, what quantities were being compared?

[The slope of a line compares the ratio of change in *y*-values to change in *x*-values. In this activity, the chan
in circumference was compared to the change in diameter. Because this ratio is always equal to ̄ Σ ŭ Ķ Ş
constant rate of change.]

Does the ratio of circumference to diameter vary depending on the size of the circle or the type of measurement (in., cm)? Explain.

[No. The ratio of circumference to diameter is constant, because all circles are similar. What measure
are used has no impact on the ratio.]

How does your equation relating circumference and diameter relate to the slope intercept equation $y = mx + b$? What are the values of *m* and *b* in your equation?

[Written in slope-intercept form, the circumference formula would be $y = \bar{}x + 0$, meaning that $m = \bar{}\ \Sigma$ and $b = 0$.]

Why are *x* and *y* considered variables, and why are *m* and *b* considered constants?

[The variables *x* and *y* represent quantities that change. Although also represented with lowercase lette
both *m* and *b* are not variables because their values do not change, so they are considered constants.]

Assessment Options

1. Use a "think-pair-share" strategy to have students discuss whether the ratio of circumference t
diameter varies depending on the size of the circle. First, ask students to decide individually wheth
the ratio varies, and have the class vote. (You might want to use "finger voting" so that all
students vote at the same time. Students raise one finger for the first choice or two fingers for
second choice.) If the voting reveals that some students think the ratio changes, pair those stu
with other students who think the ratio is constant. After discussion, have students revote. If s
students still think the ratio varies, ask others to suggest ways of convincing the student that the
ratio is constant. Suggestions might include calculating the ratio of circumference to diameter
calculating the slope of the line using various combinations of data points.
2. In their journals, allow students to summarize what it means that slope is a ratio and that ̄ ƛ ă

Extensions

1. Allow students to consider the following situation:
! ă ŀ ăLJ ƻNJŭ ă ŀ ∃ Ŝ ỿ ŭ Ŧ ƻNJ ŀ ŭ Ķ ƪ Ŝ ŭ Ŝ ă Σ Wdz ỿ Ŝ ∃ Ŝ ŭ ă
different ordered pairs of ŭ Ķ Ŝ Ŧ ƻNJỲ ó ŀ ŭ Ķ ƪ Ŝ ŭ Ŝ Ω ă Ŝ ŀ NJ ỿ ƛ ỿ ∃ ă Σ W
the equation of the line through the points; determine the slope of the line; and discuss the me
of the slope of the line. Of what two quantities is the slope a ratio? How is this problem similar to th
circle problem?
2. Give each group a sheet of centimeter graph paper with circles of different sizes drawn over t
Each group then estimates the radius of their circles as well as the area by counting squares.
Students record the data for each circle as a point of the form (r, A), where *r* is the radius and *A* is the
area. Students can then create a scatterplot of the points, but before they do so, have them
speculate as to the shape of the graph; is it likely to be linear or quadratic? Students should then us
the regression feature to find the equation of the graph and consider the coefficient of the vari
You might want to ask, "What would be a more accurate equation? How do you know?" [The a
a circle is given by the formula, $A = \bar{}r^2$, so the coefficient should be approximately ̄ Φ 6 ¦ ă Ŝ
formula to form at least six data points of the form (r, A). Plot the points and discuss why ̄ is not the
slope of a line in this situation. For a given area, have students use the graph to estimate the

radius of the associated circle.

Teacher Reflection

- Did students develop a greater understanding of slope as a rate of change?
- Did students make the connection that pi is a ratio comparing circumference to diameter, no r the size of the circle?
- How did you challenge the high-achievers in your class?
- Was your lesson appropriately adapted for the diverse learner?
- Did you set clear expectations so that students knew what was expected of them? If not, how you make them clearer?

A Math Forum Web Unit Jon Basden jbasden@mac.com

T h e D e r i πv(aPt i i)o n

May	I	Have	A	Large	Container	of	Coffee
3	**1**	**4**	**1**	**5**	**9**	**2**	**6**

Jon Basden's Lessons || Teacher Exchange || TE: Grades 6-8

Grade Level

7th Grade

Approximate Time

Two forty minute class periods

Materials Required

- six or so circular objects of various sizes
- string
- meter sticks
- paper
- pencils
- student worksheets
- overhead transparency of student worksheet
- computer with spreadsheet program

Optional Materials

- Pre-made spreadsheet in Microsoft Excel 97
- Math Madness cassette tape -- the Pi Song
  (Can order from Bob Garvey for $8.50 at bgarvey@aol.com)
- First 1001 digits of Pi on overhead transparency

Sources

Modifications of:

- "Discovering Pi" lesson from Math in the Middle Handbook, Prentice Hall, 1993
- Circles - Diameter, Circumference, Radius and the Discovery of Pi

Description

1. Divide students into small groups.

2. Have each group measure diameter and circumference of each of the circular objects in the room. They should record their results on their student worksheets.
3. Students should complete the requirements on the worksheet. Hopefully, they will see the pattern that circumference divided by diameter is about 3.14159265358... (π).
4. Depending on time, space, and resources, the groups can begin taking turns entering their data into the spreadsheet, so that we can begin to see that the class averages for the C/d ratio is very close to pi each time.
5. From the generalizations that C/D = pi, the teacher can lead the students to see how we get the formulas $C = D\pi$ and $C = 2\pi r$.
6. To help the students avoid the common misunderstanding that the digits of Pi do not stop after 3.14, one may show them the first 1001 digits of Pi. This can aid them in visualizing the complexity of the number.
7. To reinforce the formulas that the students have generated, the teacher can assign an assignment that requires the students to apply the relationships between diameter, radius, and circumference.

Software

Microsoft Excel or other spreadsheet

Web sites

Pi Mathematics

Pi Pages

Pi through the ages

Assessment

The instructor will be able to informally assess the comprehension of the students as the lesson progresses. This will enable the instructor to determine if any additional lecture is needed concerning the relationship between circumference and diameter before additional examples are shown.

Also, before he or she assigns independent practice, he or she will check for understanding by asking questions of individual students, and he or she will have students work examples for the class.

More formal evaluation will come as a result of the students completing an independent assignment that allows them to practice using the formula for the circumference of a circle and to work backwards with the formula to find the radius and/or diameter if given the circumference.

Circumference vs. Diame
Circle Measuring A

To complete these exercises, you will work in groups of three. Follow the directions on this sheet, beginning with the questions below. For questions, A, B, D, E, and F, you will need to write your answers on a separate sheet of paper. You may use this sheet to complete part C.

Questions:

A. Define *diameter.*

B. Define *circumference.*

There are six round items in the room. You will measure the circumference and diameter of each object. Give your measurements in **millimeters**. Fill in the table below for each item. Next, **add**, **subtract**, **multiply**, and **divide** the values in the "C" and "D" columns to complete the table.

C.

Number	Object	C (mm)	d (mm)	C + d	C- d	C * d	C / d
1.							
2.							
3.							
4.							
5.							
6.							

D. How do *circumference* and *diameter* appear to be related?

E. How are *radius* and *diameter* related?

F. How does this tell us that *radius* and *circumference* are related?

Spreadsheet for the Deriv

Below are the formulas that you could input into a spreadsheet to set it up so that the students can quickly enter their group's measurements. You can also **download a spreadsheet** in Microsoft Excel 97 format.

Row/Column Name	A	**B**	**C**	**D**
1	*Group*	*Circumference (mm*	*Diameter (mm)*	*Ratio (C/d)*
2	R			=B2/C2
3	S			=B3/C3
4	T			=B4/C4
5	U			=B5/C5
6	V			=B6/C6
7	W			=B7/C7
8	X			=B8/C8
9	Y			=B9/B9
10	Z			=B10/C10
11	Average	=AVERAGE(B2:B10)	=AVERAGE(C2:C10)	=AVERAGE(D2:D10)

Send comments to: Jon Basden - jbasden@mac.com

Finding the Square Root of ´.

Objective: Students will use the Binary Search Method to find the approximate value of the square root of pi.

Materials:

-Worksheet
-Calculator

Pre-requisites:

-Definition of Rational and Irrational Numbers
-Squares/square roots of numbers
-Compare decimals: sma llest to largest
-Finding averages

Procedure:

1. Review squaring a number and taking the square root of a number. Once they have mastered this concept have them use the calculator to find the square root of several numbers.
2. Explain to students that mathemat icians wondered if it was possible to find the square root of pi. Because pi is irrational (definition: an irrational number cannot be written as a fraction. Irrational numbers are non - ending non -repeating decimals), it cannot have a rational (definition: a rational number can be written as a ratio (fraction)), square root. Then mathematicians started to look for a number that was close to a square root. In this activity students will go through the Binary Search Method and find a value that is close to th e square root of pi Ӥσϕ τ
3. Use worksheet and go through a few of the sample steps as a whole group:

   - o Assign values *S* = 1 and *L* = 2
   - o ¨Y ρ and ü τ
   - o Since ¨Y is farther away from pi then ü, *S* gets replaced with the average of *S* and *L* [ρ ς σ, 3 ÷ 2 =1.5]
   - o Now assign values *S* = 1.5 and *L* = 2
   - o ¨Y ς ᴕ υ and ü τ
   - o Since ¨Y is farther away from pi then ü, *S* gets replaced with the average of *S* and *L* [1.5 + 2 = 3.5, 3.5 ÷ 2 = 1.75]
   - o Again assign values *S* = 1.75 and *L* = 2
   - o ¨Y σ ᴕ φ ς and ü τ
   - o Since ü is farther away from pi then ¨Y, *L* gets replaced with the average of *S* and *L* [1.75 + 2 = 3.75, 3.75 ÷ 2 = 1.875]
   - o Have the students use the worksheet and continue this process until they find finer and finer bo unds. Eventually they will get 1.77245é which is a good approximati exact answer.
   - o

Binary Search Method for Finding the Square Root of Pi

Mathematicians wondered if it was possible to find the square root of the irrational value of pi . They found by using the Binary Search Method they could get a good approximation.

Below is the proces s for the Binary Search Method use it to find the
Ǹ V8 0 ʌ

1. Pick a value smaller than the square root of pi and label it *S*.

   S = ____ *L* = ____

2. Pick a value larger than the square root of pi and label it *L*.

   S^2 = ____ L^2 = ____

3. Find ˜Y and ü̈

   _____ is father from pi.

4. Which value is farther away from pi? If ˜Y is farther away then ü̈ then replace *S* wit h the average of *S & L*., if not replace *L* with the average of *S & L.*

   Find average of *S & L*

   ؤ٨ٷ / . =______

   Replace _____ with average.

   S = ____ *L* = ____

5. Repeat

   S^2 = ____ L^2 = ____

6. Continue until there is a lower and upper bound for the square root of pi.

   _____ is father from pi.

   Find average of *S & L*

   ؤ٨ٷ / . =______

   Replace _____ with average.

Calculating Pi

MATERIALS

- Pen and Paper
- Masking Tape
- Tape Measure
- Calculator
- Long, thin, straight, stiff food items, preferably a pack of frozen hot dogs between 15 to 20cm (6 to 8 inches) long
- Open Space about 180 to 300 cm (6 to 10 feet)

1. Select a food item to throw. There are a couple of qualifications. First, it must be long, thin, and straight, like a frozen hot dog, for example. Second, it must be a reasonably stiff item. Third, it should be somewhere between 15 to 20 cm (6-8 inches) long; the experiment can be performed otherwise, but read on, and you will see why this size is optimal. There are lots of other items that fit these criteria including Otter Pops, celery, and churros. (If you simply can't come to grips with throwing perfectly good food, see the Tips section for some additional ideas.)

2. Select the spot from which to throw your mathematical cuisine. You will probably need about 180-300 cm (6-10 feet) in front of you, as you will be throwing straight ahead.

3. Clear the area. The place at which you are throwing should be devoid of objects that your food item could possibly run in to.

4. Measure the length of your projectile. A tape measure should do the trick. Be as accurate as you Ŏ Ɩ ɣ Σ Ŝ Ǿ Ŝ ɣ Ř ƶ ǿ ɣ ű ƶ ű Ќ Ŝ Ƴ ƛ ƚ ƚ ƛ Ƴ Ŝ ű Ŝ NJ Σ Ŧ ƶ NJ ō Ŝ ă ű NJ Ŝ ă dz f items that are all the same ă ƛ Î Ŝ Φ L Ŧ è ƶ dz Ω Ǿ Ŝ Ŏ Ќ ƶ ă Ŝ ɣ ă ƶ Ƴ Ŝ ű Ќ ƛ ɣ Ǝ ű Ќ celery sticks, cut them evenly beforehand.

5. Lay down masking tape in parallel strips across the floor as far apart as your projectile is long. The strips should be perpendicular to the direction you will be throwing. If your item is 15-45 cm (6-18 inches) long, lay down about 10-16 strips; lay down fewer if longer and more if shorter.

6. ¦ ă Ŝ ű Ķ Ŝ ά ¢ ƻ ă Chart ă ¢ Ķ Ŝ / ƅ NJ ¢ ƻ ă ă Ŝ ă ƅ Ŏ ƻ ƒ dz Ƴ ƴ ƛ ă ǿ Ķ Ŝ NJ Ŝ è ƻ dz Ω
times è ƻ dz ű Ķ NJ ƻ ǿ è ƻ dz NJ Ŧ ƻ ƻ Ř ƛ ű Ŝ Ƴ Φ ¢ Ķ Ŝ ƅ / NJ ƻ ă ă Ŝ ă ƅ Ŏ ƻ ƒ dz Ƴ
your item lands across one of the lines. (Note that landing is not the same thing as bouncing.)

7. Get into position and THROW YOUR FOOD! Throw just one item at a time. Once it is at rest, observe whether or not it is crossing one of the lines. If it is, put a tick under "Crosses" and a tick under
ƅ ¢ ƻ ă ă Ŝ ă Φ ƅ L Ŧ ƛ ű ƛ ă ƴ Ч ű Σ Ƨ dz ă ű Ǉ dz ű ŀ ű ƛ Ŏ ƪ dz ƴ Ř Ŝ NJ ƅ ¢ ƻ
re-use them, making sure to throw from the same position. Repeat this as many times as you like. You should start seeing some interesting results by around 100 to 200 throws. (This doesn't take as long as it sounds.)

8. ² Ķ Ŝ ƴ è ƻ dz Ω NJ Ŝ Ř ƻ ƴ Ŝ Σ Ř ƛ Ǿ ƛ Ř Ŝ ivide the number of tosses by half the number of crosses. For example, if you threw 300 times, and it crossed 191 times, you would calculate 300/(191/2). And, to your amazement, you will now have an approximation for pi!

TIPS:

¶ If room is a concern, consider just drawing lines on a piece of paper and dropping toothpicks onto the paper from about 90 cm (3 feet) up. This definitely is not as refreshing as throwing food across the room, but it works.

¶ For those who are troubled by throwing perfectly good food, consider throwing sticks, dowels, or pencils. In fact, any item will do so long as it is long, thin, straight, stiff and hard. The thinner the better.

¶ This type of approach (essentially, using random numbers to experimentally solve a problem) is also known as Monte Carlo Simulation.

¶ The more the merrier! If two or three throw food together, you will get a better approximation faster because you will be able to get more throws in a shorter amount of time.

¶ A quick estimation of pi is 22/7; a much better one is 355/113 (note the memorable pattern of the digits); Or, you could just press the "pi" key on your calculator.

¶ For the mathematically-inclined, this experiment is actually real! The proof and other details can be found at mathworld.wolfram.com: Buffon Needle Problem

TOSSES & CROSSES CHART

TOSSES	CROSSES	TOSSES	CROSSES	TOSSES	CROSSES	TOSSES	CROSSES
1		51		101		151	
2		52		102		152	
3		53		103		153	
4		54		104		154	
5		55		105		155	
6		56		106		156	
7		57		107		157	
8		58		108		158	
9		59		109		159	
10		60		110		160	
11		61		111		161	
12		62		112		162	
13		63		113		163	
14		64		114		164	
15		65		115		165	
16		66		116		166	
17		67		117		167	

18		68		118		168	
19		69		119		169	
20		70		120		170	
21		71		121		171	
22		72		122		172	
23		73		123		173	
24		74		124		174	
25		75		125		175	
26		76		126		176	
27		77		127		177	
28		78		128		178	
29		79		129		179	
30		80		130		180	
31		81		131		181	
32		82		132		182	
33		83		133		183	
34		84		134		184	
35		85		135		185	
36		86		136		186	

37		87		137		187	
38		88		138		188	
39		89		139		189	
40		90		140		190	
41		91		141		191	
42		92		142		192	
43		93		143		193	
44		94		144		194	
45		95		145		195	
46		96		146		196	
47		97		147		197	
48		98		148		198	
49		99		149		199	
50		100		150		200	

ó н p ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ú Ƥ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ Ƒ ¯ ó LJ ƛ ú

Total Crosses Total Tosses

ψ ψ ψ ψ ψ ψ ψ ψ ψ ψ Ƒ ¯ ó LJ ƛ ú

´Geometry

Six Stations : Working in groups, ask students to find solutions to the problems presented at six stations. Spend approximately ten minutes at each station over a period of two days. The stations should be positioned in the classroom so that students can move from station to station in a clockwise fashion.

Station 1 - Pool Problem

Students are given the area of a circular pool and a d istance from the edge where a circular fence will be constructed. They are to find the amount of fencing needed.

Station 2 - National Park Problem

Students are given sufficient information to find the circumference of a tree. They are to find the diameter of that tree.

Station 3 - Shaded Region Problem

Students are given three sketches involving the same square with a different number of circles within the square. They must determine which sketch has more shaded area.

Station 4 - Windshield Wiper Problem

Students are given the length of a windshield wiper, the length of a rubber wiping blade and the central angle of the sector. They must determine how much area is covered by the blade.

Station 5 - Pizza Problem

Students are given the diameter and the cal ories, per square unit, of a pizza. They must determine the measure of the central angle of a slice, given a restriction of number of calories per slice .

Station 6 - Tennis Can Problem

Students are given a tennis ball can filled with three tennis balls. T hey are to determine a relationship between the circumference of one tennis ball and the height of the can .

The Soda Can: Geometry in Industry:

1. Why is a soda can the shape or size that it is? One reason may be that the manufacturer wants to minimize the amount of aluminum used to make the can. This requirement involves finding the smallest surface area of the can whose shape is a cylinder. The volume of the soda can is fixed at 400 cubic centimeters. Use the volume with each radius to find the possible heights of different sized soda cans. Once the height column is completed calculate the surface areas. The results for r = 1 cm are already given. Round the height to the nearest tenth and the surface area to the nearest whole number.

Radius	Height	Surface Area
1cm		
2cm		
3cm		
4cm		
5cm		
6cm		
7cm		
8cm		

2. Graph the radii and the surface areas on a sheet of graph paper with the radius as the independent variable and the surface area as the dependent variable.

3. Based on the results of your research, what radius and height should you choose to minimize the amount of aluminum used in a soda can? Explain your conclusion.

4. Measure an actual soda can and record its dimensions (radius and height). How do these values compare to the results of your research?

´Algebra II

Objective - Students collect data and discover the functional relationships between varying quantities.

Collecting data - Students will be working in groups. They are provided with an assortment of cans, varying in height and radius. They will measure 10 different cans, using string and rulers, then record the measurements on a worksheet.

Activity - The students input this data into their TI-83 or 84. They then create a scatter plot and find the line of best fit and answer questions relating to the graph.

Explore ´

1. Search pi for number combinations (birthdays, jersey numbers, lucky numbers) using the Pi Search Results Tool. It also allows you to view any section of pi in groups of 10 to 1000 digits.
   http://www.angio.net/pi/bigpi.cgi

2. Learn how to make a circle from three points on a plane and have fun manipulating nested circles with this interactive tool that shows students that circles are awesome.
   http://windowseat.ca/circles/

´Power Point Presentation

http://www.freeclubweb.com/powerpoints/math/pi.html

´Digit Distribution

Find the mean (average) of the first 100 digits.

´Puzzles

Try these one of the following Sudoku puzzles. Use these rules to complete: Each row, column, and jigsaw region must contain exactly the first twelve digits of pi, including repeats: 3.14159265358. Notice two 3õs, three 5õs, and no 7õs. Have fun!

3	2	5	1	5	4	6	3	1	8	9	5
4	1	5	2	3	8	5	9	5	1	3	6
6	1	4	5	9	3	5	8	3	1	2	5
5	3	3	1	8	5	9	2	5	6	4	1
8	9	2	6	5	1	1	5	4	3	3	5
5	8	1	5	2	9	4	3	3	5	6	1
1	5	3	8	1	6	2	4	9	5	5	3
9	4	5	3	5	1	5	6	8	2	1	3
2	3	6	5	1	5	3	1	5	4	8	9
3	6	8	9	4	5	1	5	1	3	5	2
1	5	1	3	6	3	8	5	2	9	5	4
5	5	9	4	3	2	3	1	6	5	1	8

The Never-Ending Number Story

Use the TP-CASTT worksheet to analyze Wislawa Szymb.orskaõs poe

Pi by Wislawa Szymborska

The admirable number pi:
three point one four one.
All the following digits are also just a start,
five nine two because it never ends.
It can't be grasped, six five three five, at a glance,
eight nine, by calculation,
seven nine, through imagination,
or even three two three eight in jest, or by comparison
four six to anything
two six four three in the world.
The longest snake on earth ends at thirty-odd feet.
Same goes for fairy tale snakes, though they make it a little longer.
The caravan of digits that is pi
does not stop at the edge of the page,
but runs off the table and into the air,
over the wall, a leaf, a bird's nest, the clouds, straight into the sky,
through all the bloatedness and bottomlessness.
Oh how short, all but mouse-like is the comet's tail!
How frail is a ray of starlight, bending in any old space!
Meanwhile two three fifteen three hundred nineteen
my phone number your shirt size
the year nineteen hundred and seventy-three sixth floor
number of inhabitants sixty-five cents
hip measurement two fingers a charade and a code,
in which we find how blithe the trostle sings!
and please remain calm,
and heaven and earth shall pass away,
but not pi, that won't happen,
it still has an okay five,
and quite a fine eight,
and all but final seven,
prodding and prodding a plodding eternity
to last

TP ðCASTT Poetry Analysis

Title: Consider the title and make a prediction about what the poem is about

Paraphrase: Translate the poem line by line or word by word and put it into your own words. Look for complete thoughts and use a thesaurus to look up unfamiliar words.

Connotation: Examine the poem for meaning beyond the literal. Look for figurative language, imagery, and sound elements. What is being compared?

Attitude/Tone: What is the authorõs attitude or tone?

Shift: Note any shift or changes in attitude, mood or motif. Look for key words, time change, punctuation changes.

Title: Examine the title again. Interpret what the poet feels about the subject of the poem.

Theme: Briefly state in your own words what the poem is about(subject), then what the poet is saying about the subject (theme)

òPió Sound Vocabulary

Each of the clues has an answer that begins with the sound *pi*.

1. Pertaining to fireworks
2. A tube
3. A large snake
4. A fruit
5. A portico
6. One who prepares the way
7. A mineral
8. A typographic unit of measure
9. Reverence
10. Musical instrument
11. An outlaw, typically at home on a ship
12. A kind of spice or pickle
13. A measure of volume
14. A guide
15. Spotted or blotched, especially of black and white
16. A square column that projects from wall
17. Objects laid on top of each other
18. A philosopher

Answer Key

1.	Pertaining to fireworks	pyrotechnic
2.	A tube	pipe
3.	A large snake	python
4.	A fruit	pineapple
5.	A portico	piazza
6.	One who prepares the way	pioneer
7.	A mineral	pyrites
8.	A typographic unit of measure	pica
9.	Reverence	piety
10.	Musical instrument	piano
11.	An outlaw, typically at home on a ship	pirate
12.	A kind of spice or pickle	pimento
13.	A measure of volume	pint
14.	A guide	pilot
15.	Spotted or blotched, especially of black and white	piebald
16.	A square column that projects from wall	pilaster
17.	Objects laid on top of each other	pile
18.	A philosopher	Pythagoras

BOOKS

Pi Unleashed by Jorg Arndt

In the 4,000-year history of research into Pi, results have never been as prolific as present. This book describes, in easy-to-understand language, the latest and most fascinating findings of mathematicians and computer scientists in the field of Pi. Attention is focused on new methods of high-speed computation.

Why Pi? by Johnny Ball

This entertaining follow-up to DK's popular *Go Figure!, Why Pi?* presents even more mind-bending ways to think about numbers. This time, author Johnny Ball focuses on how people have used numbers to measure things through the ages, from the ways the ancient Egyptians measured the pyramids to how modern scientists measure time and space.

A History of Pi by Petr Beckman

The history of pi, says the author, though a small part of the history of mathematics, is nevertheless a mirror of the history of man. Petr Beckmann holds up this mirror, giving the background of the times when pi made progress—and also when it did not, because science was being stifled by militarism or religious fanaticism.

The Joy of Pi by David Blatner

The Joy of Pi is a book of many parts. Breezy narratives recount the history of pi and the quirky stories of those obsessed with it. Sidebars document fascinating pi trivia (including a segment from the 0. J. Simpson trial). Dozens of snippets and factoids reveal pi's remarkable impact over the centuries. Mnemonic devices teach how to memorize pi to many hundreds of digits (or more, if you're so inclined). Pi-inspired cartoons, poems, limericks, and jokes offer delightfully "square" pi humor. And, to satisfy even the most exacting of number jocks, the first one million digits of pi appear throughout the book.

Piece of Pi by Nalia Bokhari

There are some topics or problems that have captured the interest of mathematicians for ages. Calculating pi is one of them. Although students often encounter pi in the mathematics classroom when applying various formulas, rarely do they use or explore pi in other contexts. This marvelous infinite number we know as pi shows up in many fascinating and mysterious ways. It can be found everywhere, from astronomy and probability, to the physics of sound and light. It is one of the most important numbers that exists.

Help your students discover the number that has intrigued mathematicians for centuries. Learn different ways pi has been calculated through the ages, use pi to figure your hat size, perform a variety of experiments to estimate the value of pi, or relate pi to the alphabet. These interesting and exciting activities encourage higher order thinking and offer a complete overview of this important number while giving students practice in important math skills.

This guide includes detailed lesson plans (referenced to NCTM standards) and reproducible student worksheets. Use them for Pi Day (March 14), as an enrichment or extension to your existing curriculum, or to challenge your most able math students.

Not Awake: A Dream Embodying (pi)õs Digits Fully for 10 by David Keith & Diana Keith

Not A Wake" is a collection of poetry, short stories, a play, a movie script, crossword puzzles and other surprises, constructed according to a unique principle: counting the number of letters in successive words of the text (the first word has 3 letters, the next word has 1 letter, the next word has 4 letters, and so on) reveals the first 10,000 digits of the famous mathematical number pi (3.14159265358979...). Fans of the number pi, constrained writing (such as Georges Perec's "La Disparition"), wordplay, puzzles, or experimental prose and poetry will find much to savor in this, the first book-length work based on the pi constraint.

Pi the Great Work by Marty Leeds

Pi - The Great Work is an inspiring journey through anthropology, archaeology, alchemy, religion, spirituality, science, astrology, astronomy, numerology, linguistics, symbolism, music, riddle and rhyme. All viewed through the lens of Pi. It is an exploration of sacred number, geometry and the mathematics that rule our Universe. It is a study of oneself.

Pi in the Sky by Wendy Mass

Joss is the seventh son of the Supreme Overlord of the Universe. His older brothers help his dad rule the cosmos, but all Joss gets to do is deliver pies. That's right: pies. Of course, these pies actually hold the secrets of the universe between their buttery crusts, but they're still pies.

Joss is happy to let his older brothers shine. He has plenty to keep his hands full: attempting to improve his bowling score; listening to his best friend, Kal, try (and fail) to play the drums; and exploring his ever-changing home, The Realms. But when Earth suddenly disappears, Joss is tasked with the seemingly impossible job of bringing it back. With the help of Annika, an outspoken girl from Earth, he embarks on the adventure of a lifetime...and learns that the universe is an even stranger place than he'd imagined.

Sir Conference & the Dragon of Pi (A Math Adventure) by Cindy Neuschwander & Wayne Geehan

Sir Cumference, Lady Di of Amter, and Radius are back in their second Math Adventure! This time, a potion has changed Sir Cumference into a fire-breathing dragon. Can Radius change him back? Join Radius on his quest through the castle to solve a riddle that will reveal the cure. It lies in discovering the magic number that is the same for all circles.

Pi: A Biography of the World's Most Mysterious ... by Alfred Posamentier

This enlightening and stimulating approach to mathematics will entertain lay readers while improving their mathematical literacy. We all learned that the ratio of the circumference of a circle to its diameter is called pi and that the value of this algebraic symbol is roughly 3.14. What we weren't told, though, is that behind this seemingly mundane fact is a world of mystery, which has fascinated mathematicians from ancient times to the present. Simply put, pi is weird. Mathematicians call it a "transcendental number" because its value cannot be calculated by any combination of addition, subtraction, multiplication, division, and square root extraction. This elusive nature has led intrepid investigators over the years to attempt ever-closer approximations.

´ Movies/Videos

Pi (1998)
A paranoid mathematician searches for a key number that will unlock the universal patterns found in nature.

Life of Pi (2012)
A young man who survives a disaster at sea is hurtled into an epic journey of adventure and discovery. While cast away, he forms an unexpected connection with another survivor: a fearsome Bengal tiger.

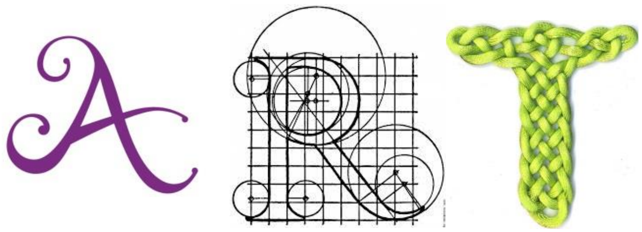
The Story of Pi http://www.projectmathematics.com/storypi.htm
The program opens with a reporter interviewing young people, asking "What can you tell me about the number pi?" Each person gives a different answer, some of which are only partially correct.
The program defines pi as the ratio of circumference to diameter of a circle, and shows how pi appears in a variety of formulas, many of which have nothing to do with circles. After discussing the early history of pi, the program invokes similarity to explain why the ratio of circumference to diameter is the same for all circles, regardless of size. This ratio, a fundamental constant of nature, is denoted by the Greek letter pi, so that 2 pi r represents the circumference of a circle of radius r.
Two animated sequences show that a circular disk of radius r can be dissected to form a rectangle of base pi r and altitude r, so the area of the disk is pi r squared, a result known to Archimedes. Animation shows the method used by Archimedes to estimate pi by comparing the circumference of a circle with the perimeters of inscribed and circumscribed polygons.
The next segment describes different rational estimates for pi obtained by various cultures, and points out that pi is irrational. After demonstrating the appearance of pi in probability problems, the program returns briefly to the reporter, who interviews the students again, asking, "Now what can you tell me about pi?" This time, each student gives a different correct statement about pi. The concluding segment explains that major achievements in estimating pi represent landmarks of important advances in the history of mathematics.

Recite Pi http://www.youtube.com/watch?v=mjuU_c3brBo&feature=youtu.be
Video of a 12-year-old boy named Meedeum from Maadi south Cairo, Egypt reciting Pi to the 120th place

Domino Pi http://www.youtube.com/watch?v=Vp9zLbIE8zo
Watch this COOL 3.14 minute video of a domino spiral creation.

Numberphile videos about the most famous ratio of all - Pi.
http://www.youtube.com/playlist?list=PL4870492ACBDC2E7C

- Calculating Pi with Pies
- Pi and the size of the Universe
- How Pi was nearly changed to 3.2
- Sounds of Pi
- Pi and Buffon's Matches
- Pi and the Bouncing Balls
- Pi
- Tau vs Pi Smackdown
- Tau Replaces Pi



1.Circle Art

Have students create pictures using only colored cut out circles.

2.Pi Paper Chains

Different colored paper strips are paired with numbers (e.g., blue for 2, red for 4). The strips are then linked in the order of ô (3.1415…). The chain can be as long or as short as time and interest allow.

Materials

- Construction paper of ten different colors cut into strips
- Stapler or tape

Procedure

- Decide which color will represent which number.
- Create your paper chain by taking a strip of paper in the color you have chosen to represent the number 3 and making it into a loop. Close the loop with a stapler or piece of tape.
- Take a strip that represents the number 1 and thread it through your loop. Close the loop.
- Repeat with the strips that match the numbers in πso that you have a visual representation of ô. How long can you make it? Here are places to get you started:

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

3. Homemade Spirograph

Try this geometric drawing that produces mathematical roulette curves of the variety technically known as hypotrochoids and epitrochoids.

Materials

- A round cake pan (or other flat, round pan)
- Cardboard
- Scissors
- A rubber band
- A pencil
- Paper
- Tape

Procedure

1. Measure the diameter of the cake pan.
2. Draw a circle with a diameter half that of the pan. You can do this easily by making one side of the square you use to draw the circle (as described in the activity above) the length you want for the diameter.
3. Trace it on the piece of cardboard.
4. Put the rubber band around the edge of the piece of cardboard.
5. Cut out a piece of paper to fit the bottom of the pan and use tape to hold the paper in place so it doesnõt move around.
6. Poke a hole in the middle of the cardboar
you can get weird shapes by making the hole away from the center of the circle.
7. Put the pencil in the hole and move the circle around the cake pan. Hold the edge of the pan with one hand so the pan doesnõt mov
circle. The circle will guide the pencil to make cool shapes on the paper in the bottom of the pan. Try it with different color fine tip markers. The circ
drawing are called hypotrochoids.

If you want to try this same idea on the computer, this Web site lets you try it: http://wordsmith.org/~anu/java/spirograph.html

(We need to give credit for this idea to Martin Gardner, a mathematician who wrote about cool things to do with math in Scientific American).

MUSIC

1. Try [this amazing activity! It allows your students to play pi as a musical sequence!] Simply pick ten notes, which are then assigned to integers, and then listen to what pi sounds like!
   http://avoision.com/experiments/pi10k

2. Listen to Kate Bushós Aerial song òôó from her al

3. Sing the song òWe Wish You a Happy Pi Day
   sung to the tune of We Wish You a Merry Christmas.

   We wish you a happy Pi Day
   We wish you a happy Pi Day
   We wish you a happy Pi Day
   To you and to all

   Pi numbers for you
   For you and for all
   Pi numbers in the month of March
   So three point one four

4. Sing Happy Birthday to Albert Einstein

5. Listen and Watch Pi Day songs here:
   http://www.piday.org/topics/videos/

6. Listen to this American Póie parody òMathem
   http://www.youtube.com/watch?v=_BwKZEp2K_0

7. Sing one of the Pi Carols on the next page

Pi Jokes

Q. What is a math teacher's favorite dessert?
A. Pi!

Q: What do you get if you divide the circumference of a pumpkin by its diameter?
A: Pumpkin pi.

Q: What do you get when you take the sun and divide its circumference by its diameter?
A: Pi in the sky.

Q: How many pastry chefs does it take to make a pie?
A: 3.14.

Q: What is 1.57?
A: Half a pie

Q: What was Sir Isaac Newton's favorite dessert?
A: Apple pi

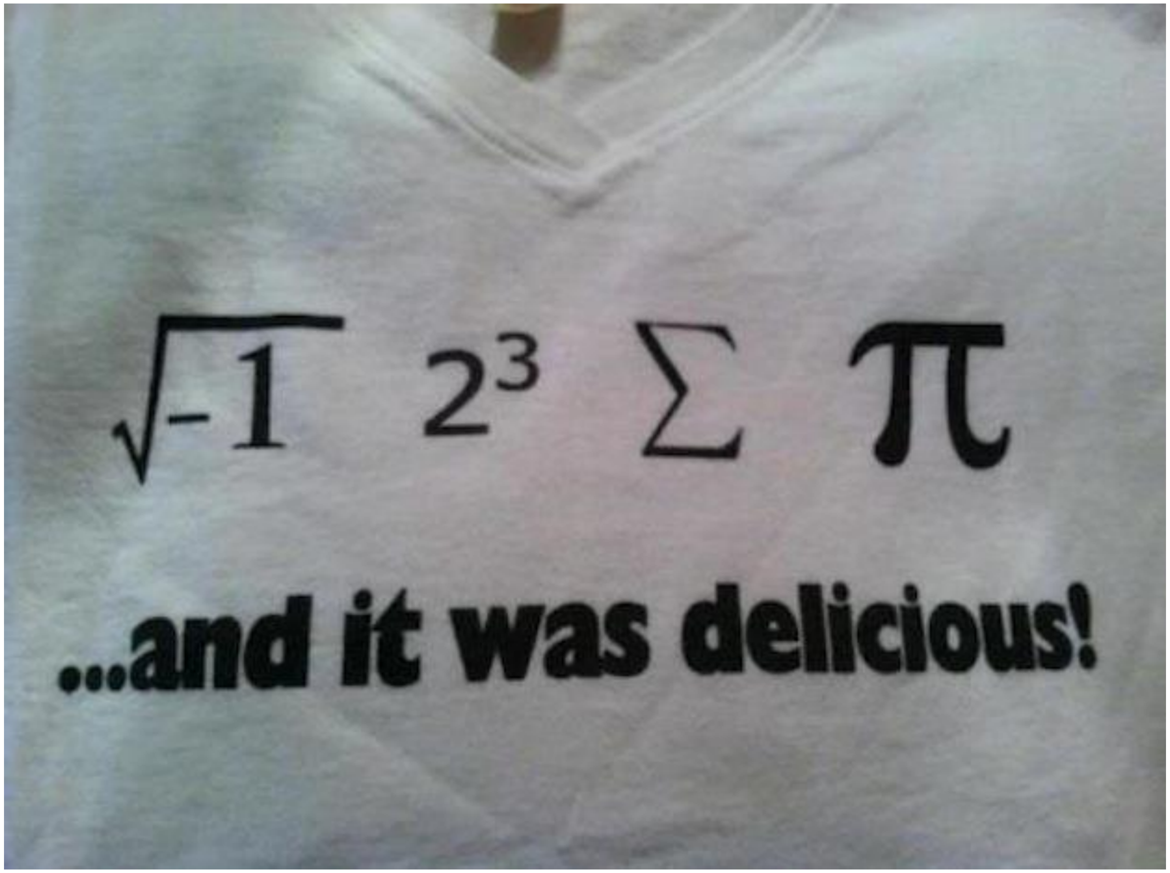
Q: What is the ideal number of pieces to cut a pie into?
A: 3.14

Q: What do you get when you take a bovine and divide its circumference by its diameter?
A: Cow pi.

Q: What do you get when you take green cheese and divide its circumference by its diameter?
A: Moon pi.

Q: What do you get when you take a native Alaskan and divide its circumference by its diameter?
A: Eskimo pi.

Q: What do you get if you divide the circumference of a bowl of ice cream by its diameter?
A: Pi a la mode. Mathematician: Pi R squared Baker: No! Pie are round, cakes are square!



i 8 SUM Pi


The roundest knight at Sir Arthur's table was Sir Cumference
He gained weight by eating too much Pi.
SO MUCH PUN.COM

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