



Pi Day Fun!

Overview

This series of educational programs was designed to simultaneously entertain and challenge gifted youth in their time outside of the school setting; however, the activities may be easily shared and enjoyed by older people as well. Programs may be scaled up or down depending on number of attendees, desired level of complexity, etc. Sample materials are included with most plans.

The Educational Programs series was developed by Lisa Van Gemert, M.Ed.T., Gifted Youth Specialist for the Mensa Foundation. If you have questions or comments about these programs, please email giftedyouth@mensafoundation.org.

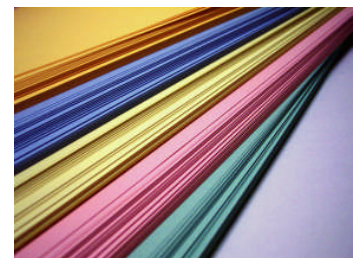
Introduction

Did you know that the ratio of the circumference (the distance all the way around) to the diameter (the distance across) of a circle always equal the same number? The number begins 3.1415, and no matter how many decimal places you take it to, it never ends! This crazy (well, mathematicians would call it irrational) number is called pi. Its symbol looks like this: π

March 14 is Pi Day! (Because it's 3/14; get it?) In honor of this international celebration, we've put together 3 math lessons and 14 math activities for you to enjoy. All the details are in the Showtime! section, but here's a quick list of supplies to get you started.

Supplies

- Internet access
- Downloadable lesson plans from the Mensa for Kids Web site
- Paper strips in different colors
- Circular foods such as cupcakes, pizza and pancakes
- Ingredients to make our Pi Day recipes!
- Multicolored beads and pipe cleaners or jewelry-making chains
- Plain, dark-colored T-shirt; bleach, water and stencil (see next page); foil, cardboard or newspaper
- Paper, pencils and/or pens, scissors, rubber band, tape, string or yarn
- A round, flat pan
- A selection of other circular household objects
- Library card or other access to selected books and movies about pi



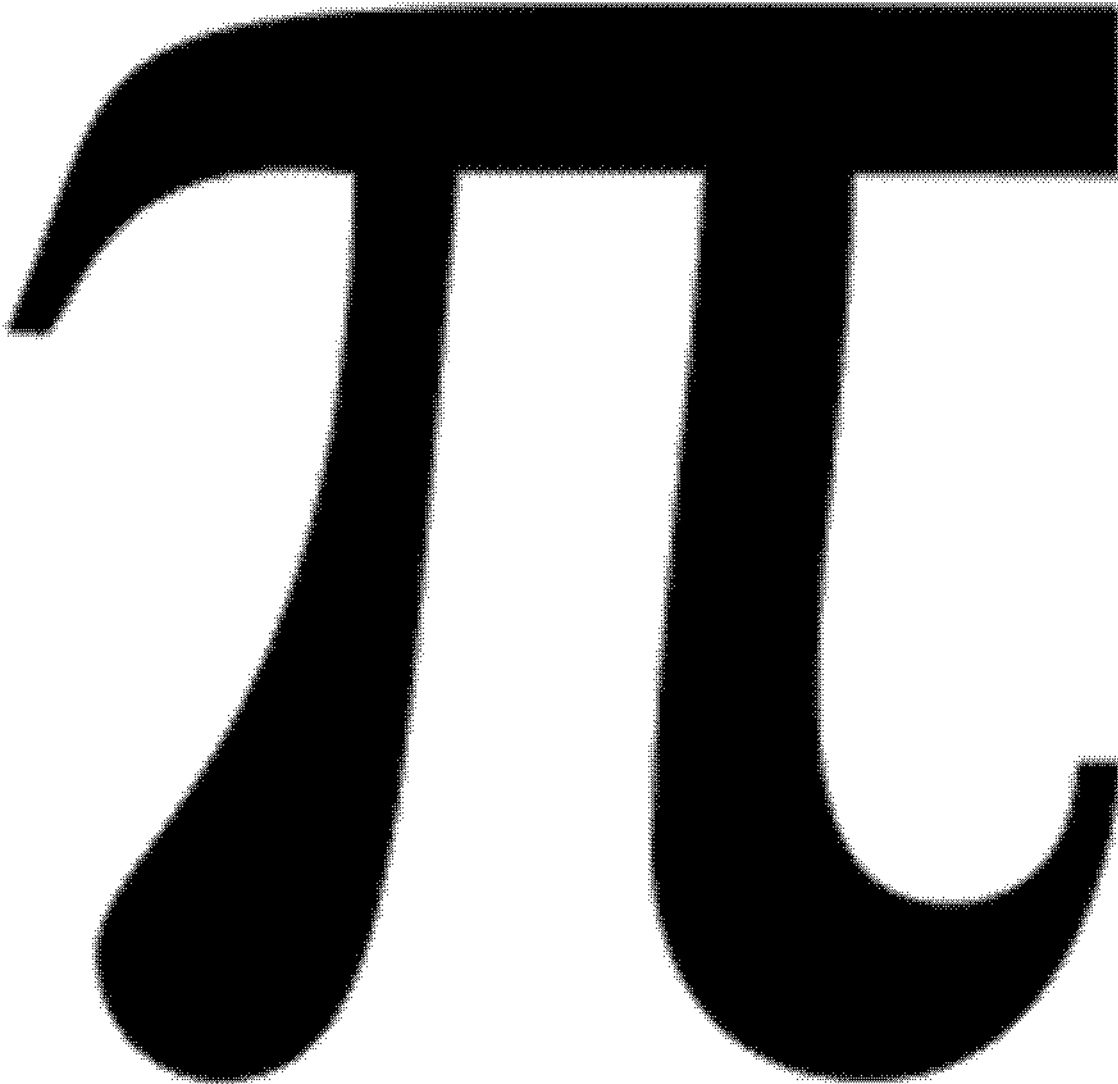


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Template

Here is the stencil for the Pi Day Couture project. Print it out and then cut it out.



Pi Day—Introduction



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Preparation

- Read through the Showtime! section (next) and decide which activities you want to try.
- Clear your chosen activities with your parent(s) or teacher(s). This includes finding an adequate location for each activity.
- Round up some friends to do them with you!
- Collect the necessary supplies for each activity for you and your friends.

If you just can't get enough pi, you may also want to visit our Web site, www.mensaforkids.org, where we have a fun Feature of the Month posted about pi. Just click on the billboard and select March 2008 from the drop-down menu at the top!



Pi Day—Preparation



Showtime!

3 math lessons

These grade-appropriate lesson plans can be downloaded at www.mensaforkids.org. Just click on the schoolhouse, then on Parent/Teacher Resources, then on Lesson Plans.

- Shapes (Kindergarten)
- Action Fractions (2nd Grade)
- Probably Probability (6th Grade)

14 Pi Day activities

Here are 14 Pi Day Activities that you can do for fun and learning at home or at school.

1. Pi Paper Chain

Even the youngest mathematician can participate in this activity! 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 π (3.1415...). The chain can be as long or as short as time and interest allow.



What you need:

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

What you do:

- 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 π so that you have a visual representation of π . How long can you make it? Here are the first 500 decimal 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



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2. Pi for Foodies!

Since π is all about circles, foods like cookies or pancakes make great Pi Day foods. Here are recipes for Pi Day Cupcakes and our secret Mensa frosting recipe, along with other Pi Day food ideas!

Easy Pi Day Cupcakes

Ingredients:

- 2 $\frac{1}{4}$ cups flour
- 1 $\frac{1}{3}$ cups sugar
- 3 tsp. baking powder
- $\frac{1}{2}$ tsp. salt
- $\frac{1}{2}$ cup shortening
- 1 cup milk (use whole milk for a moister cupcake)
- 1 tsp. vanilla
- 2 eggs (large)



Directions:

1. Preheat your oven to 350°.
2. Grease muffin tin or line with cupcake liners.
3. Mix all dry ingredients (flour through salt) in a large bowl.
4. Add the shortening, milk and vanilla. Beat well for one minute at medium speed.
5. Add the eggs and beat for one more minute. Get the batter off the sides and mix at high speed for 1 $\frac{1}{2}$ minutes.
6. Use an ice cream scoop to put the batter into the muffin tins, filling about 1/2 to 2/3 full.
7. Bake for 20-25 minutes until the tops bounce back when you touch them or a toothpick comes out clean. Cool completely before frosting.

Secret Mensa Frosting Recipe (makes enough to frost two dozen cupcakes)

- 1 lb. powdered sugar
- $\frac{1}{2}$ cup shortening (we used Crisco®)
- $\frac{1}{4}$ cup water
- $\frac{1}{2}$ tsp. each butter, vanilla, and almond flavoring
- Pinch of salt

Tint as desired with food coloring (paste works best). Mix well and spread!

Other Pi Day food ideas:

- Make the pi symbol (π) out of pretzels, hot dogs, mini-carrots, or any other long, straight food.
- Make pie, of course!
- Make circle cookies and use them to calculate π !



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3. Pi Bracelets

Inexpensive plastic beads twisted onto pipe cleaners or jewelry-making chains from the craft store can be used to create mathematical bling!

What you need:

- Plastic beads
- Pipe cleaners, yarn or other product on which to string the beads



What you do:

Like the paper chain in activity #1, you will choose a color of bead to represent each number from 0 to 9. Thread the corresponding bead in the order of π to make a bracelet (on pipe cleaner) or a necklace (using yarn, etc.). Voila! Wearable math bling!

4. Pi Day Couture

It's easy to rock this cool Pi Day look!

What you need:

- Colored T-shirt (darker colors work best)
- π stencil (included in the Introduction section)
- Spray bottle with 50/50 bleach and water solution in it
- Foil, cardboard or newspaper

What you do:

- Lay the shirt on a flat surface covered with foil, cardboard or newspaper to protect it from accidental bleach spray. You may wish to put a piece of foil between the front and back of the shirt to prevent the bleach from bleeding through, but this is usually not a problem.
- Cut out the stencil and lay it on the shirt. If you have a big shirt, cut out several stencils and lay them out in a pattern on the shirt.
- Using the spray bottle, spray the bleach/water mixture on the shirt and watch as the shirt changes color. Repeat until the shirt is the color you want. Make sure it is light enough around the edge of the stencil that the stencil will show up!
- Remove the stencil. Wash the shirt separately with very little detergent for the first wash before wearing it.



5. The Never-Ending Number Story

Pi Day isn't just for math junkies! Readers and writers have a role as well. Here are some things budding writers and savvy readers can do to celebrate this amazing number.

- Write a poem in which each line corresponds to the number of syllables in π — so, you would have three syllables in the first line, one in the second, four in the third, one in the fourth and so on. How many lines can you write?
- A more intense writing activity is to create a myth melding π and the ancient Greeks. Can you come up with a story about how the ancient gods created, used or abused pi?
- Analyze Wislawa Szymborska's poem *Pi* (below). You can use the TP-CASTT method to analyze it (see box on the next page).

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-CASTT**

Step 1: Analyze the **title**. It's easy for this poem, isn't it?

Step 2: **Paraphrase** the poem. That means to put it into your own words. You can do this line by line or word by word. Use a thesaurus to find strong, evocative synonyms.

Step 3: **Connotation** means what the words and phrases convey that they don't say explicitly. Look to the metaphors the poet uses. To what does he compare pi? What other figurative language can you find?

Step 4: What do you think the poet's **attitude** is?

Step 5: Can you find any **shifts** in the poem? Look for when the subject, attitude, mood, or motif.

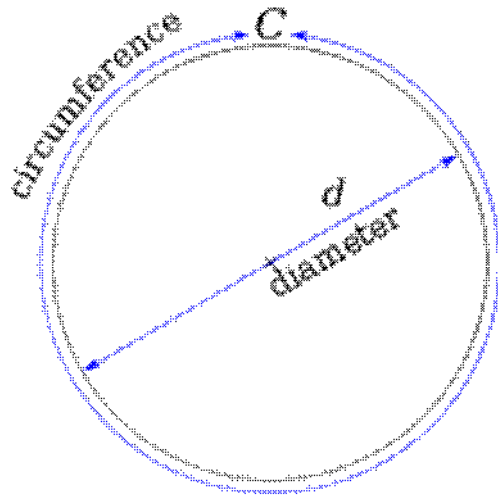
Step 6: Go back to the **title** again. What do you think the poet feels about the subject of the poem?

6. Calculate Pi

Calling all circular household items! Measure the diameter and circumference of cans, jars, glasses, bowls (even toilet bowls!), and rugs to see if you are able to find π in your house. To find π , divide the circumference of the circle (all the way around) by the diameter (the length from one side of the circle to the other):

$$C \div d = \pi$$

Do you get close?





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7. A Homemade Spirograph

All it takes is a few minutes with a Spirograph to remind you how fun drawing a plain circle can be!

What you need:

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

What you do:

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 doesn't move around.
6. Poke a hole in the middle of the cardboard. If you don't want to make circles, 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 doesn't move while you're moving the 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 circles you're drawing are called hypotrochoids. Cool name, huh?

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).

8. Pi Trivia

Go to this site to calculate your age in pi years: <http://pidays.jtey.com>



9. Surrounded by Pi!

Read about π in these books:

- *A History of Pi* by Petr Beckman
- *The Joy of Pi* by David Blatner
- *Sir Cumference and the Dragon of Pi* by Cindy Neuschwander
- *Life of Pi* by Yann Martel
- *Contact* by Carl Sagan
- *Pi: A Biography of the World's Most Mysterious Number* by Alfred Posamentier
- *Not A Wake: A Dream Embodying (Pi)'s Digits Fully for 10000 Decimals* by Michael & Diana Keith

Watch movies or TV shows that feature π and/or math:

- *Donald in Mathmagic Land* (Disney cartoon, 1959)
- *Schoolhouse Rock: Multiplication Classroom Edition* (interactive DVD, 2007)
- *October Sky* (1999, rated PG)
- *Stand and Deliver* (1988, rated PG)
- *Numb3rs* (CBS crime drama, 2005-2010)



See clips of math in movies at www.math.harvard.edu/~knill/mathmovies/

See short movies to learn about π at www.projectmathematics.com/storypi.htm

Watch a short video to learn more about π at

<http://video.google.com/videoplay?docid=-6200593424291031420&hl=en#>



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10. Singing Pi

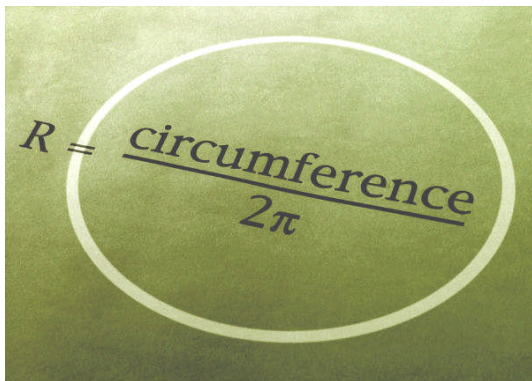
Celebrate Pi Day with a special song! Sing the song below to the tune of *O, Christmas Tree*.

Oh Number Pi written by LaVern Christianson

Oh, number Pi
Oh, number Pi
Your digits are unending,
Oh, number Pi
Oh, number Pi
No pattern are you sending.
You're three point one four one five nine,
And even more if we had time,
Oh, number Pi
Oh, number Pi
For circle lengths unbending.
Oh, number Pi
Oh, number Pi
You are a number very sweet,
Oh, number Pi
Oh, number Pi
Your uses are so very neat.
There's 2 Pi r and Pi r squared,
A half a circle and you're there,
Oh, number Pi
Oh, number Pi
We know that Pi's a tasty treat.



Can you write one yourself? Listen to *Pi* by Kate Bush to get an idea!



11. Cutting Pi

Try this “magic” trick on a friend.

What you need:

- Something circular
- String or yarn
- Scissors



What you do:

- Wrap the string or yarn around the outside of the circular object (the circumference).
- Cut the string to the exact length of the circumference.
- Take the cut piece and lay it across the diameter of the circular object. Cut the string that length. Repeat. How many pieces can you cut?

No matter how big your circle is, you will always be able to cut three pieces with a little bit more left over. You have cut pi!

12. Read About Making Pi a Law!

Once upon a time, there was a state legislature that almost tried to dictate what π is really equal to!

In 1897, a mathematics hobbyist in Indiana calculated some complicated (and, as it turned out, incorrect) “mathematical truths,” which he then copyrighted. He talked his state representative into introducing a bill that would, among other things, round π off to a normal number like any other instead of accepting the beautiful irrationality it really has — and, in exchange for adopting this bill, the Indiana school system would be able to use his copyrighted “truths” free of charge.

The bill included three numbers that people could use for π in different situations:

- The ratio of the diameter of a circle to its circumference is $5/4$ to 4. This made π $16/5$ (3.2).
- The area of a circle equals the area of a square whose side is $1/4$ the circumference of the circle. This made it 4.
- The ratio of the length of a 90-degree arc to the length of a segment connecting the arc's two endpoints is 8 to 7. This made π equal to the square root of $2 \times 16/7$ (about 3.23).

The bill was actually even more complicated than this, but nonetheless it was passed by the House of Representatives. In the Indiana Senate, it would have passed and become a law except that there happened to be a mathematics professor present who read it and had a heart attack right there on the spot. Well, not a real heart attack, but he was surprised to say the least. He made sure the bill died right then, and it was never heard from again. Pi was the winner and still irrational champion!



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13. Pi Day Greeting Cards

Create cards to send to friends and family celebrating Pi Day (or Einstein's Birthday – one in the same!).

You may use any of the following ideas for things to write on the cards, or come up with some of your own:



- Happy Day!
- You are sweeter than 3.14159265358979323846264338327950288419716939937510
- When the moon hits your eye like a big pizza π that's 3.1415...
- Circles...they're as easy as 3.1415926535897932384626

You can also decorate with π by downloading the poster at <http://unihedron.com/projects/pi/downloads/pi.pdf>

14. Making Music Out of Pi!

Turn the numbers into a tune at www.avoision.com/experiments/pi10k/index.php

