π Day

π = 3.1415926 …

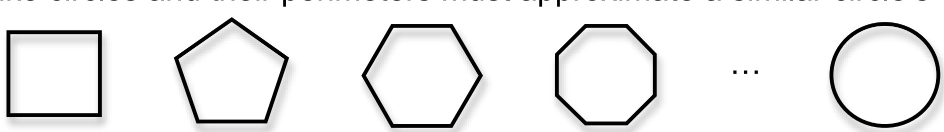
Here are some great ideas for celebrating March 14th in your class.

- Encourage all classes and teachers know that March 14th is π day. This is a teaching opportunity to help staff and students understand this surprising ratio between circle circumference and diameter.
- Encourage your principal to get on the PA system at 1:59:26pm on March 14th and wish the entire school Happy Pi Day.
- A week or two before March 14th, propose a challenge in mathematics classes to see who can memorize the first 100 digits of π. Some people have the excellent ability to memorize huge strings of digits by grouping them, singing them, or learning them with their own creation of memory devices. Honor those students on π day by letting them demonstrate their skill.

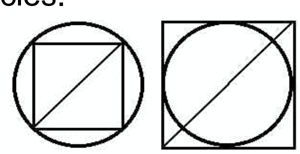
Activity #1: What is π?

People have long known that the distance around a large round building or object was related to the distance across it. Ancient Babylonians (1650 BC), Egyptians, and Chinese had figured out that the distance around any circle {circumference) was about 3 times the distance across that circle (diameter).

Archimedes (287 – 212 BC) was the first person credited with calculating π pretty exactly. He reasoned that as the number of sides of regular polygons increased the polygons started to look like circles and their perimeters must approximate a similar circle's circumference.



So, he started calculating the perimeters and diagonals of regular polygons that were both inscribed and circumscribed about circles.



Inscribed Circumscribed

Here is some of the data that he found.

Number of polygon sides	Perimeter/diameter of inscribed polygon	Perimeter/diameter of circumscribed polygon	Difference between inscribed and circumscribed polygon ratios
6	3.0000000000000000	3.4641016151377544	
12	3.1058285412302493	3.2153903091734723	
24	3.1326286132812382	3.1596599420975005	
48	3.1393502030468672	3.1460862151314348	
96	3.1410319508905098	3.1427145996453687	

1. Fill in the difference between the two “perimeter divided by diameter ratios” of the inscribed and circumscribed polygons about a circle in the chart above.

2. How does that difference change as the number of polygon sides increases?

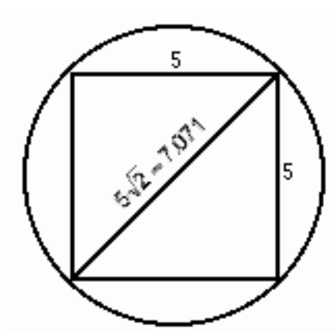
3. How will this difference change as we continue to increase the number of sides the polygon?

Activity #2: Calculate some approximations of π?

Using a process like the one Archimedes used, let’s get some approximations for π. We will try to increase the number of sides of a polygon that is inscribed in a circle and measure its perimeter, diagonal, and the ratio of these two numbers.

Beginning with an inscribed square, lets do some calculations.

$$5^2 + 5^2 = \text{diameter}^2$$
$$25 + 25 = \text{diameter}^2$$
$$50 = \text{diameter}^2$$
$$\sqrt{50} = \text{diameter}$$
$$7.071 \approx \text{diameter}$$



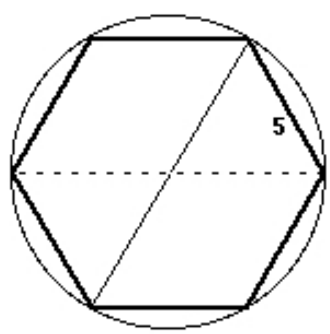
1. Would you imagine that the perimeter/diameter value of this inscribed square is smaller or larger than the circumference/diameter of the circle that surrounds it?

2. In the regular hexagon at the right,

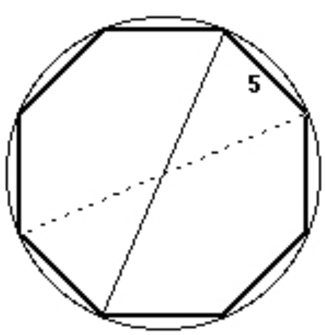
   a. Calculate its perimeter.

   b. Find the measurement of it’s diagonal.

   c. Find the ratio of perimeter/diagonal.



3. How much can you calculate for the dimensions and ratio of this octagon?



- Perimeter
- Diagonal
- Ratio

Activity #3: Where students can show off their ability to memorize a lot of π

Suggest that students try to memorize as much of π as they can. Have a prize of a pie for the student who can memorize the most digits.

These are the first 100 digits of π.
3.14159265358979323846264338327950288419716939937510582097494459230781640628620899862803482534211706 79 ...

Now people have calculated π to trillions of digits. How did they do that?

Activity #4: Discover π

Schedule a measurement and long division activities for the day.

Bring, or ask students to bring, circular objects that the class can measure. (kitchen pots, large coins, cans, bicycle tire, etc.) It helps to use objects that are a little thick so that a cloth measuring tape will not slip off of their circumferences.

Measuring these circumferences and dividing the object's circumference measure by its diameter, let's students see π appear as the ratio. Students often have difficulty measuring the increments between inches and this is a good way to reinforce reading a tape measure. This is a much needed life skill. You may also use metric or have some kids use customary and others use metric, the ratio will come out the same either way. If you don't have cloth-measuring tapes, students can use string and then measure the string against a meter or yardstick.

1. Try to accurately record the circumference and diameter of several circular objects. Record your data below. For the last row find the ratio of the circumference to the diameter that is, divide the circumference by the diameter.

Object	Circumference	Diameter	Quotient of Circumference / Diameter

2. What do you notice?

3. What does this value represent?

4. Were any of your calculations different than the rest? Why might this have happened?

5. Why might it be a good idea to measure more than one object when trying to find this ratio?

6. If you know the diameter of a circle, how can you find the circumference of that same circle without measuring it? Give an example and explain.

7. If you know the circumference of a circle, how can you find the diameter of that same circle without measuring it? Give an example and explain.

Activity #5: Hat sizes?

This activity should be done in pairs.

Using a flexible tape measure (cloth measuring tape works well) or a string that can be measured afterwards, have students measure the circumference of their heads in the place where a hat would rest.

We want to figure out the diameter of their heads but it is a difficult measurement to take since you can't measure straight through their heads. Heads are also not circular. They are usually kind of oblong in shape.

No problem, since students have learned about π they can calculate the diameter of their heads.

a. One partner could make an estimate of the other partner's head diameter by measuring ear-to-ear and front to back from above their partner's head and averaging the two measurements.
b. Or, partners could measure the circumference of their partner's head and divide by π (since circumference = $2\pi r$). and by solving for $2 \bullet r$ (diameter)

$$\text{diameter} = \frac{\text{circumference}}{\pi}$$

1. What is your hat size?

2. What is the diameter of your head?

3. What does the diameter of your head times equal π?

Activity #6: Around the world

This puzzle could be a class opener.

If the earth were perfectly spherical, had no mountains or valleys, and you could tie a belt around its entire equator, how many feet, miles, or kilometers larger would that belt have to be if you wanted the belt to stand one foot off of the surface of the earth in its entire way around?

Maybe some useful facts:

- The circumference of the earth at the equator is 24,901 miles or 40,075 kilometers.
- The radius of the earth is about 3959 miles or about 6,371 km.
- There are 5,280 feet in a mile.
- There are 3,280.84 feet in a kilometer.

Created by: **YUMMYMATH.com**

Source: http://webdocs.cs.ualberta.ca/~smillie/PiNotes/PiNotes.html