



Epic Pi Day 3.14.15 9:26:53

This date/time are the first 10 digits of pi
Happens once every 100 years!

PI ACTIVITIES

1) For small children, here's a fun activity. Have sheets of paper with 10 different colors (many sheets per color). Assign a different digit, 0 through 9, to each color. Now have the children tape the sheets together, following the digits of pi: 3.141592653... (you can look up more digits online). They end up with a long, multi-colored chain that represents pi!

2) Kids who like Legos can assemble a consecutive series of "towers" along a narrow track, corresponding to the digits of pi. The first one is 3 blocks high (and then insert a bead for a "point"), the second is 1 block high, the third is 4 blocks high, the fourth is 1 block high, the fifth is 5 blocks high, the sixth is 9 blocks high, and so on. (You can look up the digits of pi online.)

3) Find various round objects such as coins, toilet paper rolls, plates, cans, pizzas, pies, pots, pans, cups, and so on. Take a piece of string and place it across the diameter of an object; then find its length with a ruler, yardstick, or tape measure. Then wrap a string around the object and measure its length, giving the circumference. Record the results. Now divide the circumference by the diameter and record the result. Do this for many objects and see whether your results are consistent. The value you get should be a good approximation for pi, since $\pi = C/D$, where C is the circumference and D is the diameter.

4) The relation $\pi = C/D$ also works for spherical objects, as you might imagine; just think of slicing the sphere in half, measuring both the circumference and diameter of the resulting flat circle, and dividing the circumference by the diameter. But now let's test whether people intuitively believe this.

Get a standard, preferably transparent can of 3 tennis balls. Show that the tennis balls don't move much by turning the can upside down. (The can might be a little too high, but that's okay; it's also a little bit too wide, thereby compensating for the extra height.) Now ask a group of people to guess whether the height of the can is larger than, equal to, or smaller than the distance around the container (i.e., its circumference). Most people guess that the height is larger. But you can convince them otherwise by next giving them a string whose length is equal to the can's height (show them this) and asking them to wrap it around the can. The string won't quite go all the way around the can, because the can's circumference is πD whereas the string's length is $3D$, and $\pi = 3.14...$



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5) Let's make a pi graph! Get a large sheet of graph paper, roughly the size of a poster board. Draw two axes, and label the horizontal (x) axis "Diameter" and the vertical (y) axis "Circumference." Get a bunch of relatively small round objects such as various coins, toilet paper rolls, cans, cups, and so on. Take an object and place it along the horizontal axis, with its left end at the origin, and mark the position of the right end. Now carefully roll the object up the vertical axis for one complete revolution and mark the final position. These are the "x" and "y" coordinates of a point; mark that point on your graph.

Do this for the other objects you assembled. Draw a straight line through your points (which will undoubtedly show some scatter around the line). This line will have a slope ("rise over run") equal to the value of π !

6) We know that the perimeter or circumference of a circle (C) is π times its diameter (D), so $\pi = C/D$.

Estimate the value of π by measuring the perimeters of polygons and dividing by the diameter of the circle that they approximate. (Archimedes used this technique in 250 BC, but instead of measuring the perimeters, he actually calculated them mathematically.)

Draw a circle and measure its diameter. Then inscribe a triangle so that its vertices just barely touch the circle. Measure the length of one side and multiply by 3; this gives the triangle's perimeter. Now circumscribe a triangle so that its sides barely touch the circle. Measure the length of one side and multiply by 3, giving that triangle's perimeter. If you divide both perimeters by the diameter of the circle, you will have a lower bound and an upper bound on the value of π ; the true value is somewhere between those two (i.e., larger than the lower bound, but smaller than the upper bound).

Next, do the same thing with inscribed and circumscribed squares, but in each case multiply the measured length of one side by 4 to get the perimeter. The lower and upper bounds on pi will be closer together, giving you a better approximation for π .

Now do the same thing with inscribed and circumscribed hexagons, but multiply the measured length of a side by 6. Notice that the lower and upper bounds on π are closer together than before. Finally, do the same thing with inscribed and circumscribed octagons, but multiply the measured length of a side by 8. The lower and upper bounds on π should be even closer together.

Imagine drawing polygons with progressively more sides. The lower and upper bounds will gradually converge to the value of π .



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7) The area (A) of a circle is πR^2 , where R is its radius, so $\pi = A/R^2$. Here is a way to estimate the value of π from areas.

Use a compass to draw a circle on a piece of graph paper, making sure to put the compass point at one grid intersection. It is easiest if the compass pencil point is at another grid intersection, so that the radius R can be determined by simple counting of grid lines. Compute the square of the radius, R^2 . Now determine the number of squares inside the circle: count the number of full squares, estimate the number of additional squares from the partial ones, and add the two together. Finally, compute the ratio R^2/A ; this will be an approximate value of π .