The Mathematician News

Thanksgiving - Advanced

Special News: BASE Theme!

What are the Different Bases?

You may know that we use base 10, called decimal, in everyday life. Decimal uses only ten digits, hence the name "**deci**mal". As you probably know, decimal uses the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. These digits are the digits you have known almost your whole life.

Another base you've probably heard of is base 2, called binary. Binary is very commonly used to program computers and in other machines. You probably already know that binary uses only two digits, hence the name "**bi**nary". Binary uses the digits 0 and 1.

You might not have heard of another base commonly included in scientific calculators: base 16, called hexadecimal. You probably get the idea that hexadecimal uses only 16 digits, hence the name "**hexadeci**mal". Hexadecimal is commonly used for planning when programming computers, because it provides a shorter way to write in binary. However, hexadecimal uses all the digits used in decimal, and six alphabet letters, A, B, C, D, E, and F, to represent the numbers 10, 11, 12, 13, 14, and 15 using only one "digit". This can sometimes be confusing when you are working with other alphabet letters.

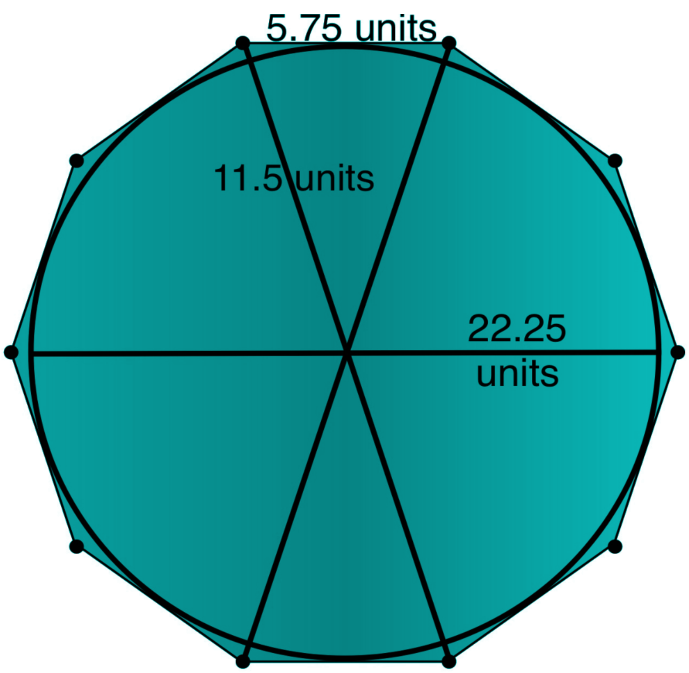
Another common base is base 8, called octal. I'm sure you can guess the digits it uses from its name, "**oct**al". That's right! Octal uses eight digits, 0, 1, 2, 3, 4, 5, 6, and 7. Octal was commonly used before, when computers were programmed using a multiple of three digits in one unit of data. It could represent binary better than hexadecimal could when this was true. Now, we use hexadecimal instead, because we have more digits in a unit of data, and it is easier to write the unit of data in hexadecimal.

Many more bases, commonly ranging from binary to hexatrigesimal(base 36), exist. If you're interested in learning more about the bases, be sure to check out Math Club's brown table near the basketball courts. If you subscribe or join, you can get taught about the different uses and forms of bases, and how to convert between them, in case you want to be a computer programmer when you grow up.

Thanksgiving - Intermediate

Special News: PI Theme!

How Do I Calculate the Area of 2D Shapes?



Let's try a simple problem. Calculate the area of these shapes using the information provided. 1 unit is equal to 1 centimeter. (Warning: Diagram not to scale.)

To calculate the area of the circle, we must use the formula: pi * r^2.
(* = multiply, ^ = exponent, / = divide)
In this case, we can use the first 5 digits of pi: 3.14159 . Since 22.25 centimeters is the diameter, the radius is half that. 22.25 divided by 2 is 11.125, so the radius of the circle is 11.125 centimeters. 11.125 squared is 123.765625 . You can compute this by distributing the numbers: (11.125 * 11) + (11.125 * 0.125($\frac{1}{8}$)) = 123.765625 . 123.765625 * 3.14159 is 388.82084984375 . You can distribute this, too: (123.765625 * 0.00009) + (123.765625 * 0.0005) + (123.765625 * 0.001) + (123.765625 * 0.04) + (123.765625 * 0.1) + (123.765625 * 3) = 388.82084984375 . Finally, we've figured out that the area of the circle is about 388.82084984375 square centimeters.

To calculate the area of the decagon, we can split it up into 10 triangles. To calculate the area of one of the triangles, we can multiply the base of the triangle by its height, and then divide that by 2. The formula is: (b*h)/2. The base is 5.75 centimeters, and the height is 11.5 centimeters. 5.75 * 11.5 is 66.125 . To solve, distribute: (5 * 11.5) + (0.75 * 11.5) = 66.125 . Now we divide that by 2. 66.125 divided by 2 is 33.0625 . Then, since there are 10 triangles, we multiply 33.0625 by 10. So, we've figured out that the area of the decagon is 330.625 square centimeters.

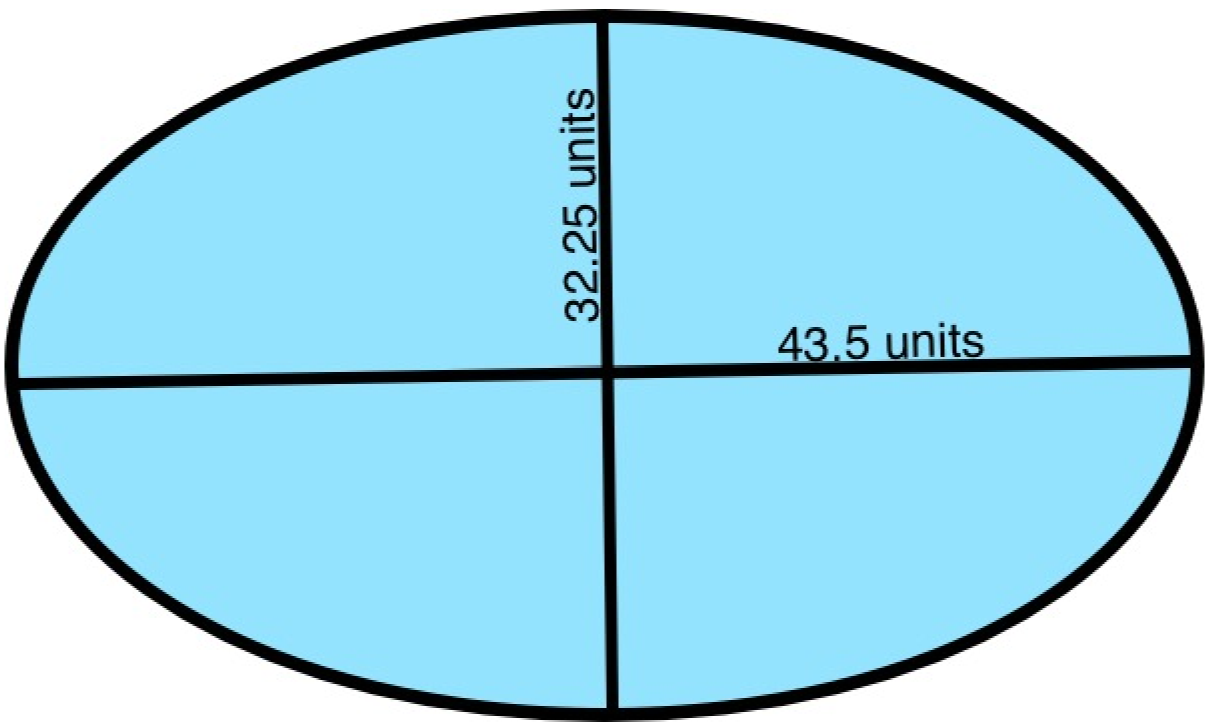
You can come to the Math Club's brown table near the basketball courts for more information on finding areas of circles and other shapes, and learn more about pi.

Thanksgiving - Oval

Special News: OVAL Theme!

How Do I Calculate the Area of an Oval?

Now that we've learned a little more about how to calculate the area of a circle, we can go into something a bit more advanced: finding the area of an oval. You might think that this is quite similar to finding the area of a circle, but these are two different topics. To understand how to find the area of an oval, we can look at its axes. An oval's axes are lines that stretch from one end of the oval to another. Its major axis is the oval's longest axis. The oval's minor axis is its shortest axis. To find the area of the circle, you have to multiply pi by half the major axis times half the minor axis. The formula for finding the area of an oval is: pi * (major axis / 2) * (minor axis / 2). We can test this formula by calculating the area of the oval shown to the left.



First, we have to calculate half of the major and minor axes. 43.5 / 2 = 21.75, and 32.25 / 2 = 16.125 . 21.75 * 16.125 = 350.71875 . Distribute the equation into (20 * 16.125) + (1 * 16.125) + (0.7 * 16.125) + (0.05 * 16.125) = 350.71875 . Now that we've figured that out, it's time to move on to the next step: multiply pi by 350.71875 . As before, we will use the first five digits of pi: 3.14159 . We can distribute the equation into (0.00009 * 350.71875) + (0.0005 * 350.71875) + (0.001 * 350.71875) + (0.04 * 350.71875) + (0.1 * 350.71875) + (3 * 350.71875) = 1101.8145178125 . So, the area of this oval is 1101.8145178125 square units.

Special News: CONVERTING Theme!

How Do I Convert from Decimal to Other Bases?

You're probably wondering why I'm telling you all this stuff about bases. Well, as you just heard, bases are used in real life. But you can't just know the numbers in any base like you do in decimal. You have to learn how to convert from base to base. On this page, we'll be learning about converting from decimal to other bases. On the next page, we will learn the technique for converting from binary to decimal. You can use the same technique to convert to decimal from any base, just replacing the 2 with whatever number base you're converting from. So, let's learn how to convert from decimal to other bases.

The technique for converting from decimal to any base is to find the powers of that base that go into the number. For example, if we are converting 111 to ternary(base 3), we can find the powers of 3 that go into 111. 111 = (1 * 3^4) + (1 * 3^3) + (1 * 3^1). The 5th to last digit is 1, because there is one (3^4). The 4th to last digit is also 1, because there is one (3^3). The 3rd to last digit is 0, because there are zero (3^2)s. The 2nd to last digit is 1, because there is one (3^1). The last digit is 0, because there are zero (3^0)s. So, 111 in decimal converted to ternary is 11010. On the left is a chart showing the binary, ternary, quaternary, quinary, seximal, septimal, octal, and nonary versions of numbers 2 through 10. It only shows numbers 2 through 10 because 1 is the same in all the bases. You may want to memorize the binary and octal numbers for later.

#	binary	ternary	quaternary	quinary	seximal	septimal	octal	nonary
2	10	2	2	2	2	2	2	2
3	11	10	3	3	3	3	3	3
4	100	11	10	4	4	4	4	4
5	101	12	11	10	5	5	5	5
6	110	20	12	11	10	6	6	6
7	111	21	13	12	11	10	7	7
8	1000	22	20	13	12	11	10	8
9	1001	100	21	14	13	12	11	10
10	1010	101	22	20	14	13	12	11

Thanksgiving - Encoded Sudoku

Special News: CODE Theme!

Secret Sudoku!

You'll be playing a game of sudoku, of course. But the answers are shown… in code. The answers will be in binary instead of decimal. In order to decode them, you will need to learn how to convert an number from binary to decimal:

- "n" = the digit's place in the number, when the last digit's place is 0, the 2nd to last digit's place is 1, the 3rd to last digit's place is 2, etc.
- "*" = multiply, "^" = exponent, "/" = divide.
- Use decimal to do operations for this technique.

1. Multiply each digit of the number by (2^n).
2. Add the products of all the equations up, using decimal.
3. The sum of all the products is the binary number converted to decimal.

Thanks to https://www.nytimes.com/puzzles/sudoku/hard for the sudoku.

110	10	8	1	9	101	7	100	11
4	11	1	111	110	8	10	5	1001
101	9	111	100	11	10	1000	1	110
1001	111	100	5	1000	1	3	110	2
11	101	110	10	100	1001	1	111	8
1000	1	10	6	111	11	100	9	101
1	1000	1001	11	101	7	6	10	100
111	6	5	1000	2	4	1001	11	1
10	100	3	1001	1	110	101	8	7

Now you're ready to decode the answers to this sudoku puzzle. On the top of each square, you will see the answer to that square written in blue. But wait! It is written in binary, using only 2 digits: 1 and 0. You will have to convert each number from binary to decimal so you can get the answers to the sudoku puzzle. If you find this difficult, you can always come to the Math Club brown table, or find Sooriyan Thiruchelvam and his friends at Room 20/24 tables. Good luck!

Thanksgiving - All About

Special News: FACT Theme!

All About these Topics…

We'd like to share some amazing fun facts about the topics we just went over. You can share any of these fun facts with your friends, and feel free to submit fun facts you know, too!

Here are Some Amazing Fun Facts:

- The highest base ever is trecentosexagesimal, base 360!
- Decimal is also called denary!
- The English language has a hexavigesimal, or base 26, alphabet!
- Pi-lish is an entire language made based on pi!
- The record for calculating pi is 62.8 trillion decimals!

All About this Article…

Hi! This article was written by Sooriyan Thiruchelvam. He's in 4th grade and in Room 20. If you're having trouble understanding this article, you can find him or ask a member of the Math Club (from Room 20 or Room 24). He wrote this article for the Thanksgiving edition. Previous November articles by Daniel Pei and Brooks Wang have been passed out already, and if you don't have one, be sure to contact any one of us. Feel free to sign up and write an article for the newspaper as well! Just contact the Math Club! Be sure to join Math Club by finding us at the brown table near the basketball courts, or keep an eye out for our next newspaper, coming out in December! If you would like to participate in any other article-related activities, like suggesting a fun math topic for the newspapers, be sure to find Sooriyan at the Room 20 tables, or ask any of his Math Club colleagues:

- Eddie Yang, Room 20
- Daniel Pei, Room 20
- Junxiao Wu, Room 24
- Brooks Wang, Room 24
- Abhinav Shah, Room 19
- Hady Jalloul, Room 24