Decimal (Base 10) Numbers

There are ten numerals that make up the numbers we use every day: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

The position, or **place**, of a numeral is as important as the numeral itself.

3 0 7

Three | No | Seven
hundreds | tens | ones

We say that numbers have a ones place (at the right end), a tens place, then a hundreds place.

What comes after hundreds? _____

Ones place: One stands alone, and starts every system of numbers

Tens place: Ten times one

Hundreds place: Ten times ten
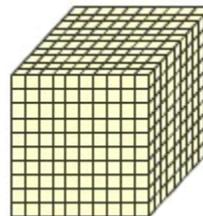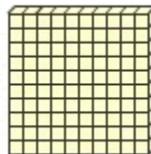
Thousands place: Ten times a hundred.

What's next? _____

Each place is ten times the one before it. We say this is a **base ten** number system because we multiply by ten to get to the next place.

Using this system, we can count as high as we want. We just keep adding more places on the left.

Revised: 8/21/2017 17:27

Binary Numbers

Computers work best when things are on or off. Computers have only two numerals, zero and one. *(Poor computers!)*

0   1

We call numbers with only zero and one **binary numbers**. The "bi" in binary means *two,* like the two wheels on a **bi**cycle. We call each place a *bit*, short for **bi**nary digi**t**.

Binary numbers also have places, but they're *times two* places.

Ones place: One stands alone and starts every system of numbers

Twos place: Two times one

Fours place: Two times two

Eights place: Two times four

What's next? _____

Each place is two times the one before it. We say this is a **base two** number system because we multiply by two to get to the next place.

Using this system, we can count as high as we want. We just keep adding more places on the left.

Let's try it: Arrange your cards like this. How many dots are showing?

0 1 1 0 1

| No sixteens | One eight | One four | No twos | One one |

Exercises

Write your age in years _____

Put your binary cards on the desk, with "one" on the right, then two, four, eight, and sixteen. Starting at the left, turn cards over to take away dots until the number of dots is the same as your age in years. Turn a card over when the total number of dots on the left is more than your age.

Write a 1 for every card that is face up and a 0 for every card that's face down _____
You have just written your age in years as a binary number!

Write the day of the month of your birth _____

Put your binary cards on the desk, with "one" on the right. Turn cards over to take away dots until the number of dots is the same as the day of your birth.

Write a 1 for every card that is face up and a 0 for every card that's face down _____
You have just written the day of month of your birth date as a binary number!

Can you write the month of your birth in binary? _____

How about the year, written as a two-digit number, like 09 _____

With the cards you have, you can show up to 31 dots, and so make binary numbers up to 31. (The binary number for 31 is all cards facing up: 1 1 1 1 1.)

Dr. Brown is much older than 31 years! To show his age, you need two more cards.

How many dots will be on the one after sixteens? _____

How many dots will be on the next one after that? _____

Patterns and Relationships in Powers of Two

Starting at the right (ones place) put three cards up and the next two down.

How many dots are showing? _____

Turn the next card up. How many dots are on it? _____

What is the difference between the two numbers? _____

How many total dots do you have now? _____

Turn the last card up. How many dots are on it? _____

What can you say about the dots on any card and the total number of dots on the cards to the right of it? _____