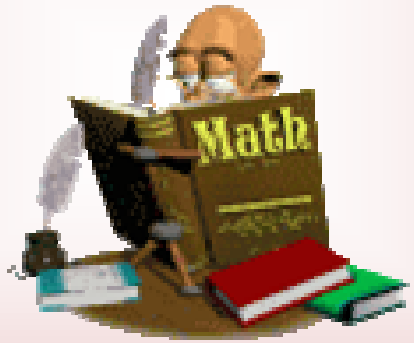
MATH



The Basics

And other interesting things...

Concepts: the Nuts & Bolts

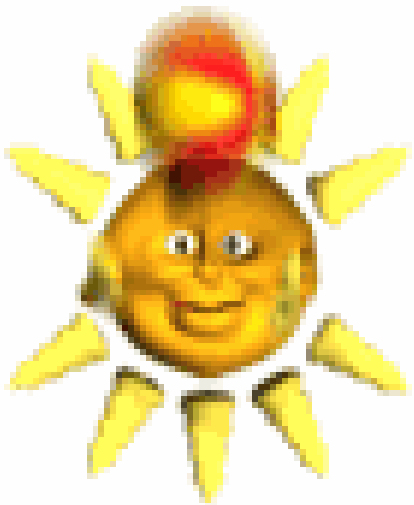
- Geometry
- The Language of Computers:

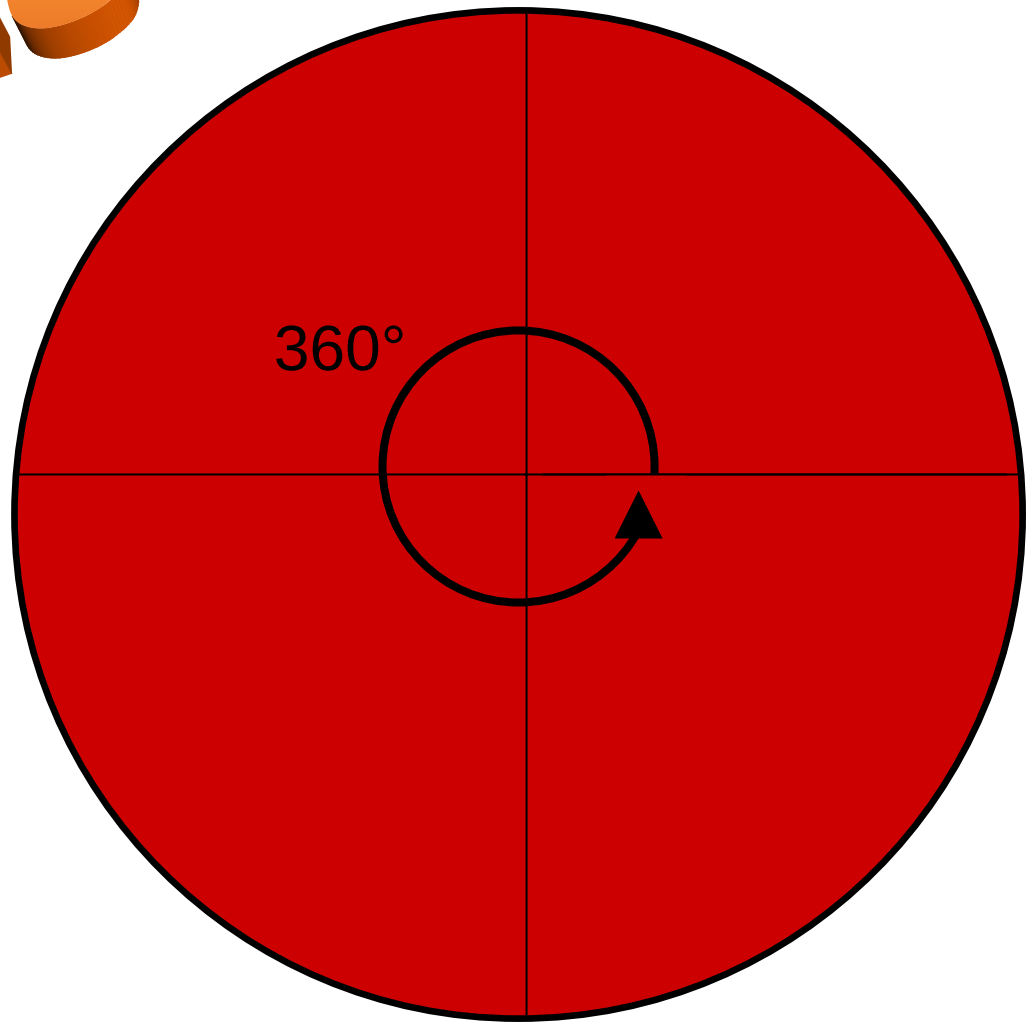
  Binary Numbers
- Order of Operations

Geometry

- “The mathematics of the properties, measurement, and relationships of points, lines, angles, surfaces, and solids.”
- We’re going to focus mainly on angles for use in Logo.

DEGREES

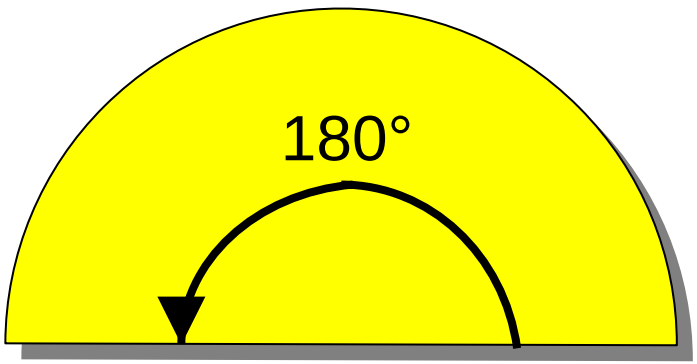


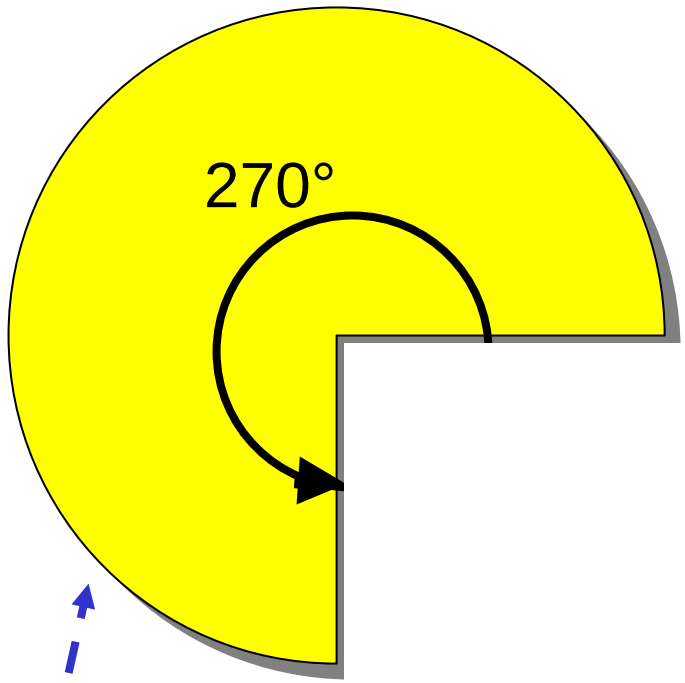


DEGREES are used to measure distance around a circle. A full circle has 360 DEGREES.

Pieces of the Pie

A half circle has
180 degrees





¾ of a circle has
(¾) × 360 = 270 degrees

Binary

- Binary is a system of numbers.
- The numbers you already know are in the *decimal system*, which is based on ten numbers, 0 - 9.
- The *binary system* of numbers is based on two digits: 0 and 1.

The Language of Computers

- The way humans communicate is either by talking or writing.
- Humans even have trouble communicating if they speak different languages (like English and Italian).
- Each kind of animal has a different way of expressing itself.
- What kind of language does a computer understand??

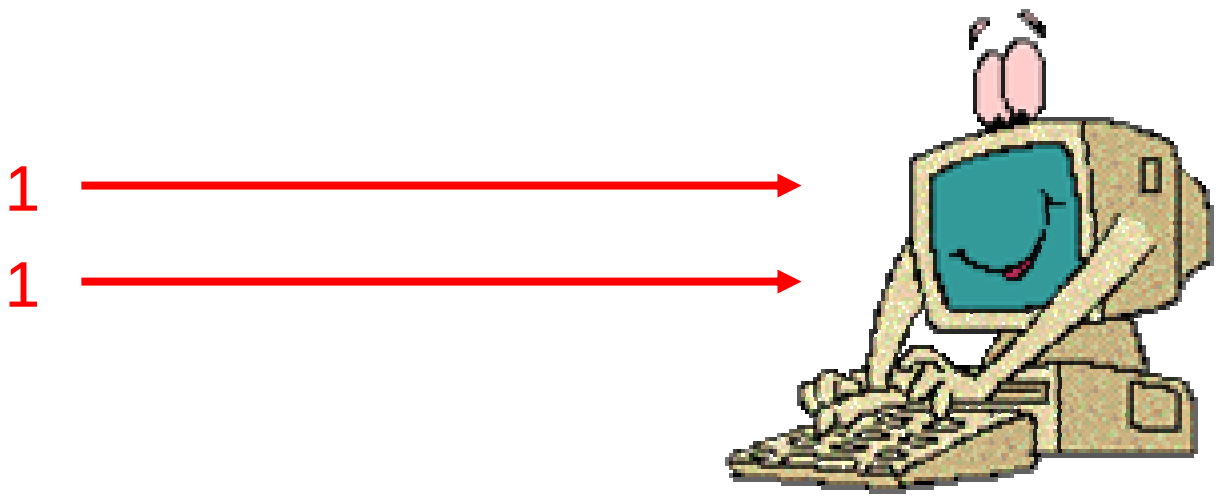
BINARY

- The language of computers — the binary system — is based on 0s and 1s.
- For instance, a computer would completely understand the following: 01001010111101001001010000010100101011110100
- This is called a binary number.
- Computers communicate using these binary numbers, which make up *computer language.*

What do the numbers mean?

- There are electrical wires inside a computer.
- Each wire is either on (1) or off (0).
- Take a simple computer with just two wires:

11 means both wires are on.



Translating into Actions

These on/off signals tell the computer what to do. You can program the computer to respond to the wires in whatever way you want. Suppose we programmed the computer to behave like this:

- If both wires are ON, then the computer is on.
- If both wires are OFF, then the computer is off.
- If one wire is ON and the other is OFF, then the computer is sleeping.

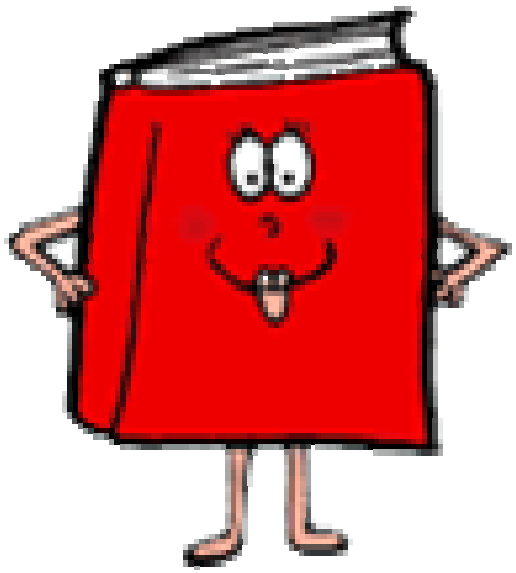
1

0

This computer is sleeping.

Translating into English

Let's make a BINARY dictionary:



01000001 means "A"
01000010 means "B"
01000011 means "C"
01000100 means "D"
01010010 means "R"

There are no spaces between these "words" in binary numbers.

Decipher this Binary Message:

REMEMBER: Every set of eight numbers is a separate letter.

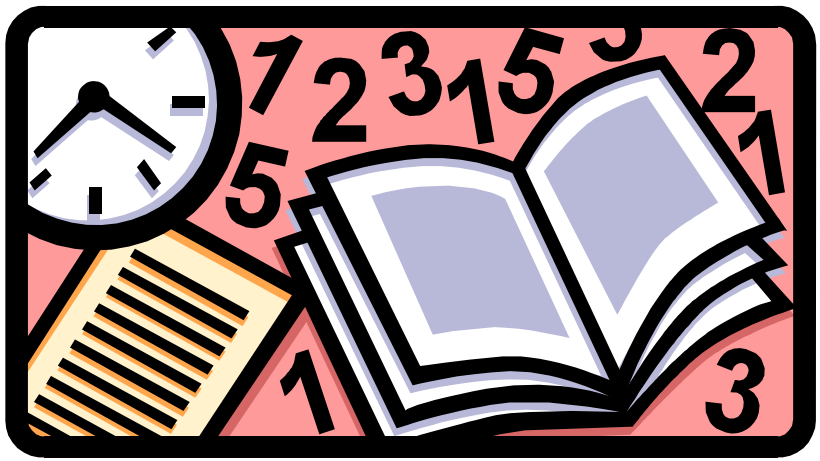
01000001
01000010
01010010
01000001
01000011
01000001
01000100
01000001
01000010
01010010
01000001

01000001 means “A”
01000010 means “B”
01000011 means “C”
01000100 means “D”
01010010 means “R”

ABRACADABRA!

A	01000001
B	01000010
R	01010010
A	01000001
C	01000011
A	01000001
D	01000100
A	01000001
B	01000010
R	01010010
A	01000001

Order of Operations



- When you evaluate an algebraic expression, there's a certain order that you need to do it in.
- This is called "order of operations."

Order of Operations

Please → **P** arentheses (...)

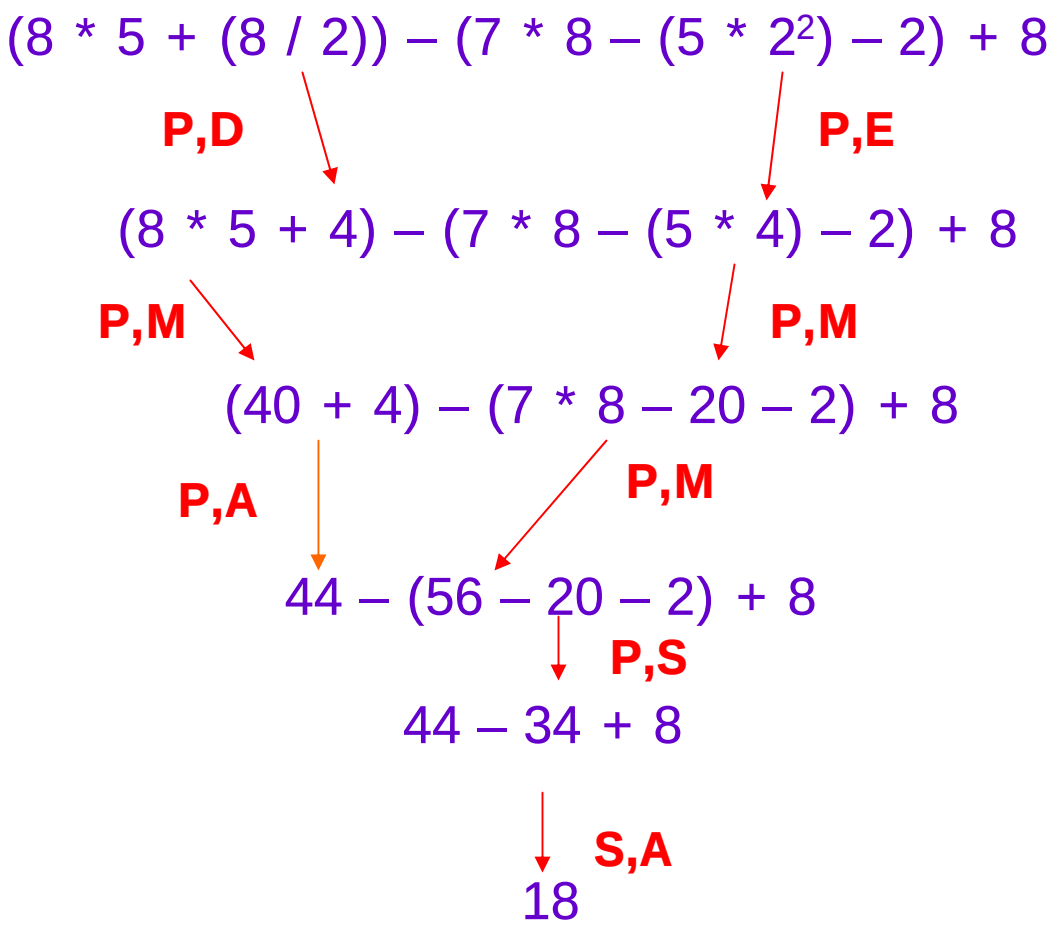
Excuse → **E** xponents a^b

My Dear → **M** ultiplication a * b **D** ivision a / b

Aunt Sally → **A** ddition a + b **S** ubtraction a - b

With M|D or A|S, you evaluate the expression from left to right.

Example Order of Operations Problem



That’s All Folks!

- Geometry, binary, and order of operations make up the majority of the math you’ll need for the rest of Artemis.
- We’ll use this math in Logo, Visual Basic, and Robotics, among other topics.