# Understanding Advanced Maths with and for Data

Understanding the concepts, rather than memorizing facts or focusing on calculations.

Advanced Maths using the plural or British way of saying abbreviating mathematics to be inclusive of set theory, algebra, trigonometry, calculus, statistics, data science and more maths.

Data is information that we can record, measure, and analyze.

Why maths?
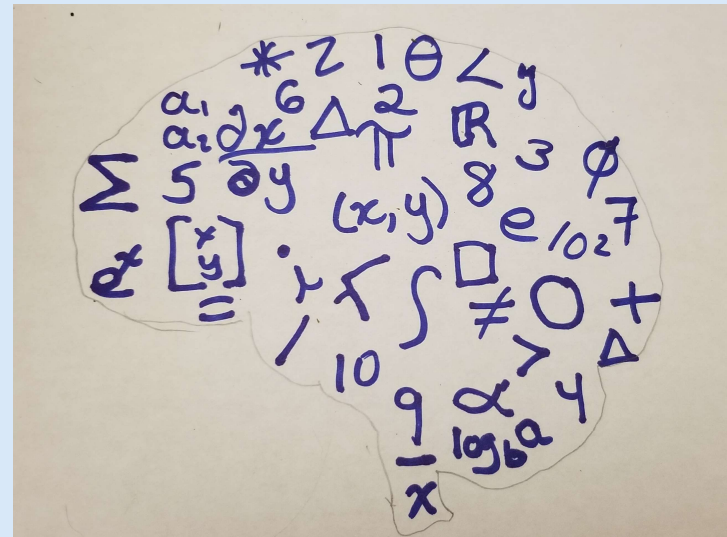
Communication

Processing

Tools for:

Making Sense

area for building

shopping

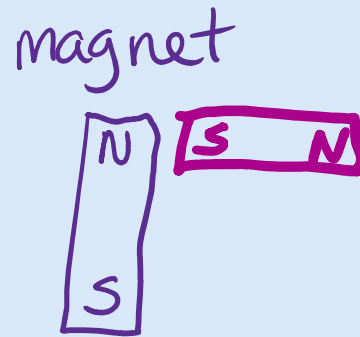We can use maths to map, study, and communicate:
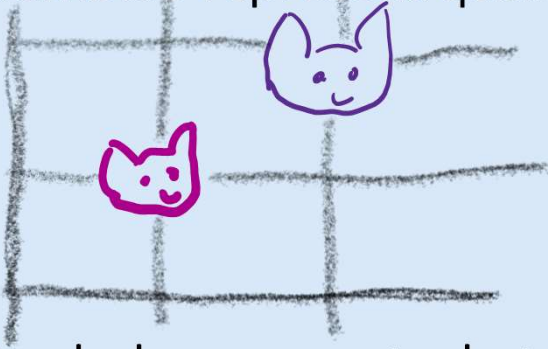
Objects

Amount

Location

Patterns

Relationships

magnet

N

S

S   N

Numbers represent quantity, measurement, and location.

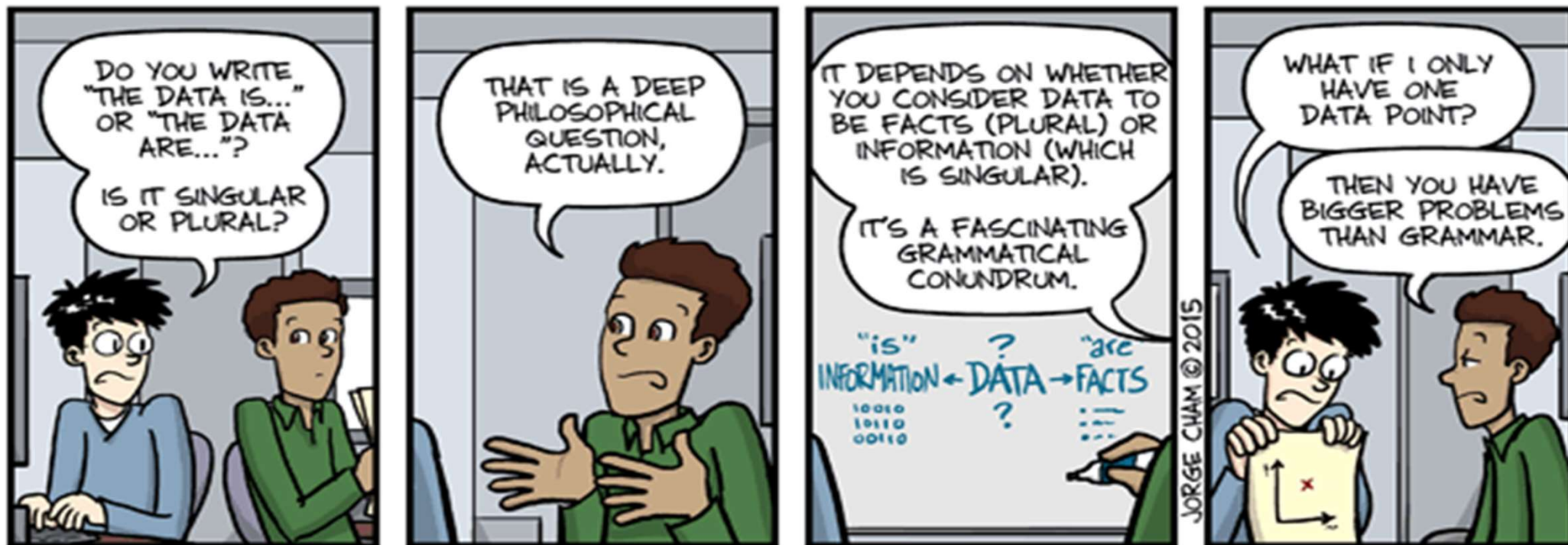Symbols represent what we do with the numbers, called operations.

$$1 + 1 \qquad 2 - 1$$

Data is the information that we collect or measure, and the term is usually used for one piece of information.

Doc   cat   grey   8 digits on each front paw
Aury   cat   gold+white   5 digits on each front paw

Data Data - Wikipedia

PHD Comics: A Grammatical Conundrum

There are different types of data. We will start by looking at categories of different types.

Levels of Measurement (Statistics, Data Science)

Levels of Measurement: Nominal, Ordinal, Interval and Ratio – Statology

Level of measurement - Wikipedia

Nominal- names

Ordinal- order

Interval- evenly spaced scale

Ratio- evenly spaced scale that starts at zero

Don't worry about all these terms. We are going to do them one at a time, starting with Nominal.

Algebra is a basis for communicating and thinking about math. It uses symbols to represent numbers or data and there are also symbols for operations that can be done on the numbers or data.
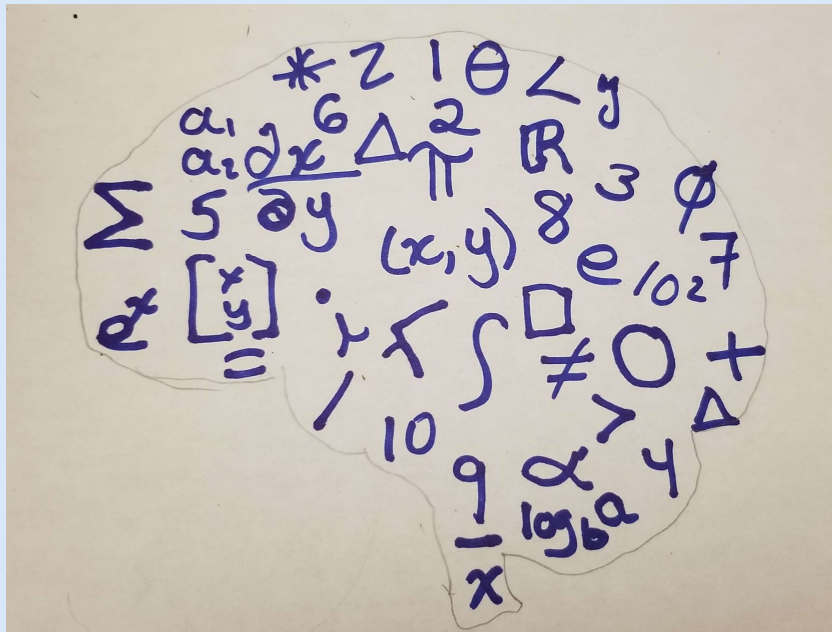
We can use algebra to work with the data.

Concrete reasoning is when you are thinking about a particular object or example. It can be something tangible that you can touch, count or measure.

$$1 \text{ cat} + 1 \text{ cat} = 2 \text{ cats}$$

Abstract reasoning is when you generalize to have it represent anything.

$$n_1 + n_2 = S$$

Some number + another number = a sum

Algebra uses variables, which are letters that represent numbers.

In the US, we use English and Greek letters most commonly for variables.

$$x, y \text{ and } n$$

Using variables, we can go from concrete to abstract reasoning.

$$1 + 1 = 2 \qquad\qquad x + 1 = 2$$

$$3 + 2 = 5 \qquad\qquad x + 2 = 5$$

$$\text{input number} + \text{a number} = \text{output number} \qquad x + n = y$$

These are called algebraic expressions. They describe what you are doing using the language of algebra. Here we are taking a number and adding another number to it. $x + 1$

$$x + 2$$

$$x + n$$

These are called algebraic equations. Do you notice that they have an equal sign? That is why we say equation.

$$x + 1 = 2$$

$$x + 2 = 5$$

$$x + n = y$$

Introduction
Nominal Data
     Set Theory
     Set Operations
Ordinal Data
     Lists and tables
Interval Data
     Integers and Number Lines
     Vectors
     Addition (Subtraction)
Ratio Data
     Rational numbers
     Multiplication (Division)

Then we will move into Algebra

Teaching Assistants for the program:

Socrates visits from Canada.

Doc, short for Doctor Strange.

Aury, short for Aurum because she is golden.

(c) Crainix