



Mathematics, English for Sek I and Sek II

Mathematica - The Principles of Math

7. Equations, the Mathematics of Curiosity

08:35 minutes

00:35 Perhaps in the days of early humans, simply counting what they saw was all they did.

00:40 But then their curiosity was piqued.

00:43 “How many did that other guy get?” Beyond simple addition and subtraction, people began to search for effects of these results. Thus came the greatest turnaround in the development of human thought.

00:53 That’s how we got equations.

00:54 (caption)

equation

a math equality containing variables, which can be true or false depending on the variables

01:07 Imagine there’s a news article on some cute pop singers.

01:12 Their group is composed of five members whose average age is nineteen. The youngest two, A and B, are the same age. C is one year older than they are. D is two years older and E is seven years older.

01:13 (caption)

average age: 19

five members

A and B, the youngest, are the same age

C is one year older

D is two years older

E is seven years older

01:28 So then, how old are these members?

01:31 Sounds complicated?

Don’t worry, because we can calculate all their ages.

01:41 (caption)

A’s age

B: A’s age

C: A’s age + 1

D: A’s age + 2

E: A’s age + 7

01:49 What we need right now is an equation.

01:53 If we use x to represent the age of A, then we can organize all the other variables according to x .

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02:11 We know their average age is nineteen. So we add all the members' age and divide the result by the number of members, which is five.

02:05 (caption)
average age
number of members

02:24 Here's the completed equation.

02:27 But what do we do now?

02:30 The answer is in the equal sign.

02:34 This is a mathematical sign, which simply means the numbers or expressions on both sides have the same value.

02:35 (caption) equal sign
a sign meaning two numbers or expressions are the same value

02:44 For example, let's say you're watching an old-fashioned scale.

02:49 On both sides we place a chicken of the same weight.

02:54 Even when you double or triple the weight on both sides, ...

02:58 ...divide them by the same number, ...

03:03 ...add the same amount of seasoning on both sides, ...

03:07 ...or eat up the same sized drumstick from both, ...

03:12 ...as long as the scale is balanced, then the weight on both sides is the same.

03:24 The ultimate goal in equations is to find a value for the variable x which makes the equation true.

03:27 (caption)
ultimate goal

03:31 We can get rid of the parentheses for a simple calculation.

03:37 We put all the variables on one side, ...

03:41 ...and the constants are put together.

03:48 From here, we can apply rules of equality.

03:54 If we multiply both sides of the equation by five, then we can get rid of the denominator on the right. We should also calculate what's on the left.

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04:05 In order to get rid of the number ten, we subtract ten from each side. Five next to x means the 5 and x are multiplied together. We can divide both sides by 5 to make it simple.

04:21 Now we can obtain a value for x that makes the equation true.

04:28 Can you figure out the ages for each member of this cute singing group?

04:45 (caption) Why should we express variables using x ?

04:52 Back in the beginning, it wasn't x .

04:58 This is an equation found in a papyrus from ancient Egypt.

04:57 (caption)

When the sum of aha and $\frac{1}{7}$ of aha is 19, find the aha.
— Papyrus written by Ramsay Ames, Egyptian priest

05:03 Here the variables are written as aha.

05:10 On a Babylonian clay tablet, igibum and igum were the variables they used.

05:10 (caption)

Igibum is bigger than igum by seven. What are the values of igibum and igum?
— Plimpton 322, Babylonian clay tablet

05:24 (caption)

There are one hundred dumplings and one hundred monks. The senior monks must get three dumplings and the three junior monks each get one dumpling. How many senior and junior monks are there?

05:28 This is a favorite poem of scholars from Korea's historic Chosŏn Dynasty.

05:32 Without any symbols or letters, the equation is expressed in words.

05:44 (caption)

René Descartes (1596-1650)
I think, therefore I am.
French philosopher and mathematician

05:45 It was French mathematician René Descartes who first used x as a variable in 1637.

05:59 Legend has it that when publishing his books, the little used letter x was very plentiful for publishers.

06:00 (caption) "How about using x , since there are so many...?"

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06:05 Since then, x has become the default go-to variable. Here is an airplane traveling across the blue sky. How did humans manage to invent a flying object?

06:21 If you take a closer look at air speed around the plane's wings, tension changes according to air pressure, and the force of gravity on the plane is taut.

06:31 (caption)
air speed
force of gravity
pressure
height
density

06:34 This complex relationship of power is organized in the form of an equation by representing each item as a variable, ...

06:42 ...so the complicated dynamics of flight are expressed in a single math operation.

07:01 About three centuries ago, a Dutch-Swiss mathematician organized this equation.

07:02 (caption)
Bernoulli's equation
constant value
pressure
velocity
height

07:02 Daniel Bernoulli (1700 – 1782)
Dutch-Swiss mathematician

07:02 Bernoulli's principle

07:05 That equation is still put to use in the production of every flying object.

07:15 Equations are able to make what humans think and imagine simpler and clearer.

07:19 (caption)
distance between an apple and the Earth
force of gravity
weight of the apple
weight of the Earth
gravitational constant

07:21 Isaac Newton managed to express the dynamics of gravity in an equation, supposedly after seeing a falling apple.

07:28 The formula for Newton's Law of Universal Gravity became the driving force toward the spatial era.

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07:28 (caption) Law of Universal Gravity

07:42 The most famous of these equations, which reminds us also of Albert Einstein, ...

07:44 (caption)

Albert Einstein (1879 – 1955)

German-born American theoretical physicist

07:47 ...contains his ideas that mass can be transformed into energy and vice versa.

07:47 (caption)

energy

velocity of light

mass

07:53 This in turn became the basic foundation for power plants producing nuclear energy and explaining the foundations of the universe.

08:01 (caption) Philosophy [nature] is written in that great book which ever is before our eyes -- I mean the universe -- but we cannot understand it if we do not first learn the language and grasp the symbols in which it is written. The book is written in mathematical language,

Galileo Galilei (1564 – 1642)