



Mathematics, English for Sek I and Sek II

Mathematica - The Principles of Math

11. Mathematical Relationships and Functions, Part 1

09:39 minutes

00:27 It's snack time. These children have come together to draw a ladder-shaped game to see who gets to buy snacks.

00:33 There are four participants. Whether they get free snacks or have to pitch in a dollar completely depends on their choice at this moment.

00:48 Whatever they decide, they will face one of four choices.

01:02 Do you realize this ladder-shaped game is a kind of function?

01:10 Hold on, let's have a little refresher on what we've learned in school.

01:14 (caption)

function

When each element from Set X corresponds to only one element from Set Y, this corresponding relationship is called a function of X to Y. The symbol for that definition is $f: X \rightarrow Y$, or $y = f(x)$.

domain of definition

range

co-domain

01:16 When each element from Set X corresponds to only one element from Set Y, this corresponding relationship is called a function of X to Y.

01:27 And it is formulated as $y = f(x)$.

01:31 Okay, so how about applying this definition to the ladder-shaped game?

01:38 The four participants in the game are the elements of Set X. And their results in the game are the four elements of Set Y.

01:53 Since any of the students in Set X can result from the four possible elements in Set Y, we have a situation where each item in Set X corresponds to only one thing in Set Y.

02:07 Now isn't that the same thing as the definition of a function?

02:13 How about writing this function in the form of $f(x)$?

02:20 It is not always the case that a function $f(x)$ can be expressed with a numeral formula.

02:25 Let's look at an example. Here, x values are the titles of novels, and their corresponding y values are the "authors of x."

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If you input The Adventures of Tom Sawyer into the function, the y value is Mark Twain. How about a book on Harry Potter? In that case, J.K. Rowling comes out. And The Hobbit gives you a y value of J.R.R. Tolkien.

02:43 (caption)

The Adventures of Tom Sawyer → Mark Twain
Harry Potter and the Chamber of Secrets → J.K. Rowling
The Hobbit → J.R.R. Tolkien

03:05 We can't express this relationship with numbers, but since each value of x (the books) corresponds to a value of y (the author of each book x), we are able to define it as a function.

03:11 (caption)

f(The Adventures of Tom Sawyer) = Mark Twain
f(Harry Potter and the Chamber of Secrets) = J.K. Rowling
f(The Hobbit) = J.R.R. Tolkien

03:22 Can we define all the relationships in the world in the form of a function?

03:28 Let's take another look at the definition of a function.

03:40 The value of x has to correspond to only one value in Set Y.

03:32 (caption)

function

When each element in Set X corresponds to only one element of Set Y, this corresponding relationship is called a function of X to Y. And that is symbolized by $f: X \rightarrow Y$ or $y=f(x)$.

03:52 Let's take some relationships found at school.

03:51 (caption)

Adams Middle School
A: first year, second year, third year
B: faculty room

04:03 The group of students is Set A and the group of teachers is Set B.

03:56 (caption)

$A = \{x \mid x, \text{ all the students}\}$
 $B = \{x \mid x, \text{ all the teachers}\}$
 $f(x) = \text{homeroom teacher of } x$

04:10 When we define an $f(x)$ of the students as their homeroom teachers, ...

04:15 ...several students correspond to one teacher y.

04:30 In this case, there are no teachers who don't correspond to a student. The value x has at least one y value. Therefore, this relationship constitutes a function.

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04:46 As you know, some of the educators at school don't do their job in the classroom. They are elements of Set B but they have no corresponding values.

04:54 (caption)
principal

04:55 When we recognize a function, all we need to see is that the values of x each have one value of y .

05:10 Now let's take a look at another relationship found at school.

05:15 This time, let's call the group of students Set A.
For each element x in Set A, $f(x)$ represents the friends of x .

05:16 (caption)
 $f(x)$ = friends of x
 $A = x \mid x$ students in that class

05:26 In cases where there are several friends for x , there is more than one corresponding value of y .

05:37 Therefore, this relationship isn't a function.

05:50 Now let's imagine the second-year students are Set A and the third-year students are Set B.

05:50 (caption)
 $A = x \mid x$ second-year students
 $B = x \mid x$ third-year students

05:56 If one student in Set A pairs up with one student in Set B and plays a two-player game with three parties, is this relationship a function?

06:16 If the number of students in Set A is more than in Set B, ...

06:20 ...then some y values have no corresponding x values. Then this is not a function.

06:25 There are many ways to express functions.

06:38 As you've seen before, you can connect each corresponding element,...

06:47 ...or you can create a table.

06:53 But the more common way is...

06:55 ...to draw ordered pairs in the form of a graph with coordinates.

06:59 (caption)
graph of a function
the graph of a function f is the collection of all ordered pairs of x and y (x, y)

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07:09 All ordered pairs of x and y , which represent x and their corresponding value of y , can show the different shapes of a function when they're drawn on a graph. This varies according to what kind it is.

07:22 When a function is a linear expression, it is called a linear function.

07:28 The graph of a linear function is a straight line on a coordinate graph.

07:40 There is a graph that looks like half an oval. Since its formula comes from a quadratic equation, this is called a quadratic function of x .

07:42 (caption) a , b , and c are constants

07:55 There is a fractional function, in which the value of x and y are in inverse proportion. The graphs of the fractional function are shaped like hyperbola facing each other.

08:02 (caption) a is a constant

08:13 In addition to these, some graphs of functions form waves like this.

08:17 $y = \sin x$ and $y = \cos x$ are trigonometric functions that are examples of this.

08:30 Many different graphs can be drawn on a set of coordinates. But not all of these are functions.

08:43 In this graph, two values of y are assigned to one value of x . That means this is not a graph of a function.

09:01 A horizontal parabola on the set of coordinates...
...is not a graph of a function.

09:16 In our next episode, we'll explore the variety found in the world of functions, including so many we may not have recognized in our daily lives.