함수
(Function)

Function

Start End

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Definition (Function)

Start End

Definition (Function)

A **function** f

Start End

Definition (Function)

A **function** f is

Start End

Definition (Function)

A **function** f is a rule

Start End

Definition (Function)

A **function** f is a rule that assigns to each element x

Start End

Definition (Function)

A **function** f is a rule that assigns to each element x in a set D

Start End

Definition (Function)

A **function** f is a rule that assigns to each element x in a set D exactly one element,

Start End

Definition (Function)

A **function** f is a rule that assigns to each element x in a set D exactly one element, called $f(x)$,

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A **function** f is a rule that assigns to each element x in a set D exactly one element, called $f(x)$, in a set E.

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A **function** f is a rule that assigns to each element x in a set D exactly one element, called $f(x)$, in a set E.

Definition (Domain, Value of f at x, Range, Independent variable)

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The set D is called the **domain**

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The set D is called the **domain** of the function.

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Definition (Independent variable, Dependent variable)

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A symbol

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Function

Home Start End

▸ Home ▸ Start ▸ End

A function f

Home Start End

A function f from X

Home Start End

A function f from X to Y

Home Start End

A function f from X to Y is a subset

Home Start End

A function f from X to Y is a subset of the Cartesian product $X \times Y$

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element of X

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element of X is the first component

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element of X is the first component of one and only one

Home Start End

A function f from X to Y is a subset of the Cartesian product $X \times Y$ subject to the following condition:
Every element of X is the first component of one and only one ordered pair

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element of X is the first component of one and only one ordered pair in the subset.

Home Start End

A function f from X to Y is a subset of the Cartesian product $X \times Y$ subject to the following condition:
Every element of X is the first component of one and only one ordered pair in the subset.
In other words,

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element of X is the first component of one and only one ordered pair in the subset.
In other words, for every x

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element of X is the first component of one and only one ordered pair in the subset.
In other words, for every x in X

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element of X is the first component of one and only one ordered pair in the subset.
In other words, for every x in X there is

Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element of X is the first component of one and only one ordered pair in the subset.
In other words, for every x in X there is exactly one element y

Home Start End

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Home Start End

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Home Start End

A function f from X to Y is a subset of the Cartesian product X $\times$ Y subject to the following condition:
Every element of X is the first component of one and only one ordered pair in the subset.
In other words, for every x in X there is exactly one element y in Y such that the ordered pair (x, y) is contained in the subset defining the function f.

Home Start End

Home Start End

$X \times Y$

Home Start End

$X \times Y =$

Home Start End

$$X \times Y = \{$$

Home Start End

$$X \times Y = \{(x, y)$$

Home Start End

$$X \times Y = \{(x, y)|$$

Function

Home Start End

$$X \times Y = \{(x, y) | x \in X,$$

Home Start End

$$X \times Y = \{(x, y) | x \in X, y \in Y\}$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}:$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$
f is a function

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

▸ Home ▸ Start ▸ End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \\ \\ \end{cases}$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset \\ \\ \end{cases}$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

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$$\begin{cases} f \subset X \times Y \\ \\ \end{cases}$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X \end{cases}$$

Home Start End

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f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X, \ \exists! y \in Y \end{cases}$$

Home Start End

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$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t.} \end{cases}$$

Home Start End

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f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases}$$

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$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ \\ \end{cases}$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

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Home Start End

$\mathrm{X} \times \mathrm{Y} = \{(x, y) | x \in \mathrm{X}, y \in \mathrm{Y}\}$: The Cartesian product $\mathrm{X} \times \mathrm{Y}$

f is a function from X to Y.

$$\begin{cases} f \subset \mathrm{X} \times \mathrm{Y} \\ \forall x \in \mathrm{X},\ \exists! y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in \mathrm{X},\ \exists y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \end{cases} \end{cases}$$

Home Start End

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$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow \end{cases} \end{cases}$$

▸ Home ▸ Start ▸ End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

f

▸ Home ▸ Start ▸ End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

f :

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X, \ \exists ! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X, \ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y, X$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$
f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y, X \xrightarrow{f}$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists ! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

Home Start End

$X \times Y = \{(x,y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x,y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x,y) \in f \\ (x,y_1) \in f \text{ and } (x,y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

X Domain

Y

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

X Domain

Y Codomain

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

X Domain

Y Codomain

f

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

f :

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

X Domain

Y Codomain

$f : x$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,$$

Home Start End

$X \times Y = \{(x,y)|x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x,y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x,y) \in f \\ (x,y_1) \in f \text{ and } (x,y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y, x$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f}$$

Home Start End

$\mathrm{X} \times \mathrm{Y} = \{(x, y) | x \in \mathrm{X}, y \in \mathrm{Y}\}$: The Cartesian product $\mathrm{X} \times \mathrm{Y}$

f is a function from X to Y.

$$\begin{cases} f \subset \mathrm{X} \times \mathrm{Y} \\ \forall x \in \mathrm{X},\ \exists! y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in \mathrm{X},\ \exists y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : \mathrm{X} \to \mathrm{Y},\ \mathrm{X} \xrightarrow{f} \mathrm{Y}$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y$$

▸ Home ▸ Start ▸ End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists ! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y =$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y, x \xrightarrow{f} y, y = f$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f($$

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f(x$$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f(x)$$

Home Start End

$\mathrm{X} \times \mathrm{Y} = \{(x, y) | x \in \mathrm{X}, y \in \mathrm{Y}\}$: The Cartesian product $\mathrm{X} \times \mathrm{Y}$

f is a function from X to Y.

$$\begin{cases} f \subset \mathrm{X} \times \mathrm{Y} \\ \forall x \in \mathrm{X},\ \exists! y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in \mathrm{X},\ \exists y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : \mathrm{X} \to \mathrm{Y}, \mathrm{X} \xrightarrow{f} \mathrm{Y}$$

X Domain

Y Codomain

$$f : x \longrightarrow y, x \xrightarrow{f} y, y = f(x)$$

$f(x)$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \ \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y, x \xrightarrow{f} y, y = f(x)$$

$f(x)$ The value

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f(x)$$

$f(x)$ The value of a function f

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f(x)$$

$f(x)$ The value of a function f at x

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f(x)$$

$f(x)$ The value of a function f at x

x

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \end{cases} \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f(x)$$

$f(x)$ The value of a function f at x

x The independent variable

▸ Home ▸ Start ▸ End

$\mathrm{X} \times \mathrm{Y} = \{(x, y) | x \in \mathrm{X}, y \in \mathrm{Y}\}$: The Cartesian product $\mathrm{X} \times \mathrm{Y}$

f is a function from X to Y.

$$\begin{cases} f \subset \mathrm{X} \times \mathrm{Y} \\ \forall x \in \mathrm{X},\ \exists! y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in \mathrm{X},\ \exists y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : \mathrm{X} \to \mathrm{Y},\ \mathrm{X} \xrightarrow{f} \mathrm{Y}$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f(x)$$

$f(x)$ The value of a function f at x

x The independent variable

y

▸ Home ▸ Start ▸ End

$\mathrm{X} \times \mathrm{Y} = \{(x, y) | x \in \mathrm{X}, y \in \mathrm{Y}\}$: The Cartesian product $\mathrm{X} \times \mathrm{Y}$

f is a function from X to Y.

$$\begin{cases} f \subset \mathrm{X} \times \mathrm{Y} \\ \forall x \in \mathrm{X},\ \exists! y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in \mathrm{X},\ \exists y \in \mathrm{Y} \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : \mathrm{X} \to \mathrm{Y},\ \mathrm{X} \xrightarrow{f} \mathrm{Y}$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f(x)$$

$f(x)$ The value of a function f at x

x The independent variable

y The dependent variable

▸ Home ▸ Start ▸ End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y,\ X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y,\ x \xrightarrow{f} y,\ y = f(x)$$

$f(x)$ The value of a function f at x

x The independent variable

y The dependent variable

$f(X)$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

f is a function from X to Y.

$$\begin{cases} f \subset X \times Y \\ \forall x \in X,\ \exists! y \in Y \text{ s.t. } (x, y) \in f \begin{cases} \forall x \in X,\ \exists y \in Y \text{ s.t. } (x, y) \in f \\ (x, y_1) \in f \text{ and } (x, y_2) \in f \Rightarrow y_1 = y_2 \end{cases} \end{cases}$$

$$f : X \to Y, X \xrightarrow{f} Y$$

X Domain

Y Codomain

$$f : x \longrightarrow y, x \xrightarrow{f} y, y = f(x)$$

$f(x)$ The value of a function f at x

x The independent variable

y The dependent variable

$f(X)$ $=$

Home Start End

$X \times Y = \{(x, y) | x \in X, y \in Y\}$: The Cartesian product $X \times Y$

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Image of f

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Image of f or

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Image of f or Range

▸ Home ▸ Start ▸ End

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Image of f or Range of f

Github:
https://min7014.github.io/math20190810112.html

Click or paste URL into the URL search bar, and you can see a picture moving.