Set Theory

Next Chapter:

Set, Subset, Power Set

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GATE CSE AIR 53; AIR 67;
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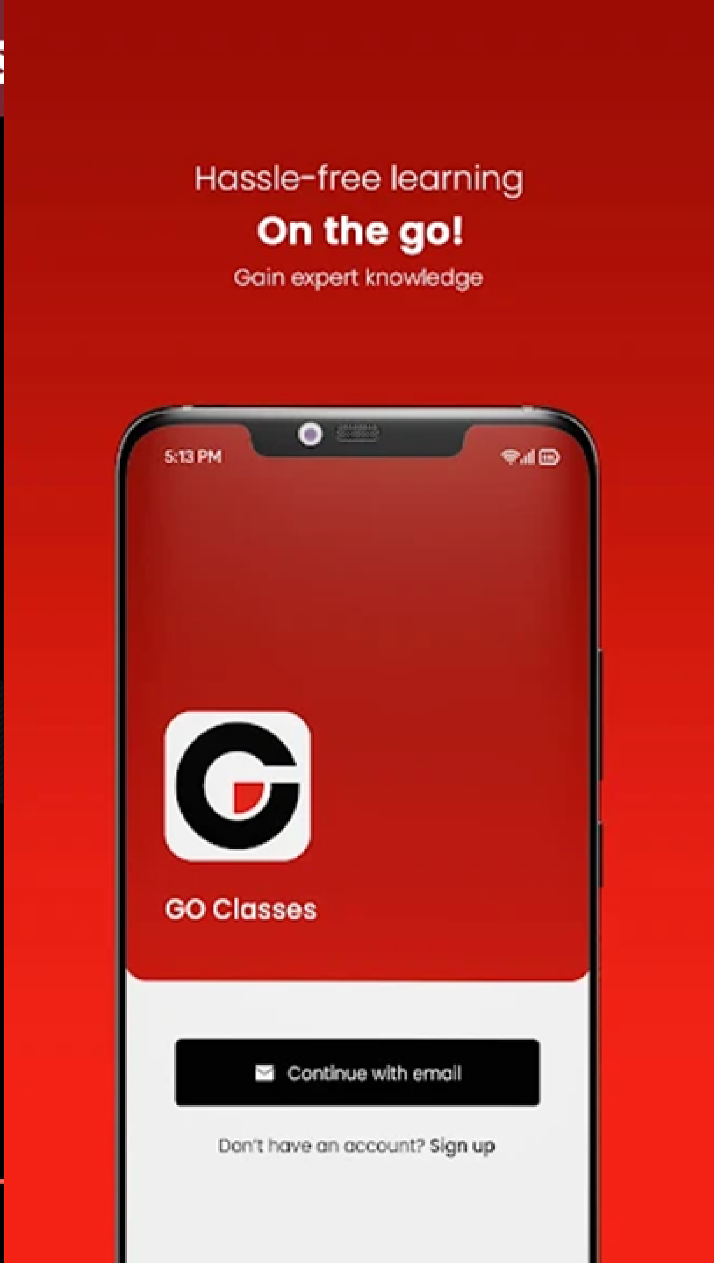

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Next Module:

Set Theory

Set Theory:

1. Set

2. Relation
- Lattice

3. Function

Next Topic:

Set

Set (Definition):

In most simple words,

Set is just a collection of objects.

Collection of elements:

Goclasses Students $= \{A_1, A_2, A_3, \ldots\ldots\}$

Dogs

Indian currency coins $= \{1, 2, 5, 10\}$

Integers $= \{0, +1, -1, +2, -2, \ldots\}$

Example:

English Vowels: a e i u o

English Vowels $= \{a, e, i, u, o\}$

object/element

object/element

element

Set (Definition):

In most simple words, Set is just a collection of objects.

Set notation: Curly braces with commas separating out the elements.

Set Notation:

Set $S = \{ a, b, c \}$

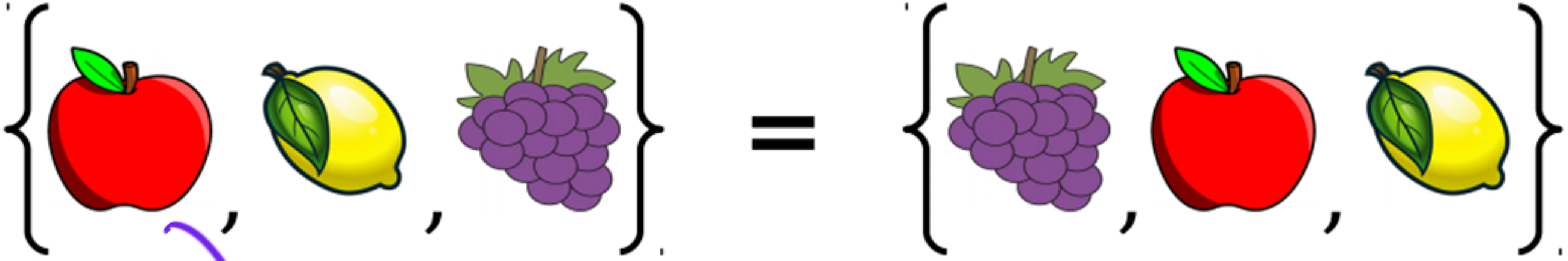
element/object

Set Notation

Set (Definition):

Set has two VERY Important Properties:

1. **Unordered Collection:** Order of objects does not matter.
2. **Distinct Elements:** No duplicate elements

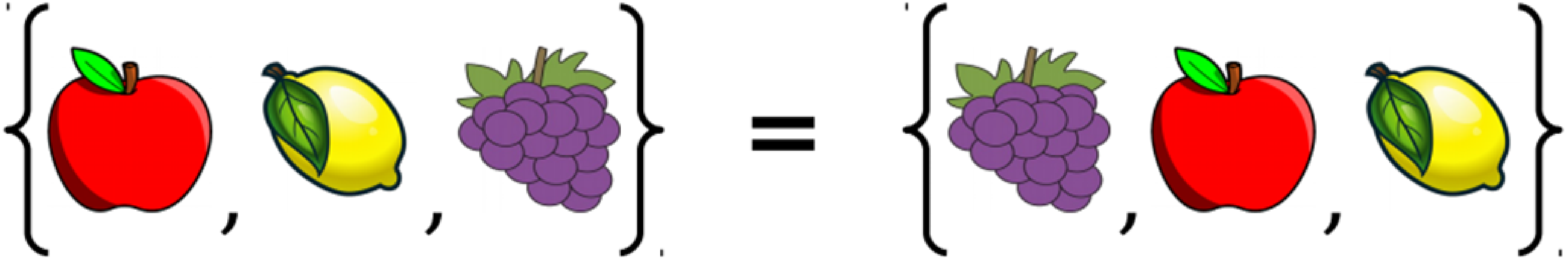


a set

object / element

These are two different descriptions of exactly the same set.

Two sets are equal when they have the same contents, ignoring order.



These are two different descriptions of exactly the same set.

Two sets are equal when they have the same contents, ignoring order.

A **set** is an **unordered** collection of distinct objects, which may be anything (including other sets).

A **set** is an *unordered* collection of distinct objects, which may be anything (including other sets).

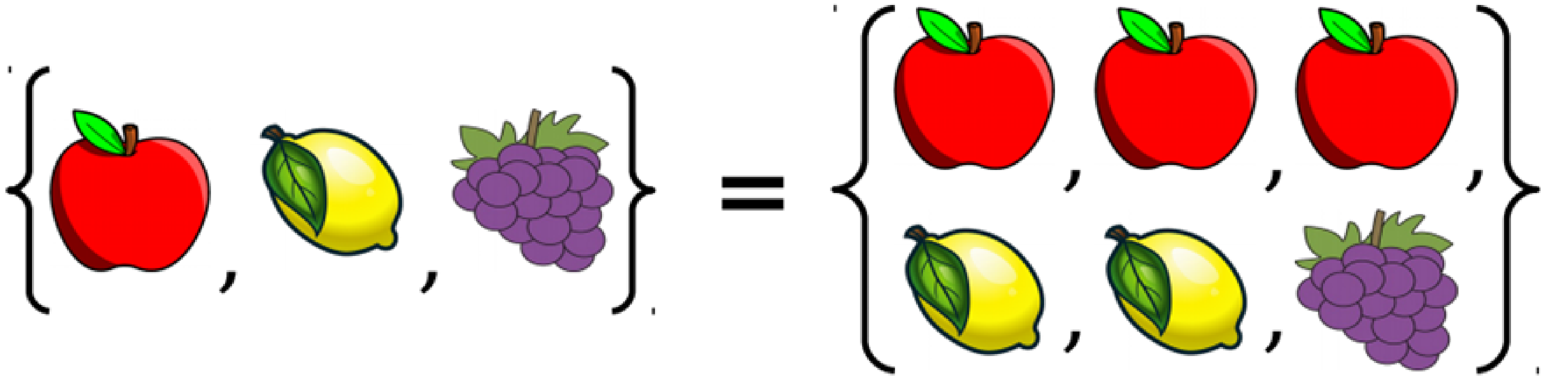
Set (Formal Definition):

A set is an unordered collection of distinct objects, which may be anything.

No Duplicates.

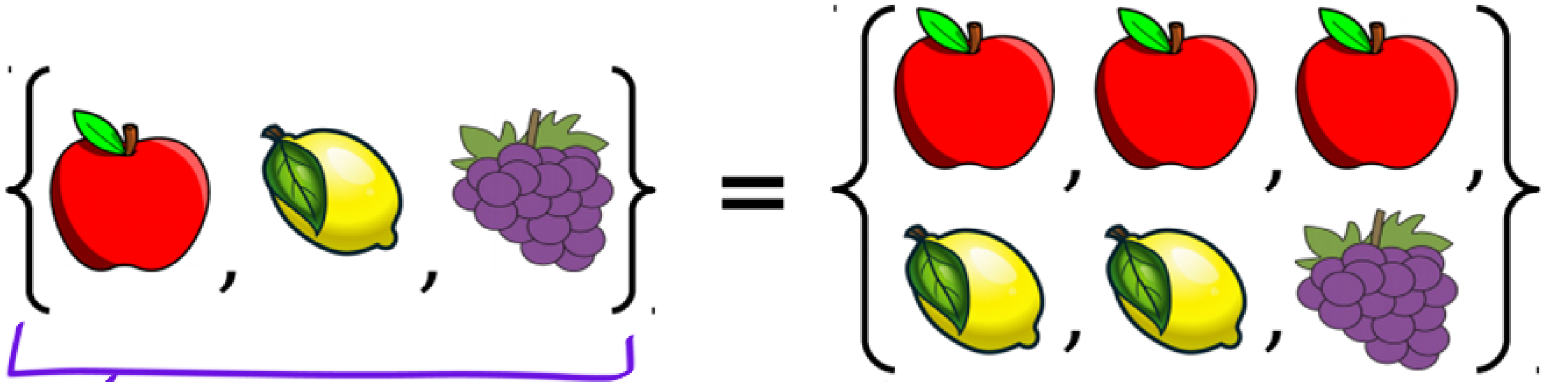
No two same elements.

We ignore Duplicate elements.



These are also two different descriptions of exactly the same set.
(But please use the description without duplication :-))

Sets cannot contain duplicate elements.
Any repeated elements are ignored.

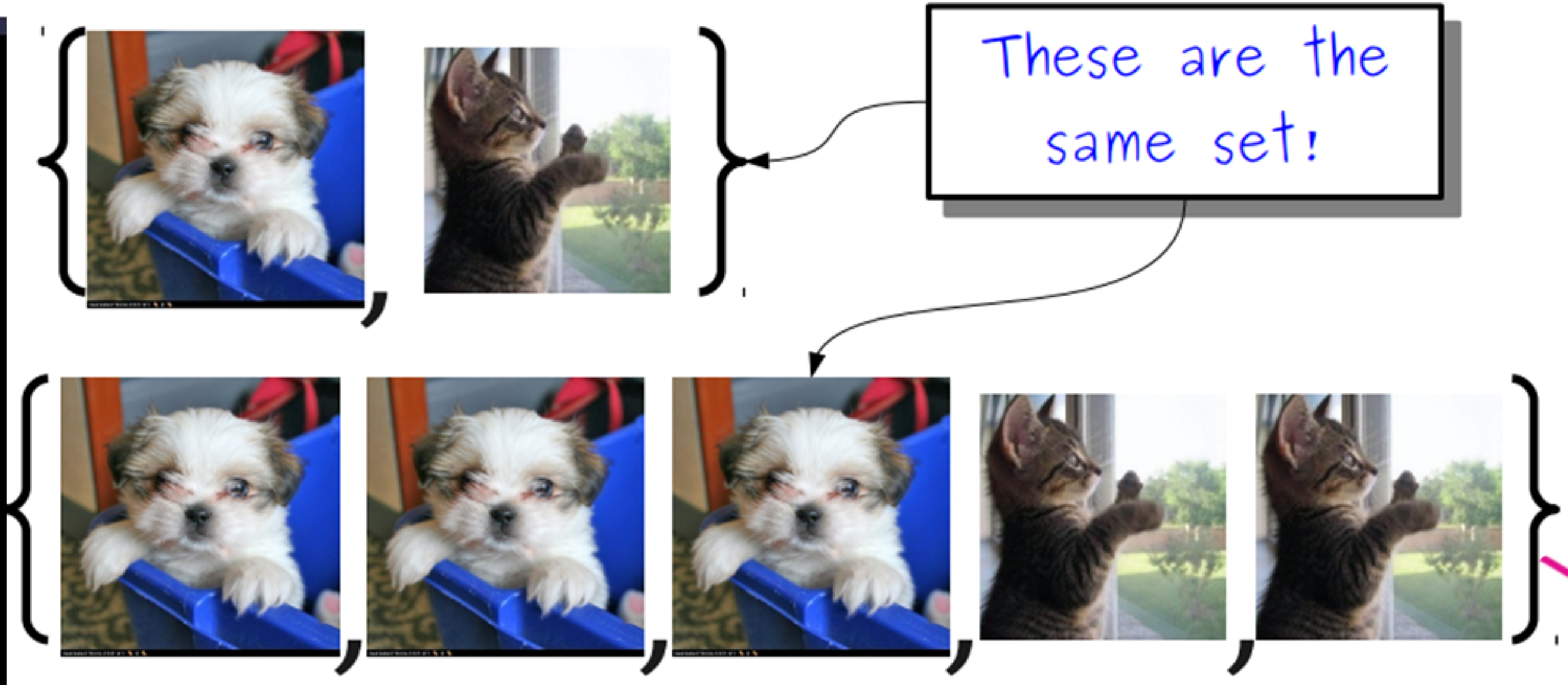


3 elements

3 elements

These are also two different descriptions of exactly the same set.
(But please use the description without duplication :-))

Sets cannot contain duplicate elements.
Any repeated elements are ignored.



2 elements

A **set** is an unordered collection of **distinct** objects, which may be anything (including other sets).

2 elements

A **set** is an unordered collection of *distinct* objects, which may be anything (including other sets).

Example:

Set of

English Vowels:

$= \{a, e, i, o, u\} = \{a, i, u, o, e\} =$

$= \{a, a, e, e, e, i, o, u\}$

5 elements

Example:

Set of prime numbers less than 10:

$\{2, 3, 5, 7\} = \{7, 2, 3, 5\}$

$= \{2, 2, 3, 3, 5, 5, 7\} = \{2, 3, 3, 5, 5, 5, 7\}$

4 elements

4 elements

Example:

How many elements does the following sets have?

$\{a, b\}$

$\{a, b, a, a\}$

$\{b, a\}$

Example:

How many elements does the following sets have?

Only Count Distinct elements

{a, b} 2 elements

{a, b, a, a } 2 "

{ b , a } → 2 "

Same set

Example:

ISRO Exam Question:

How many elements does the following sets have?

$$\{ a, b, a, a, 1, 1, 2, 3, 3, 2\}$$

Example:

ISRO Exam Question:

How many elements does the following sets have?

$\{ a, b, \cancel{a}, \cancel{a}, 1, \cancel{1}, 2, 3, \cancel{3}, \cancel{2} \}$ → 5 elements

Example:

Which of the following a the set of all prime numbers less than 10?

A. $\{ 3, 2, 5, 7 \}$

B. $\{ 3, 2, 5, 7, 7, 5, 2 \}$

C. $\{ 2, 3, 5, 7 \}$

Example:

Which of the following a the set of all prime numbers less than 10?

A. $\{3, 2, 5, 7\}$

B. $\{3, 2, 5, 7, 7, 5, 2\} = \{2, 3, 5, 7\}$

C. $\{2, 3, 5, 7\}$

Set (Formal Definition):

A set is an unordered collection of distinct objects, which may be anything.

$S = \{a, b, 1, 2, \text{dog}, \text{goa}\}$ → 6 elements

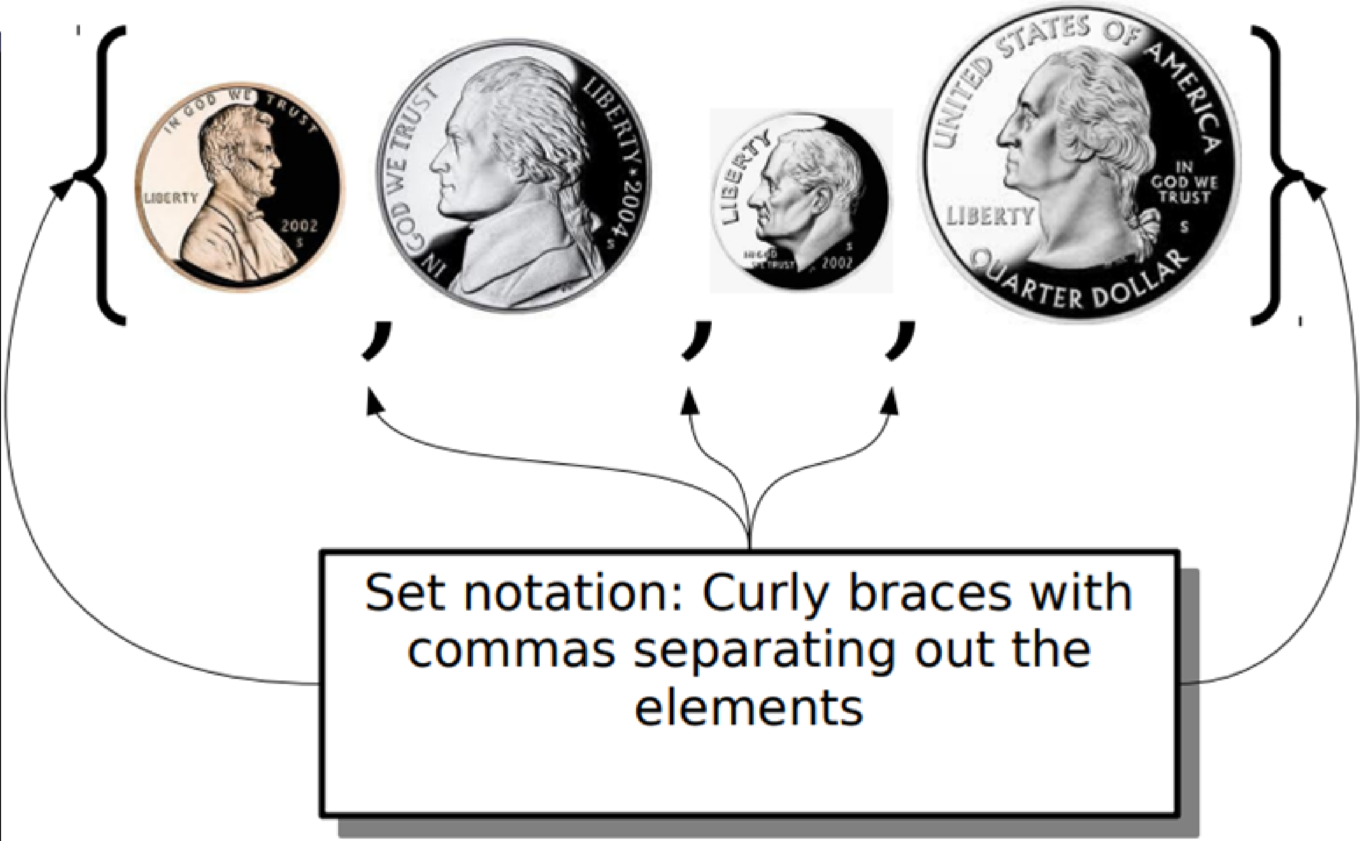
a set

$S = \{\{a\}, \{b\}, \{1,2\}, 3\}$

4 elements

$\{a\}$
$\{b\}$
$\{1,2\}$
3

elements of S



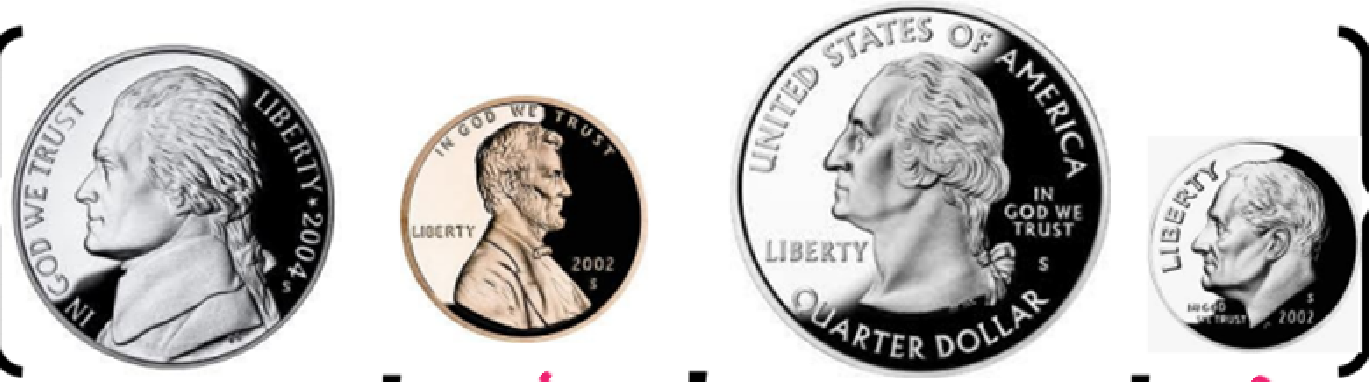
A ***set*** is an unordered collection of distinct objects, which may be anything, including other sets.

Set notation: Curly braces with commas separating out the elements

A **set** is an unordered collection of distinct objects, which may be anything (including other sets).

Next Topic:

Set Membership

$S = \{$  $\}$

element

object

element

element

The objects that make up a set are called the ***elements*** of that set.

$S = \{a, b, c\}$ → element of S

a
b
c

a $\boxed{\text{is in}}$ set S

$a \in S$

d $\boxed{\text{is not in}}$ set S

$d \notin S$

$\in$: Symbol for memership

$\boxed{\text{belongs to}}$

$\notin$: does not belong to

$S = \{a, b, c\}$

$a \in S$; $b \in S$; $d \notin S$; $2 \notin S$

This symbol means "is an element of."

The objects that make up a set are called the ***elements*** of that set.

$\notin$ $\{$

,

,

,

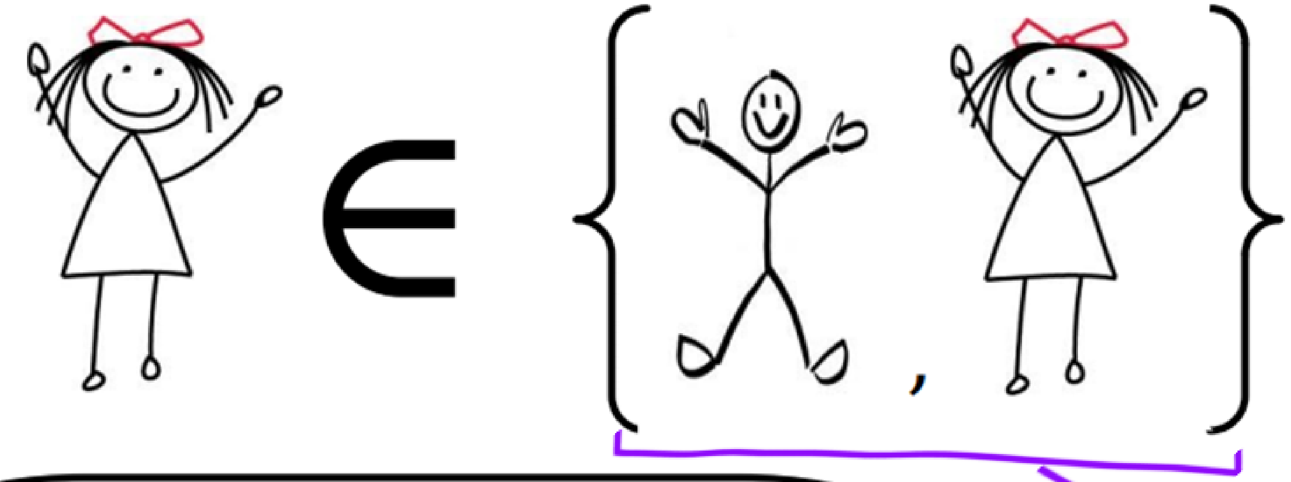
$\}$

This symbol means "is not an element of."

The objects that make up a set are called the ***elements*** of that set.

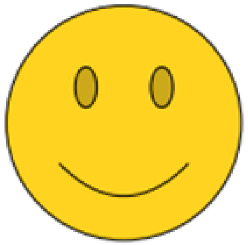
$$\in$$

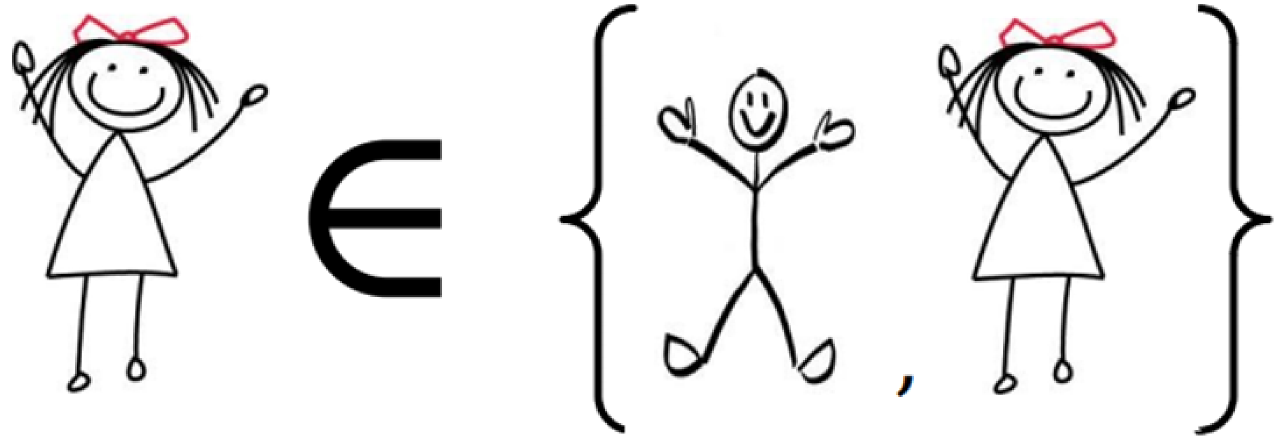
This symbol is the "element-of" symbol.



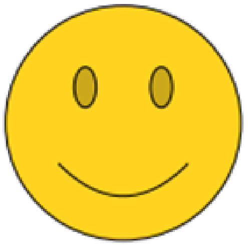
It's used to indicate that something is an *element* of a set.

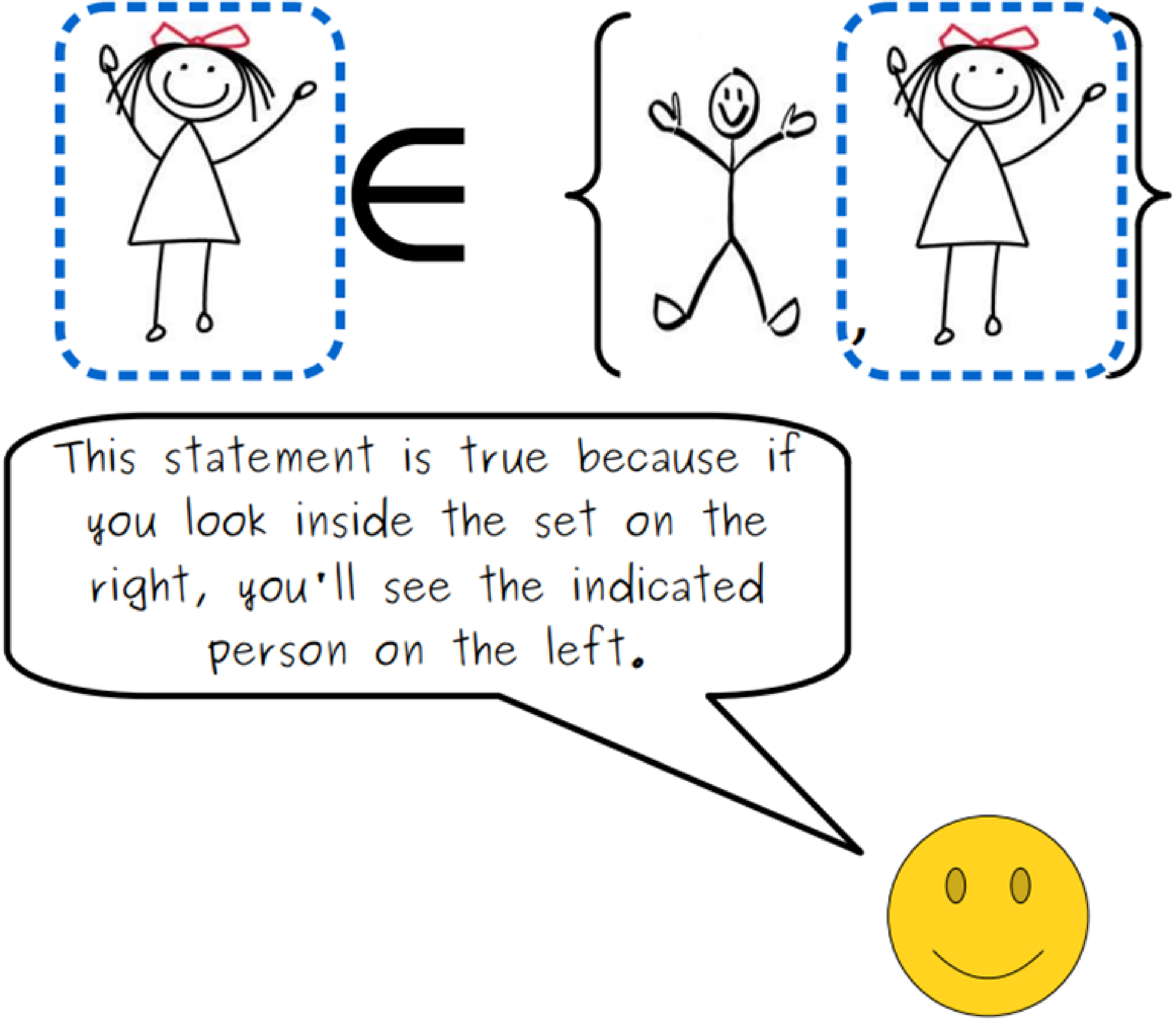
set
(collection)

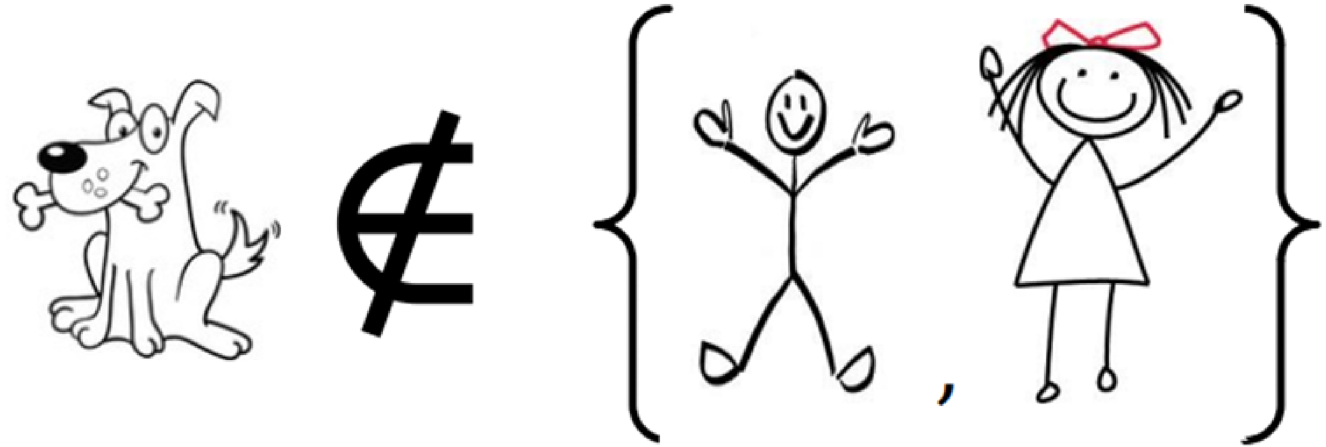




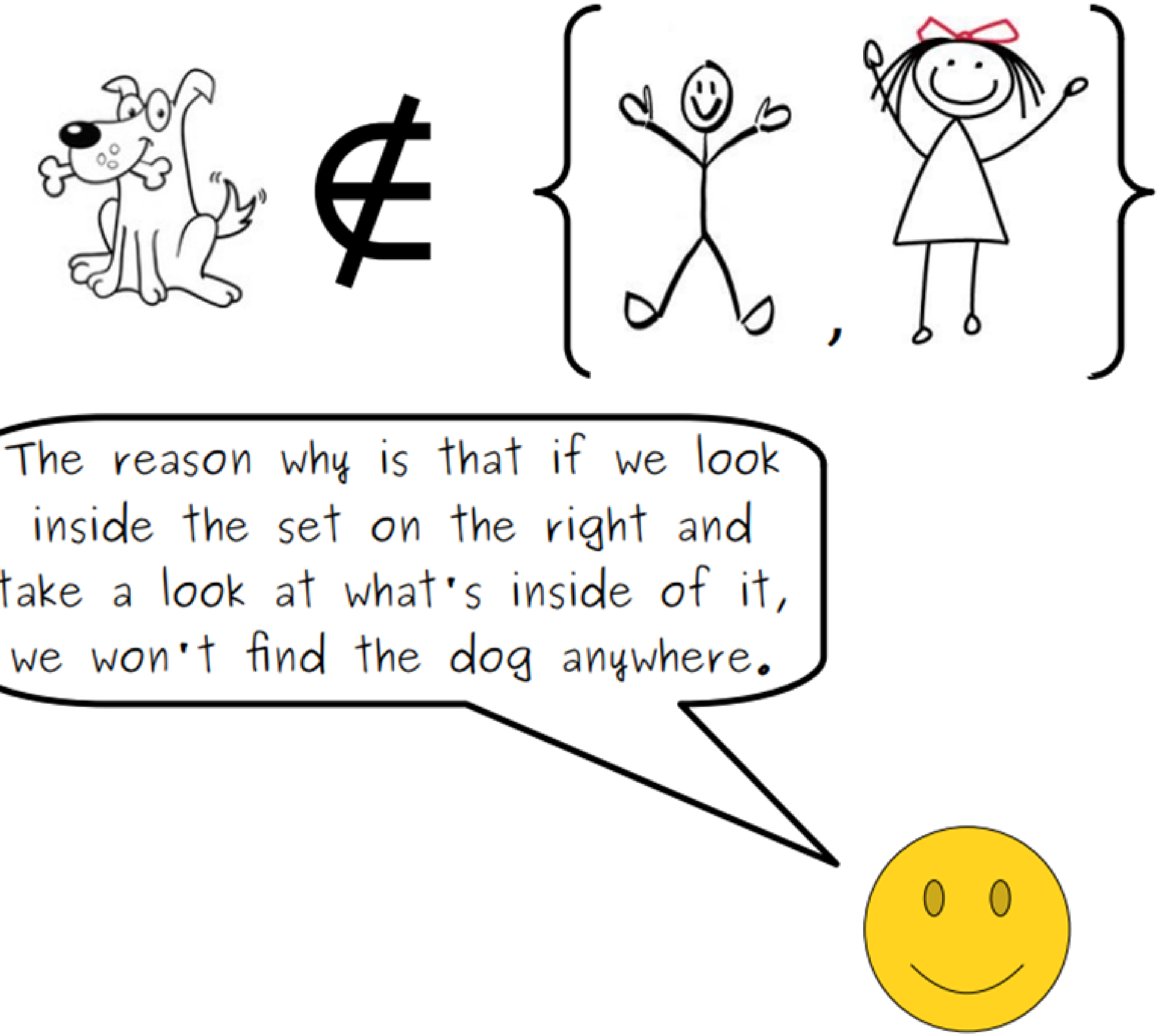
So, in this example, we're using the symbol to indicate that the girl belongs to the set containing the boy and the girl.




∈
This statement is true because if you look inside the set on the right, you'll see the indicated person on the left.



On the other hand, the dog on the left is not an element of the set on the right.


∉
The reason why is that if we look inside the set on the right and take a look at what's inside of it, we won't find the dog anywhere.

Definition 2.2 *The* set membership symbol $\in$ *is used to say that an object is a member of a set. It has a partner symbol* $\notin$ *which is used to say an object is not in a set.*

$S = \{a, b\}$

a $\boxed{\text{is member of}}$ S

$a \in S$

d $\boxed{\text{is not member of}}$ set S

$d \notin S$

Set Membership

GO Classes

- Given a set S and an object x, we write

$$\boldsymbol{x \in S}$$

if x is contained in S, and

$$\boldsymbol{x \notin S}$$

otherwise.

- If $x \in S$, we say that x is an **element** of S.
- Given any object and any set, either that object is in the set or it isn't.

Set $S = \underbrace{\{ \;,\;,\;, \ldots \}}_{\text{set } S}$

element x

$$\begin{cases} x \in S \quad \underline{\text{OR}} \quad x \notin S \\ \text{But not both} \end{cases}$$

$$1 \stackrel{?}{=} \{1\}$$

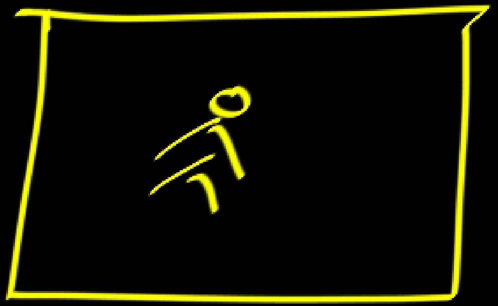
Question: Are these objects equal?

$$1 \overset{?}{=} \underbrace{\{1\}}_{\text{a set}}$$

a number

a set

Question: Are these objects equal?

me  $\neq$ 

a person

a Room

$1 \neq \{1\}$

a Set

Set $\equiv$ Box

Analogy

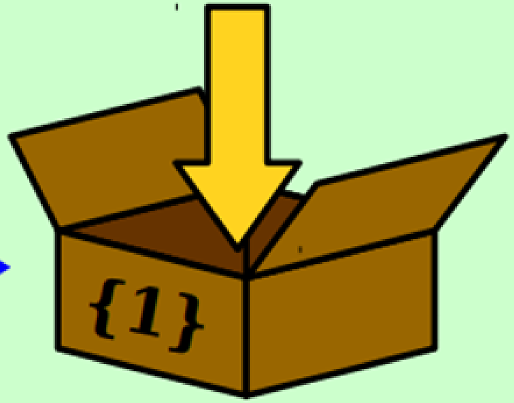
$$\underbrace{1}_{\text{a number}} \neq \underbrace{\boxed{1}}_{\text{a Box}} \qquad \underbrace{\{1\}}_{\text{set}} = \boxed{1}$$

$$1 \neq \{1\}$$

This is a number.

1

1



This is a set. It contains a number.

Question: Are these objects equal?

Set $S = \{ a,b,c \}$

① $a \in S$

② $\{a\} \in S$

③ $b \in S$

④ $\{b\} \in S$

⑤ $\{a,b\} \in S$

⑦ $\{a,b,c\} \in S$

⑧ $c \in S$

⑨ $\{c\} \in S$

Set S = { a,b,c }

set S → elements: a, b, c → 3 elements

1. $a \in S$
2. ~~$\{a\} \in S$~~
3. $b \in S$
4. ~~$\{b\} \in S$~~
5. ~~$\{a,b\} \in S$~~
7. ~~$\{a,b,c\} \in S$~~
8. $c \in S$
9. ~~$\{c\} \in S$~~

Next Topic:

Finite Set

Infinite Set

Finite Set

A set with a limited number of elements

Example: $A = \underbrace{\{\text{Dog, Cat, Fish, Frog}\}}_{4 \text{ elements}}$

a whole number

Infinite Set

A set with an unlimited number of elements

Example: $N = \{1, 2, 3, 4, 5, \ldots\}$

finite set :

a set in which number of elements is equal to some whole number.

0, 1, 2, 3, 4 - - - - - - - - -

$\{1, 2, 3, 4, \ldots, 10\}$ → finite set

10 elements → a whole no.

$N = \{1, 2, 3, \ldots\}$

infinite set

$W = \{0, 1, 2, 3, \ldots\ldots\}$

$\infty \in W$ ✗

$\infty \notin W$

Not a whole number

a Concept

Not a number

not a Real number

Some Popular Infinite Sets:

1. $N = \{1, 2, 3, 4, \ldots\}$ Natural numbers

2. $Z = \{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$

integers

3. $P = \{2, 3, 5, 7, 11, \ldots\}$ Set of prime numbers

Some Popular Infinite Sets:

(4) $\mathbb{Q}$ = Set of Rational numbers

$= \left\{ \frac{a}{b} \middle| a, b \text{ are integers}; b \neq 0 \right\}$

$= \left\{ \frac{7}{5}, \frac{-7}{-2}, \frac{7}{1}, \frac{2}{1}, \dots \right\}$

Some Popular Infinite Sets:

(5) R = set of Real numbers

$R = (-\infty, \infty)$

$-e \in R$

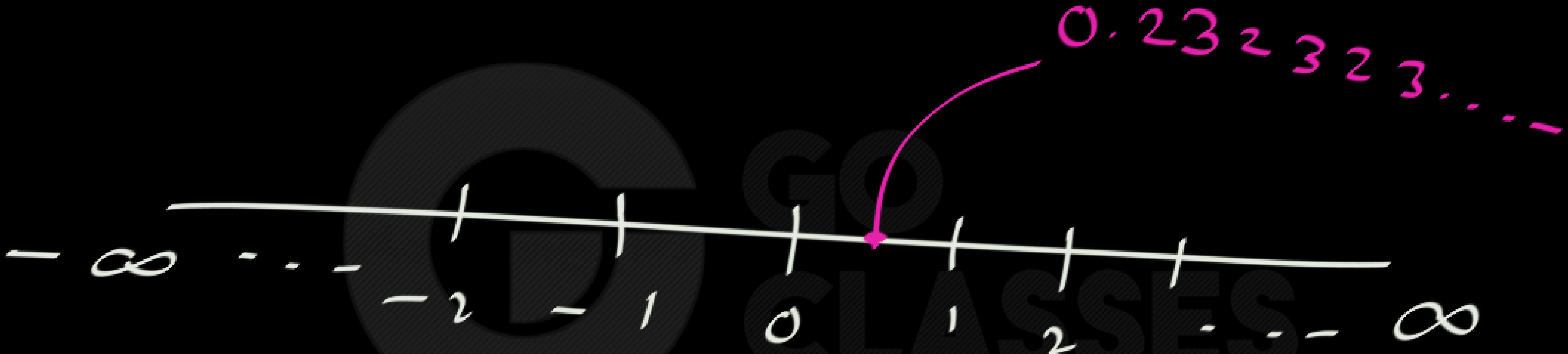
$0 \in R$

$0.232323\ldots \in R$

$\infty \notin R$; $-\infty \notin R$

$\pi \in R$

Real line:



Next Topic:

Cardinality of a Set

$S = \{1, 2, 3, a, b\}$

Set S

5 elements

Cardinality of S

$|S| = 5$

Cardinality of S

$S = \{1, 2, 3, \{a, b\}\}$ → elements of S

$\underbrace{|S|}$ = 4

Cardinality of S

1 ✓
2 ✓
3 ✓
$\{a, b\}$ ✓

Cardinality

- The ***cardinality*** of a set is the number of elements it contains.
- If S is a set, we denote its cardinality as $|S|$.
- Examples:

Cardinality

  - $|\boxed{\{whimsy, mirth\}}| = 2$
  - $|\{\{a, b\}, \{c, d, e, f, g\}, \{h\}\}| = 3$

Cardinality = 3

  - $|\{1, 2, 3, 3, 3, 3, 3\}| = 3$

Definition 2.4 *The* **cardinality** *of a set is its* size. *For a finite set, the cardinality of a set is the number of members it contains. In symbolic notation the size of a set S is written $|S|$. We will deal with the idea of the cardinality of an infinite set later.*

Let S be a set. If there are exactly n distinct elements in S where n is a nonnegative integer, we say that S is a *finite set* and that n is the *cardinality* of S. The cardinality of S is denoted by $|S|$.

Next:

$\boxed{\text{Empty Set}}$

Q:

What is the set of all prime numbers between 1 to 10 (inclusive)

$\{2, 3, 5, 7\}$

Q:

What is the set of all prime numbers between 14 to 16 (inclusive)

{ } → Empty Set

Q:

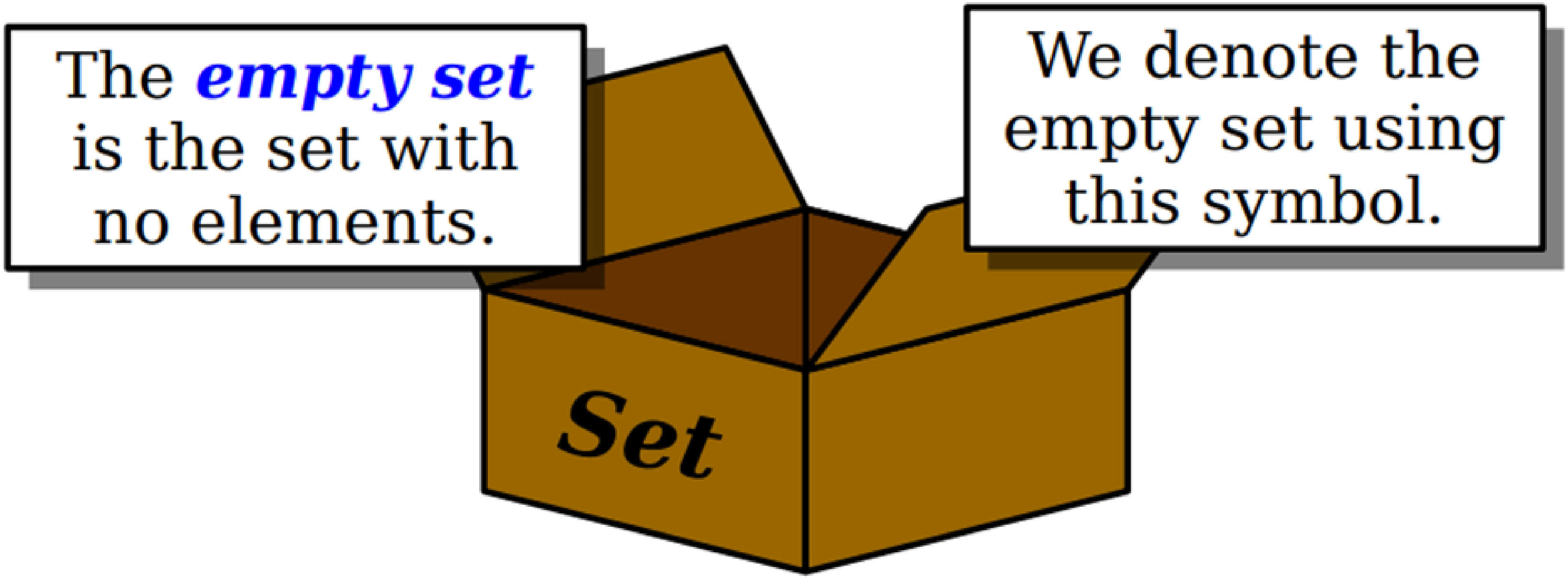
What is the set of all people whose weight is more than 1000 KG?

$$\underbrace{\{\ \}}_{\text{Set}} \rightarrow \text{empty set}$$

$S = \underbrace{\{ \quad \}}_{\text{Set}}$

$\boxed{|S| = 0}$

$$\{\ \} = \emptyset$$



Sets can contain any number of elements.

$\{ \ \} = \phi$ → Empty set

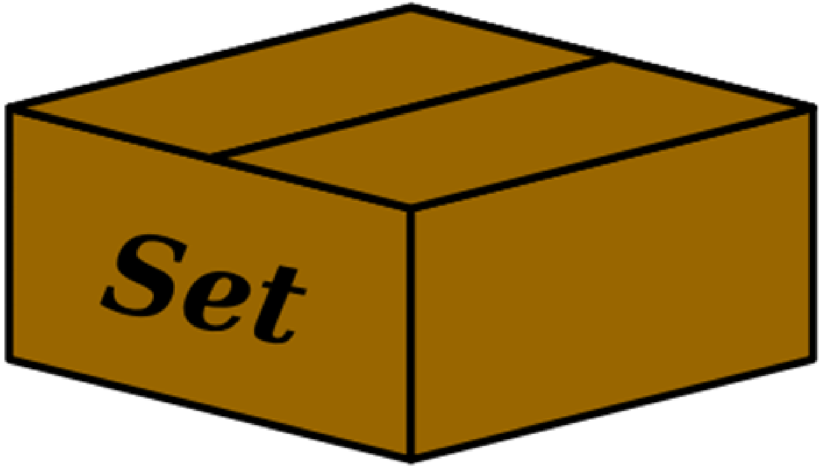
ϕ → Phi

a set containing nothing

$\phi = \{ \ \}$

Empty set / Null set / Void set

$$|\phi| = |\underbrace{\{\ \}}_{\text{empty set}}| = 0$$



Sets can contain any number of elements.

Definition 2.1 *The* **empty set** *is a set containing no objects. It is written as a pair of curly braces with nothing inside* $\{\}$ *or by using the symbol* $\emptyset$.

As we shall see, the empty set is a handy object. It is also quite strange. The set of all humans that weigh at least eight tons, for example, is the empty

GO Classes

This symbol means "is defined as"

$$\emptyset \equiv \{\ \}$$

We denote it with this symbol

The <u>empty set</u> contains no elements.

A **set** is an unordered collection of distinct objects, which may be anything (including other sets).

$$1 \stackrel{?}{=} \{1\}$$

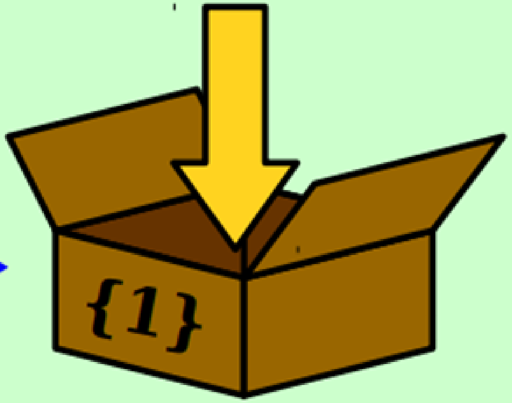
Question: Are these objects equal?

$$1 \neq \{1\}$$

This is a number.

1

1



This is a set.
It contains a
number.

Question: Are these objects equal?

$$\emptyset \stackrel{?}{=} \{\emptyset\}$$

Question: Are these objects equal?

$$\emptyset \stackrel{?}{=} \{\emptyset\}$$

$\{\ \}$

$$\boxed{} \neq \boxed{\boxed{}}$$

Question: Are these objects equal?

ϕ

$|\phi| = 0$

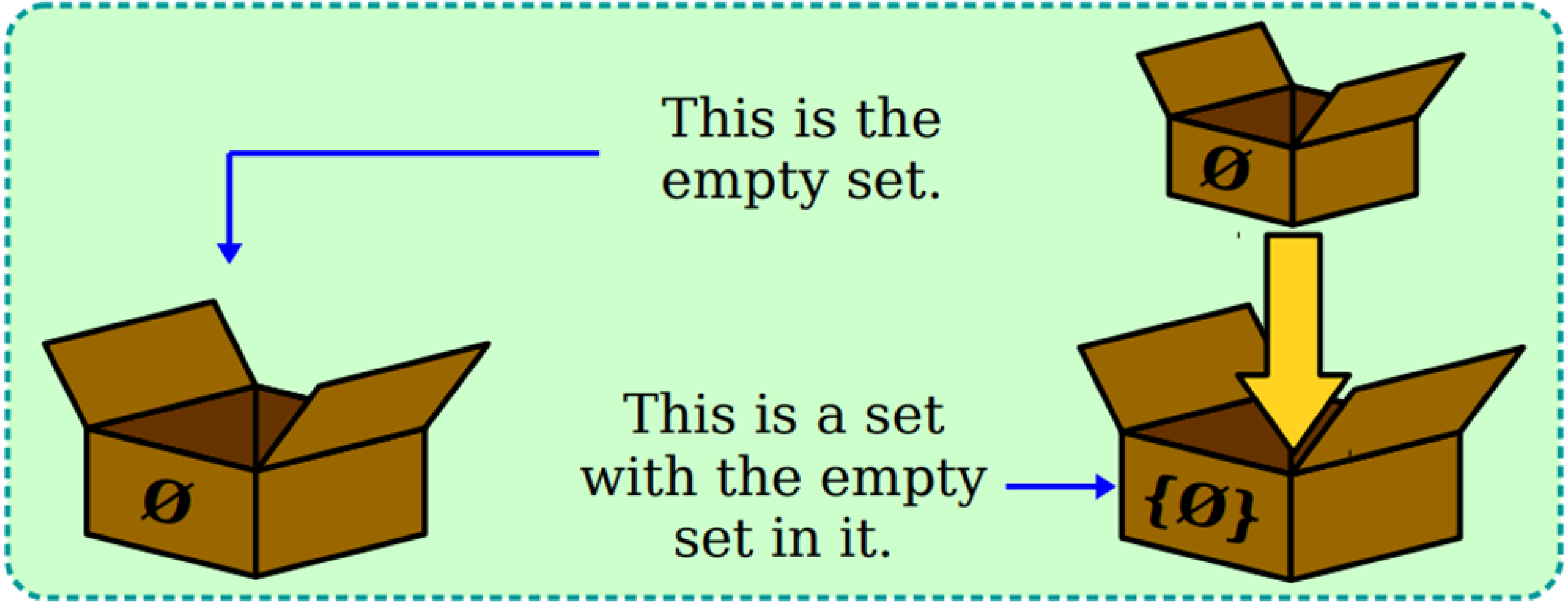
$S = \{ \phi \}$

a set containing one element

ϕ

$|S| = 1$

$$\varnothing \neq \{\varnothing\}$$



Question: Are these objects equal?

Anything x

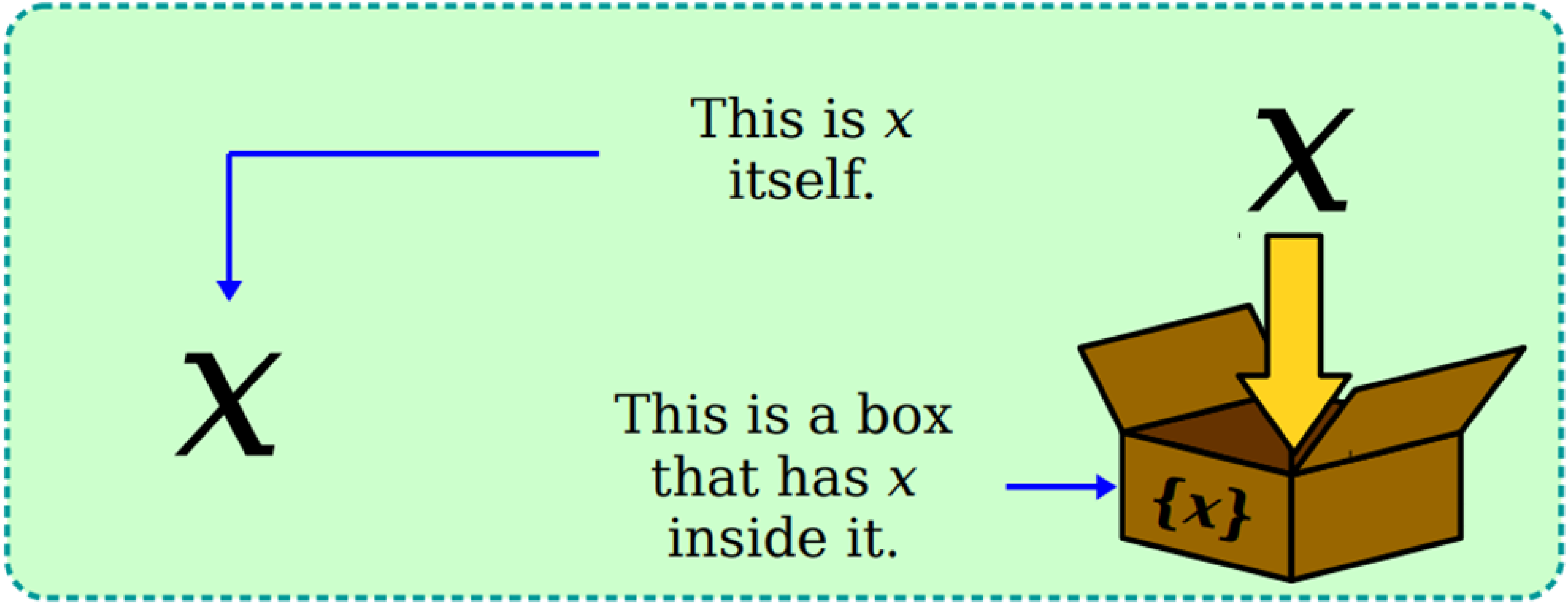
$x \neq \{x\}$

$x \neq \boxed{x}$

$1 \neq \{1\}$

$\phi \neq \{\phi\}$

$$x \neq \{x\}$$



No object x is equal to the set containing x.

Next Topic:

Set Representations

Set Builder Notation, List, Venn Diagram

Consider the Set of all prime numbers less than 10.

Verbal Rep

$= \{2, 3, 5, 7\}$ → List Rep (Roster Rep)

= 2 3 5 7

Venn Diagram Rep

$= \{x \mid \boxed{x \text{ is prime } \& \ x < 10}\}$

Set

Set Builder Representation :

$$\underbrace{\{\, x \mid \text{Some property that } x \text{ must satisfy} \,\}}_{\text{Set}}$$

x → All Those elements x

$\mid$ → Such that some property of x

Set Builder Representation :

$\{ y \mid$ Some property that y must satisfy $\}$

All Those elements y

Such that

Set

Set Builder Representation:

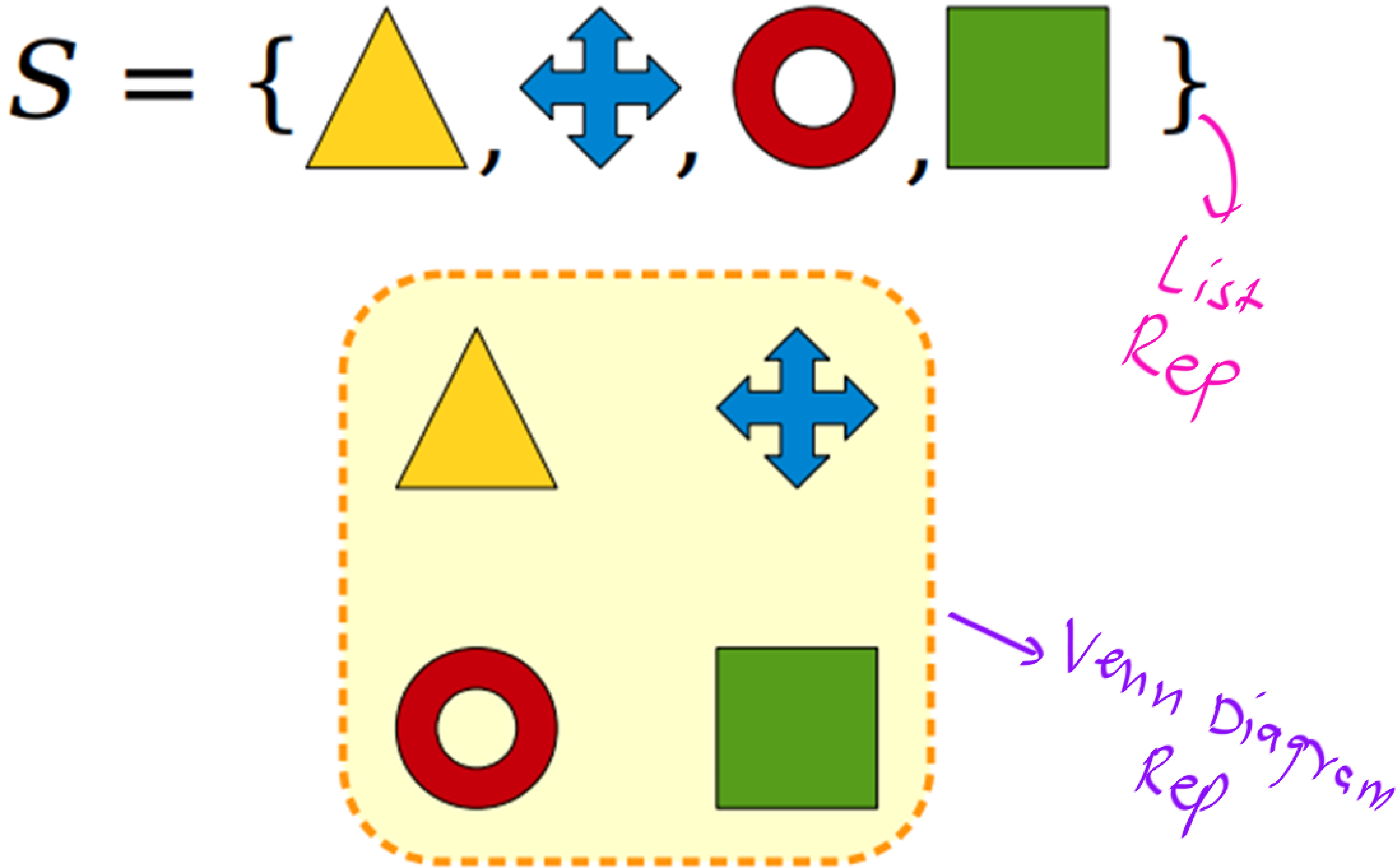
$$\{ x \mid P(x) \}$$

All those element x

such that

some property of s

Set


S = {
List Rep
Venn Diagram Rep

$\left\{ 0 : \begin{array}{l} \text{Neither } +\text{ve} \\ \text{Neither } -\text{ve} \end{array} \right\}$

$Z^+ = \{1, 2, 3, \ldots\}$

$Z^- = \{-1, -2, -3, \ldots\}$

The set of positive integers less than 100 can be denoted by $\{1, 2, 3, \ldots, 99\}$.

Verbal Rep

$= \{1, 2, 3, \ldots, 99\}$ — List Rep (Roster Rep)

$= $ 1, 2, 3, — — — — — 99

Venn Dig Rep

$= \{ y \mid y \text{ is a pos. int } \& \ y < 100 \}$

Even Natural Numbers

$$\{\ n \mid n \in \mathbb{N} \text{ and } n \text{ is even}\ \}$$

The set of all n

where

n is a natural number

and n is even

$$\{\quad 2, 4, 6, 8, 10, 12, 14, 16, \dots \}$$

Even Natural Numbers

$$\{\, n \mid \underbrace{n \in \mathbb{N} \text{ and } n \text{ is even}}\,\}$$

The set of all n

where

n is a natural number

and n is even

set

set Builder

$$\{ \quad 2, 4, 6, 8, 10, 12, 14, 16, \ldots \}$$

The Set of Even Numbers

$$\{\ \boldsymbol{x} \mid \boldsymbol{x} \in \mathbb{N} \text{ and } \boldsymbol{x} \textbf{ is even}\ \}$$

The set of all x

where

x is in the set of natural numbers

and x is even

Set Builder Notation

- A set may be specified in **set-builder notation**:

  $\{\ x \mid \textit{some property } x \textit{ satisfies}\ \}$

- For example:

  $\{\ r \mid r \in \mathbb{R} \text{ and } r < 137\ \}$

  $\{\ n \mid n \text{ is a power of two}\ \}$

  $\{\ x \mid x \text{ is a set of US currency}\ \}$

  $\{\ p \mid p \text{ is a legal Java program}\ \}$

Set Builder Notation

- A set may be specified in **set-builder notation**:

  { x | *some property x satisfies* }

- For example:

  = { r | $r \in \mathbb{R}$ and $r < 137$ } = Real no. < 137

  = { n | n is a power of two } = $\{2^1, 2^2, 2^3, 2^{-1}, 2^{-2}, \ldots\}$

  = { x | x is a set of US currency }

  = { p | p is a legal Java program }

Set Builder Notation

- A set may be specified in ***set-builder notation***:

$$\{\ x \mid \textit{some property } x \textit{ satisfies}\ \}$$

$$\{\ x \in S \mid \textit{some property } x \textit{ satisfies}\ \}$$

- For example:

$\{\ n \mid n \in \mathbb{N} \text{ and } n \text{ is even}\ \}$

$\{\ C \mid C \text{ is a set of US currency}\ \}$

$\{\ r \in \mathbb{R} \mid r < 3\ \}$

$\{\ n \in \mathbb{N} \mid n < 3\ \}$ **(the set {[illegible]1, 2})**

$$\{n \in \mathbb{N} \mid n < 3\}$$

$$= \{n \mid \underline{n \in \mathbb{N} \,\&\, n < 3}\}$$

same

$$= \{1, 2\}$$

$$\underbrace{\{ r \in R \mid r < 3 \} = \{ r \mid r \in R \;\&\; r < 3 \}}_{\text{Same}}$$

$$= \text{Real no.} < 3$$

$\{ n \mid n \in \mathbb{N} \text{ and } n \text{ even} \}$

All those elements n

such that

$P(n)$

set

n satisfies it

$$\{n \mid \underbrace{n \in N \text{ and } n \text{ even}}_{P(n)}\}$$

$$= \{2, 4, 6, \ldots\}$$

Consider the set

$$S = \{\ x \mid x \in \mathbb{N} \text{ and } x \text{ is even}\ \}$$

What is $|S|$?

Consider the set

$$S = \{ x \mid x \in \mathbb{N} \text{ and } x \text{ is even} \}$$

$S = \{2, 4, 6, 8, \ldots\}$

What is $|S|$?

$\boxed{|S| : \infty}$

Express the following set in set-builder notation.

$B = \{15, 16, 17, 18, 19, 20, 21, 22\}$

Choose the correct set.

A. $B = \{x \mid x \in N \text{ and } 15 < x < 22\}$

B. $B = \{x \mid x \in N \text{ and } 15 \le x \le 22\}$

C. $B = \{x \mid x \in N \text{ and } 15 < x \le 22\}$

D. $B = \{x \mid x \in N \text{ and } 15 \le x < 22\}$

Express the following set in set-builder notation.

B = {15, 16, 17, 18, 19, 20, 21, 22}

Choose the correct set.

A. B = {x | x∈N and 15 < x < 22} = {16, 17, - - - - , 21}

B. B = {x | x∈N and 15 ≤ x ≤ 22} = {15, 16, - - - , 22}

C. B = {x | x∈N and 15 < x ≤ 22} = {16, 17, - - , 22}

D. B = {x | x∈N and 15 ≤ x < 22} = {15, 16, - - , 21}

Write each of the following sets in set-builder notation.

a) $\{-5, -3, -1, 1, 3, 5, 7, ...\} =$

b) $\{..., \frac{1}{27}, \frac{1}{9}, \frac{1}{3}, 1, 3, 9, 27, ...\} =$

c) $\{..., -\frac{4}{3}, -1, -\frac{2}{3}, -\frac{1}{3}, 0, \frac{1}{3}, \frac{2}{3}, ...\} =$

Write each of the following sets in set-builder notation.

GO Classes

a) $\{-5, -3, -1, 1, 3, 5, 7, \ldots\} =$

$= \{x \mid x \text{ is odd integer } \& \ x \geq -5\}$

$= \{x \mid x = 2k+1 \ ; \ k \geq -3, \ k \in Z\}$

b) $\{\ldots, \frac{1}{27}, \frac{1}{9}, \frac{1}{3}, 1, 3, 9, 27, \ldots\} =$

$= \{\ldots, 3^{-3}, 3^{-2}, 3^{-1}, 3^{0}, 3^{1}, 3^{2}, \ldots\} = \{3^n \mid n \in Z\}$

c) $\{\ldots, -\frac{4}{3}, -1, -\frac{2}{3}, -\frac{1}{3}, 0, \frac{1}{3}, \frac{2}{3}, \ldots\} = \{\frac{n}{3} \mid n \in z\}$

Question 7 (1 point)

Match the following sets in set builder notation with the corresponding set in set-builder notation.

$\left\{\ldots, \frac{1}{3^2}\frac{1}{3}, 1, 3, 3^2, 3^3, 3^4, \ldots\right\}$	1. $\{3^n \mid n \in N\}$
{(000), (001), (010), (011), (100), (101), (110), (111), }	2. $\{3^n \mid n \in \mathbb{Z}\}$
$\{3, 3^2, 3^3, 3^4, \ldots\}$	3. $\{(a_1, a_2, a_3) \mid a_i \in \{0, 1\}\}$
{}=Ø	4. $\{x \in \mathbb{R} \mid x^2 + 4 = 0\}$
{1/1, 1/4, 1/9, 1/16, 1/25...}	5. $\{x \in \mathbb{R} \mid (x-2)(x+2)(x-5)^2 = 0\}$
{-2, 2, 5}	6. $\{\frac{1}{n^2} \mid n \in \mathbb{N}\}$

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GO Classes

Question 7 (1 point)

Match the following sets in set builder notation with the corresponding set in set-builder notation.

2 $\left\{\ldots, \frac{1}{3^2}\frac{1}{3}, 1, 3, 3^2, 3^3, 3^4, \ldots\right\}$

3 {(000), (001), (010), (011), (100), (101), (110), (111), }

1 $\{3, 3^2, 3^3, 3^4, \ldots\}$

4 {}=Ø

6 {1/1, 1/4, 1/9, 1/16, 1/25...}

5 {-2, 2, 5}

1. $\{3^n | n \in N\} = \{3^1, 3^2, 3^3, \ldots\}$
2. $\{3^n | n \in \mathbb{Z}\} = \{\ldots \frac{1}{9}, \frac{1}{3}, 1, 3, 3^2, \ldots\}$
3. $\{(a_1, a_2, a_3) | a_i \in \{0, 1\}\}$
4. $\{x \in \mathbb{R} | x^2 + 4 = 0\}$
5. $\{x \in \mathbb{R} | (x-2)(x+2)(x-5)^2 = 0\}$
6. $\{\frac{1}{n^2} | n \in \mathbb{N}\} = \{\frac{1}{1}, \frac{1}{4}, \frac{1}{9}, \ldots\}$

5 $\left\{ x \in R \;\middle|\; (x-2)(x+2)(x-5)^2 = 0 \right\}$

$\boxed{x = 2 ; -2 ; 5}$

$= \{2, -2, 5\}$ ✓

$$\{x \in R \mid x^2 + 4 = 0\} = \{\ \} = \phi$$

$x^2 + 4 = 0$

$$\boxed{x^2 = -4}$$

No Real no. x

Real y

$y^2 \geq 0$

3\. $\{ (a_1, a_2, a_3) \mid a_i \in \{0,1\} \}$

$= \{ (\ , \ , \ ), (\ , \ , \ ), \}$

triplet

3. $\{(a_1, a_2, a_3) \mid a_i \in \{0,1\}\} = S$

$= \{(0,0,0), (0,0,1), (0,1,0), (0,1,1), (1,0,0), (1,0,1), (1,1,0), (1,1,1)\}$

$\boxed{|S| = 8}$

7. Answer each of these questions about sets.

(a) Write the following set using Set Builder notation:

$$A = \left\{\frac{2}{3}, \frac{4}{5}, \frac{6}{7}, \frac{8}{9}, \dots\right\}$$

(b) Write out all elements of this set using the roster method:

$$B = \{n \in \mathbb{Z} \mid n^2 \leq 9 \text{ and } n \text{ is even }\}$$

(c) Write out at least 3 different elements of this set using the roster method:

$$C = \left\{\frac{n+1}{2n-1} \mid n \in \mathbb{N}\right\}$$

7. Answer each of these questions about sets.

(a) Write the following set using Set Builder notation:

$$A = \left\{\frac{2}{3}, \frac{4}{5}, \frac{6}{7}, \frac{8}{9}, \ldots\right\}$$

$= \left\{ \frac{n}{n+1} \;\middle|\; n \text{ is even Natural no.} \right\}$

Set Builder Rep

(b) Write out all elements of this set using the roster method:

List method

$$B = \{n \in \mathbb{Z} \mid n^2 \leq 9 \text{ and } n \text{ is even }\}$$

$= \{0, 2, -2\}$

(c) Write out at least 3 different elements of this set using the roster method:

$$C = \left\{\frac{n+1}{2n-1} \mid n \in \mathbb{N}\right\}$$

$$C: \left\{ \frac{n+1}{2n-1} \;\middle|\; n \in \mathbb{N} \right\}$$

$$= \left\{ \frac{2}{1}, \frac{3}{3}, \frac{4}{5}, \frac{5}{7}, \frac{6}{9}, \frac{7}{11}, \frac{8}{13}, \ldots \right\}$$