Sets

A Set is a collection of elements (numbers, names, colors, etc)

$\{5, 6, 10, 9\}$

{Sean, Steve, Sam, Megan, Diane}

{Blueberry, Banana, Apple}

We can build a set instead of listing out all the values.

Set-Builder Notation

$$\{x \mid x > 0\}$$

the set of all x such that x is greater than zero

$\{0.1, 2, 9000, 856, \ldots\}$

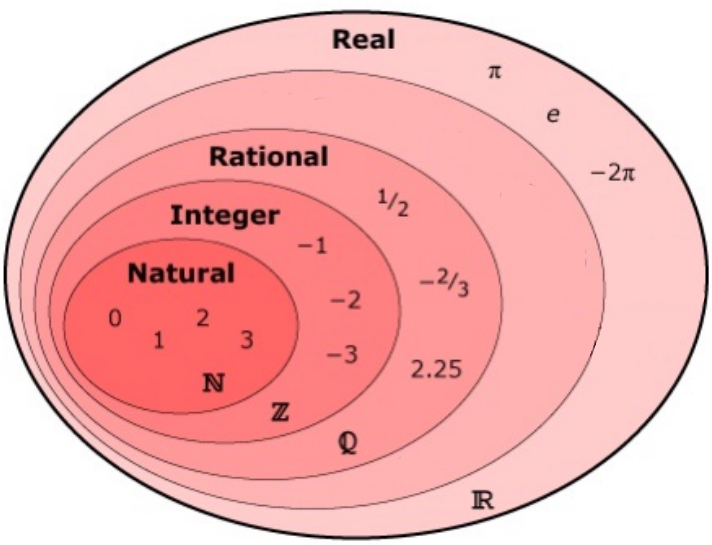
- Set-Builder Notation helps us describes LARGE sets
- x is a placeholder variable, it can be y, z, p, q, etc
- You may also see ":" be used instead of "|"

$\{x : x > 0\}$

Number Types

Recall

$\mathbb{N}$	Natural Numbers	$\{0,1,2,3,4\}$
$\mathbb{Z}$	Integers	$\{\ldots,-2,-1,0,1,2,\ldots\}$
$\mathbb{Q}$	Rational Numbers	$\{\ldots,-10,-\frac{5}{2},0,\frac{2}{3},999,\ldots\}$
$\mathbb{R}$	Real Numbers	All non-imaginary numbers



It is normal to specify what type of number x is

$$\{ x \in \mathbb{N} \mid x \geq 3 \}$$

"the set of all x's that are a member of the Natural Numbers, such that x is greater or equal to 3"

★ "$\in$" - element of

$$= \{3,4,5,6,7,\ldots\}$$

ex] Consider $\{K \in \mathbb{Z} \mid -2 < K \leq 5\}$

ⓐ Write in sentence form what this is saying

the set of all K integers that are between -2 and 5

ⓑ list the set of specific values

$\{-1, 0, 1, 2, 3, 4\}$

ex] Build a Set that holds all even numbers

$\{x \in \mathbb{N} \mid 2x\} = \{2x \mid x \in \mathbb{N}\} = \{x \mid x = 2n, n \in \mathbb{N}\}$

* There are many different acceptable answers

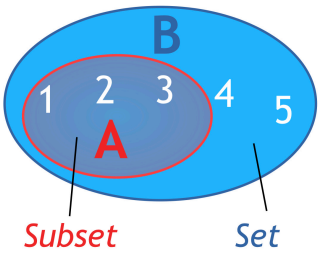
ex] Build a Set that holds all odd numbers between 1 and 200

$\{x \in \mathbb{N} \mid 2x+1, x \leq 99\}$

$2x+1 = 200$
$2x = 199$
$x \approx 99$

Subsets

A is a subset of B if and only if ALL elements of A are also in B



ex] Consider the set $A = \{11, 15, 22, 9, 3\}$

Write a subset of A.

$\{11\}$ $\{3, 9, 22, 11\}$ etc...

$\{15, 9\}$ $\{22, 9\}$

ex] let set A be all the multiples of 4 and set B be all multiples of 2.

$A = \{\ldots -8, -4, 0, 4, 8, \ldots\}$

$B = \{\ldots -8, -6, -4, -2, 0, 2, 4, 6, 8, \ldots\}$

(a) Is A a subset of B?

Yes

(b) Is B a subset of A?

No, $-6 \in B$ and $-6 \notin A$

Notation

"$\subset$"

$A \subset B$ "A is a subset of B"

$A \not\subset B$ "A is not a subset of B"

Q: Is $A \subseteq A$?

ex | Write the set of all bad Harry Styles Songs

$\{\} = \emptyset$ Empty Set / Null Set

Q: Is an empty set a subset of $A = \{1, 2, 3\}$?

$\emptyset \stackrel{?}{\subseteq} A$

We can't find any elements in $\emptyset$ that aren't in A, so it must be that all elements in $\emptyset$ are in A.

$\emptyset$ is a subset of every set, including $\emptyset$ itself