

**1.1 Introduction to Real Numbers****Set** – collection of objects**Element** – an object in a set**Natural numbers** = counting numbers

$$\mathbb{N} = \{1, 2, 3, 4, \dots\}$$

**Prime number** = only factors are 1 and itself

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

**Composite number** = has factors other than 1 and itself

$$\{4, 6, 8, 9, 10, \dots\}$$

**Integers** = set of all positive and negative whole numbers

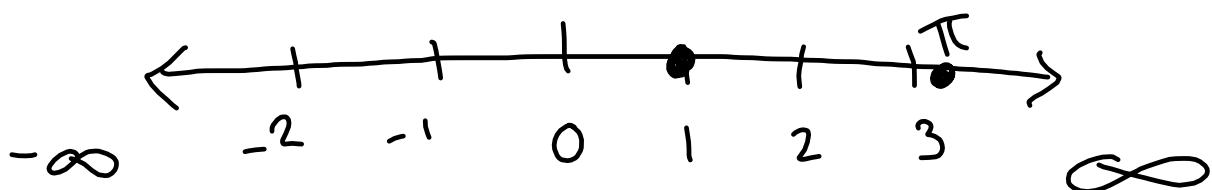
$$\mathbb{Z} = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$$

$\{0, 1, 2, 3, \dots\}$   
"whole numbers"

**Rational numbers** = set of all numbers that can be written as fractions = set of all terminating or repeating decimals

$$\mathbb{Q} = \left\{ \frac{p}{q} \mid p, q \in \mathbb{Z} \right\}$$

"the set of  $p$  over  $q$  such that  $p$  and  $q$  are elements of the 'set of integers'"

**Irrational numbers** = set of all non-terminating, non-repeating decimals (includes  $\pi$ ,  $\sqrt{2}$ , etc.)**Real numbers** = set of all numbers that can be expressed as decimals = all rational and irrational numbers together
$$\mathbb{R}$$


## methods of writing a set

roster method - list

$$\{1, 2, 3, \dots\}; \{\dots -2, -1, 0, 1, 2, \dots\}; \{a, b, c\}$$

Set-builder Notation


$\{\text{variable(s)} \mid \text{condition(s) on the variables}\}$

$$\left\{ \frac{p}{q} \mid p, q \in \mathbb{Z} \right\} \text{ "such that" } \left\{ x \mid x \geq 2 \right\}$$


$$\{x \mid x = 2\} = \{2\}$$

## Interval Notation

$[a, b]$  closed interval includes endpoints




$(a, b)$  open interval does not include endpoints



$(a, b]$  half-open interval



$[a, b)$  half-closed interval "clopen"



all acceptable

$\mathbb{N}, \mathbb{Z}, \mathbb{Q}, \mathbb{R}$ 
 $\mathbb{R} = (-\infty, \infty)$ 
 $[2, \infty)$  or  $(-\infty, 3)$ 

\*  $\infty$  is not a number, no it is never included

$\emptyset$  = the empty set = the set containing no elements

$\{\emptyset\}$  = the set containing the empty set as an element

Union & Intersection

$\cup$  "or"

$\cap$  "and"

the set of all the elements from any set

$A/B$   
relative complement  
 $A-B$

overlap of sets; all elements that occur in each set

$$A = \{1, 2, 3, 4, 5\}; B = \{4, 5, 6, 7\}; C = \{6, 7, 8\}$$

$$A \cup B = \{1, 2, 3, 4, 5, 6, 7\} \quad A \cup \emptyset = A$$

$$A \cap B = \{4, 5\}$$

$$B \cap \emptyset = \emptyset$$

$$A \cap C = \emptyset$$

$$B \cup C = \{4, 5, 6, 7, 8\}$$

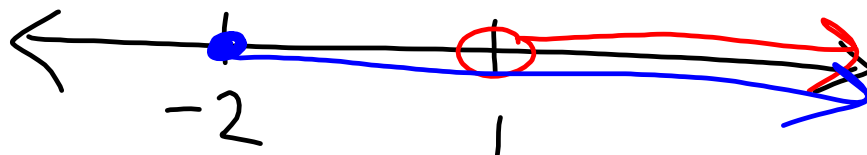
$$A \setminus B = A - B = \{1, 2, 3\}$$

$$A \cup B \cup C = \{1, 2, 3, 4, 5, 6, 7, 8\}$$

$$(A \cap B) \cup C = \{4, 5, 6, 7, 8\} = B \cup C \quad A \setminus C = A$$

1.1

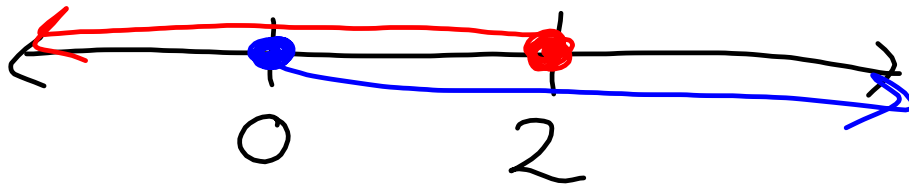
$$77. \quad \{x \mid x > 1\} \cap \{x \mid x \geq -2\}$$



$$= \{x \mid x > 1\} = (1, \infty)$$

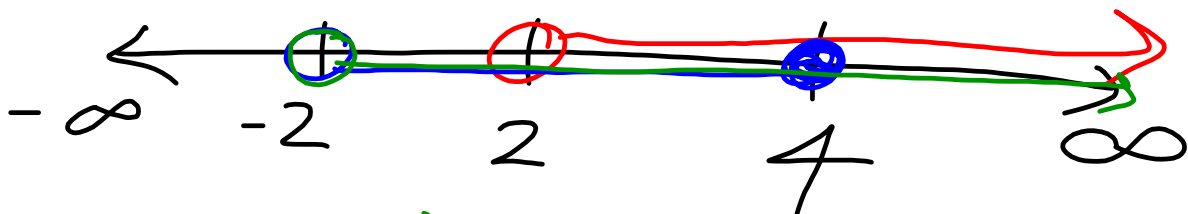
75.

$$\{x | x \leq 2\} \cap \{x | x \geq 0\}$$



$$= [0, 2] = \{x | 0 \leq x \leq 2\}$$

$$113. \quad \underline{(2, \infty)} \cup \underline{(-2, 4]}$$



$$= (-2, \infty) = \{x | x > -2\}$$

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