

## Linear Inequations in One Variable

### Symbols

=	Equal to
<	Less than
≤	Less than or equal to
>	Greater than
≥	Greater than or equal to
∧	And
∈	Belongs to
∪	Union
∩	Intersection

Equation:  $3x + 5 = 4x - 1$

Inequation:  $4x - 5 > 8x + 2$

### Rules for solving inequations

Rule 1	Positive term becomes <i>negative</i> when moved across the inequality sign	$3x + 5 > 8$ $3x > 8 - 5$	
Rule 2	Negative term becomes <i>positive</i> when moved across the inequality sign	$4x - 6 \leq 9$ $4x \leq 9 + 6$	
Rule 3	Inequation sign <i>does not</i> change if both side terms are multiplied or divided by same <i>positive</i> value	$x \geq 8$ $4x \geq 32$	$y < 12$ $\frac{y}{3} < 4$
Rule 4	Inequation sign <i>reverses</i> if both side terms are multiplied or divided by same <i>negative</i> value	$x \geq 8$ $-x \leq -8$	$y < 12$ $\frac{y}{-2} > -6$
Rule 5	Inequation sign <i>reverses</i> if sign changes on both sides	$-x < 4$ $x > -4$	$-y \geq -8$ $y \leq 8$
Rule 6	When reciprocals of the values are taken, inequation sign <i>reverses</i>	$x > 5$ $\frac{1}{x} < \frac{1}{5}$	$\frac{1}{y} \leq 2$ $y \geq \frac{1}{2}$

### Number systems

					Natural numbers (N)				
-4	-3	-2	-1	0	1	2	3	4	5
					Whole numbers (W)				
Integers (Z or I)									

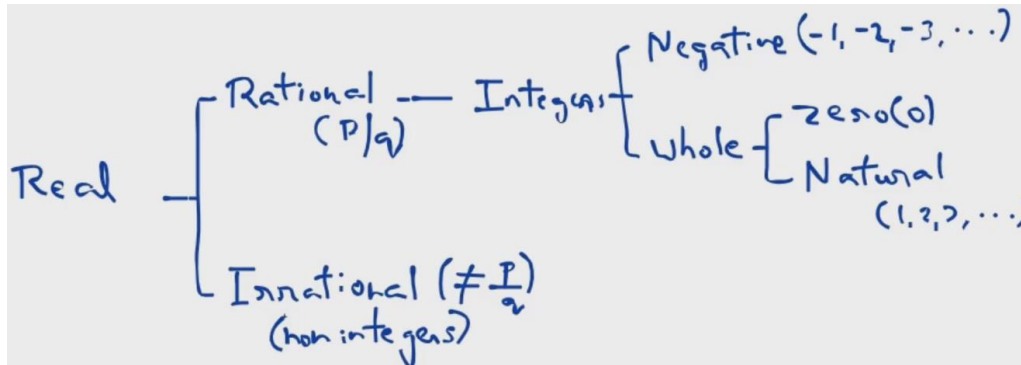
Rational numbers are in the form of  $p/q$ . They can be -

- non repeating (0.5, 0.25, 3.1)
- repeating (0.1111..., 4.3333...)

Irrational numbers cannot be represented in the form of a fraction,  $p/q$

Examples are  $\sqrt{2}, \sqrt{5}, \pi$

Rational + Irrational = Real numbers



**Replacement set:** The set from which a variable  $x$  is chosen

**Solution set:** The subset of replacement set that satisfies the inequation

For inequation  $-2 \leq x < 5$

Replacement set	Solution set
N, natural numbers	$x = \{1, 2, 3, 4\}$
W, whole numbers	$x = \{0, 1, 2, 3, 4\}$
Z or I, integers	$x = \{-2, -1, 0, 1, 2, 3, 4\}$
R, real numbers	$\{x: x \in R \text{ and } -2 \leq x < 5\}$

The solution set for real numbers is described in set builder form.

### Representation of the solution on the number line

\* Representation of real numbers

Hollow circle: Represents end of range with  $<, >$

Filled circle: Represents end of range with  $\leq, \geq$

$\{x: x < -3 \wedge x \in R\}$	
$\{x: x \geq 5 \wedge x \in R\}$	
$\{x: -3 < x \leq 2 \wedge x \in R\}$	

$\{x: -4 \leq x \leq -2 \wedge x \in R\}$	
$\{x: 5 < x < 8 \wedge x \in R\}$	

\* Representation of natural, whole numbers, integers

Every number is represented by a filled circle

$\{x: -3 < x \leq 6 \wedge x \in N\}$	
$\{x: -4 \leq x < 3 \wedge x \in W\}$	
$\{x: -3 \leq x < 3 \wedge x \in Z\}$	
$\{x: x > 3 \wedge x \in N\}$	
$\{x: x \geq 3 \wedge x \in N\}$	

### Combining inequations

$\{x: x > 3 \text{ and } x \in R\}$		
$\{x: x \leq 5 \text{ and } x \in R\}$		

$\{x: x \leq 3 \text{ and } x \in R\}$		
$\{x: x \geq 5 \text{ and } x \in R\}$		

The solution sets of two inequations are:

$$P = \{-3, -2, -1, 0, 1, 2, 3, 4, 5\}$$

$$Q = \{3, 4, 5, 6, 7, 8\}$$

$P \cap Q$	$\{3, 4, 5\}$	Common between both P and Q
$P \cup Q$	$\{-3, -2, -1, 0, 1, 2, 3, 4, 5, 6, 7, 8\}$	All numbers in both P and Q
$P - Q$	$\{-3, -2, -1, 0, 1, 2\}$	Numbers only in P, not in Q
$Q - P$	$\{6, 7, 8\}$	Numbers only in Q, not in P
$P \cap Q'$	$\{-3, -2, -1, 0, 1, 2\}$	$P - Q$
$P' \cap Q$	$\{6, 7, 8\}$	$Q - P$