# Section 1.2 Linear Inequality

Dr. Abdulla Eid

College of Science

MATHS 103: Mathematics for Business I

### **Comparison Operators**

Let *a* and *b* be two real numbers of the number line.

• *a* = *b*.

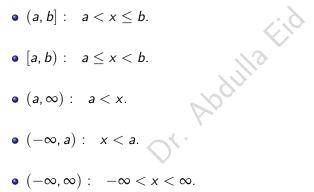
• a < b which is read as a " is less than " b.

- a > b which is read as a " is greater than " b.
- $a \le b$  which is read as a " is less than or equal to " b.

•  $a \ge b$  which is read as a " is greater than or equal to " b.

### Intervals

Let *a* < *b*. Recall:



### Exercise

Describe each of the following interval in the number line and inequality symbols:

- [2,5].
   (-5,∞).
   (-∞,0].
- ④ [a,∞).
- **(**0, 1).
- **③** [0, 1].

#### Definition

An *inequality* is a mathematical statement that uses inequality symbols  $(<, >, \leq, \geq)$  to connect two expressions.

Goal: To solve inequalities that contain a variable. The answer will be written in the form of an interval, inequality symbols, and will be described in the number line.

#### Definition

A **linear inequality** in the variable x is an inequality that can be written in the form

$$ax + b < 0$$
, or  $>, \leq, \geq$ 

Rules of inequality:

- If A + c < B, then A < B c. (As we did for the equations).
- If cA < cB, then A < B if c > 0. (As we did for the equations).
- If cA < cB, then A > B if c < 0. (Exception of what we did for the equations).

#### Example

Solve 2(x - 3) < 4

Solution: We solve linear inequality in the same way we solve linear equations (see Section 0.7) except if we multiply or divide by a negative number, then we need to reverse the inequality sign.

$$2(x-3) < 4$$
$$2x-6 < 4$$
$$2x < 4+6$$
$$2x < 10$$
$$\frac{2x}{2} < \frac{10}{2}$$
$$x < 5$$

1- Set notation

Solution Set = 
$$\{x \mid x < 5\}$$

2- Number Line notation

3- Interval notation

(−∞, 5)

You can check your answer by picking any value in the solution set and substitute it in the original inequality. Take x = 0. Then

$$2(0-3) \boxed{4} \rightarrow -6 \boxed{4}$$

which we can fill it with <.

#### Exercise

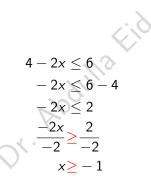
Solve 3 < 2y + 3

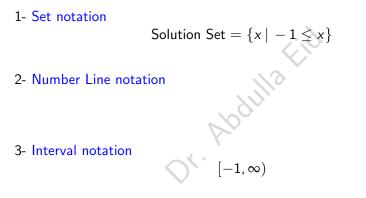
Dr. Abdulla Fid

#### Example

Solve  $4 - 2x \le 6$ 

Solution:





### Exercise

Solve  $-3 \ge 8(2-x)$ 

Dr. Abdulla Eid

Example

Solve 
$$\frac{3}{2}(x-2) + 1 > -2(x-4)$$

Solution:

$$\frac{3}{2}(x-2) + 1 > -2(x-4)$$

$$2(\frac{3}{2}(x-2)) + 2(1) > 2(-2(x-4))$$

$$3(x-2) + 2 > -4(x-4)$$

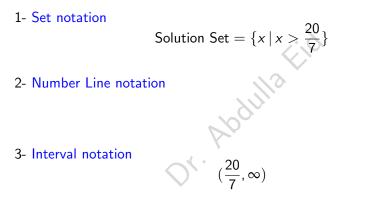
$$3x - 6 + 2 > -4x + 16$$

$$3x + 4x > 16 + 4$$

$$7x > 20$$

$$\frac{7x}{7} > \frac{20}{7}$$

$$x > \frac{20}{7}$$



### Special Cases

#### Example

Solve 2(x-2) > 2x + 6

Solution: 2(x-2) > 2x+6 2x-4 > 2x+6 2x-2x > 6+40 > 10

Which is not true at all. Hence in the case that x disappears and the last statement we got is incorrect we say that we don't have a solution!.

1- Set notation

Solution Set =  $\{\} = \emptyset$  ("The empty set) 2- Number Line notation 3- Interval notation

### Special Cases

#### Example

Solve 2x + 6 < 2(x + 5)

Solution:

$$2x + 6 < 2(x + 5)$$
  

$$2x + 6 < 2x + 10$$
  

$$2x - 2x < 10 - 6$$
  

$$0 < 4$$

Which is always true. Hence in the case that x disappears and the last statement we got is correct we say that all real numbers are solution. In short,

$$-\infty < x < \infty$$

1- Set notation

