

## Introduction to Inequalities

**Level:** Key Stage 3

**Dimension:** Number and Algebra

**Module:** Algebraic Relations and Functions

**Unit:** Inequalities

**Student ability:** Average

### Content Objectives:

After completing the activity, students should have gained a better understanding of the meaning and use of algebraic inequalities and should be able to present the solution of an inequality problem on the number line.

### Language Objectives:

After completing the activity, students should be able to:

- understand the English terms related to inequalities (e.g., *inequality, compare, express, relationships, symbols, notations, greater than, less than, equal to, greater than or equal to, unknown values, algebraic inequality*);
- understand the English expressions for explaining the key concepts related to inequalities, e.g.,
  - *In everyday life, there are situations that involve inequalities and unknown values. For example, in a geography test, David gets  $u$  marks. The passing mark is 30 and David fails the test. We can express the situation as:  $u < 30$ .*
  - *An inequality involving unknown values is an **algebraic inequality**.*
  - *Sometimes, it may not be appropriate to express an inequality by either “greater than” or “less than”. For example, in a test, the passing mark is 50. Tom gets  $y$  marks and he passes the test. So  $y$  can be equal to 50 or greater than 50. To represent this situation, we can use the symbol “ $\geq$ ” which means “greater than or equal to”.*
  - *We can also use the symbol “ $\leq$ ” (less than or equal to) to express an inequality.*
  - *the solution of an inequality can be represented on a number line.*
- follow English instructions on solving problems concerning this topic and work on related problems written in English.

**Prerequisite knowledge:**

Students should have learned, through the medium of Chinese, how to use the notations “ $<$ ” and “ $>$ ” to compare numbers, as well as the concept of a number line.

**Time:** 2 lessons (80 minutes)

**Procedure:**

1. The teacher should ask students to complete Activity 1 which requires them to compare values and further express the relations of the numbers in words. The teacher should check the answers with the class.
2. The teacher should introduce algebraic inequality to the class and assign Activity 2 for the discussion. The teacher should check the answers with the students.
3. The teacher should then introduce the more complex situations which must be interpreted with the notations of “ $\leq$ ” or “ $\geq$ ”.
4. The teacher should then assign Activity 3 to the class and ask students to express the more complex situations of the question in terms of inequality. The teacher may assign this activity for group discussion.
5. The teacher should discuss Activity 4 with the class to help them understand that the solution of the inequality is not always a unique number. The teacher should then introduce how to represent the solution of an inequality on the number line.
6. The teacher may assign the exercise as classwork to check on students’ understanding. He or she may assign the exercise as a group activity.

**Explanatory Notes for Teachers:**

1. Through the inductive approach, students may observe how the notations of inequality express the different relationships between the two numbers.
2. Through the activity, students may realize that there is more than one solution to problems of inequality and that there is not always a unique solution.
3. The teacher may remind the students that it is not necessary to include so many values along the number line when they use a number line to represent the solution of an inequality.
4. The suggested answers are provided on the last page of the exercise.

Name: \_\_\_\_\_ Class: \_\_\_\_\_ (       )

### Inequality

#### Activity 1:

Compare the following numbers and express their relationships to each other using the symbols “>” (greater than), “<” (less than) or “=” (equal to). Write a sentence to express the meaning of the inequality between the two numbers.

e.g.  $4 < 8$

4 is less than 8.

1.  $249$  \_\_\_\_\_  $100$ .

\_\_\_\_\_

2.  $29$  \_\_\_\_\_  $9$ .

\_\_\_\_\_

3.  $5$  \_\_\_\_\_  $120$ .

\_\_\_\_\_

4.  $12.5$  \_\_\_\_\_  $1.38$

\_\_\_\_\_

5.  $\frac{1}{2}$  \_\_\_\_\_  $\frac{4}{8}$

\_\_\_\_\_

In everyday life, there are situations that involve inequalities and unknown values.

e.g. In the geography test, David gets  $u$  marks. The passing mark is 30 and David fails the test.

We can express the situation as:  $u < 30$ .

An inequality involving unknown values is an *algebraic inequality* (代數不等式).

#### Activity 2:

Express the following situations using algebraic inequality.

1. Lily gets  $x$  marks and fails the Mathematics test. The passing mark of the test is 60.

2. Mary loves a yellow dress which costs \$1200 but she has only \$ $y$  and it is not enough to buy the dress.

3. John is taller than Tom and Tom is 168 cm tall. The height of John is  $h$  cm.
  
4. Paul brings 3 pencils to school but Tommy has more pencils than Paul. Tommy has  $c$  pencils.

Sometimes, we may have complicated situations for which it is not appropriate to express the situation by either “<” or “>”.

Situation 1:

In a test, the passing mark is 50. Tom gets  $y$  marks and he passes the test. So  $y$  can be equal to 50 or greater than 50. To represent this situation, we can use the symbol “ $\geq$ ” which means “greater than or equal to”.

We can express the situation as:  $y \geq 50$

Situation 2:

If your body temperature is over  $37.1^{\circ}\text{C}$ , it means that you have a fever. Joe’s body temperature is  $x^{\circ}\text{C}$  and he does not have fever. To represent this situation, we can use the symbol “ $\leq$ ” which means “less than or equal to”.

We can express the situation as:  $x \leq 37.1$

Activity 3:

Express the following situations using algebraic inequality.

- a) The lowest temperature on 6<sup>th</sup> June was  $25.8^{\circ}\text{C}$ . The temperature at 3 a.m. was  $x^{\circ}\text{C}$ .
  
- b) The maximum capacity of the oil tank of a car is 55.8 litres. There are  $c$  litres of oil in the tank now.

- c) Mary and Tom make a deal that if Mary gets the same or higher marks than Tom in the coming year-end examination, Tom will buy her a new pencil case. Mary gets  $x$  marks and Tom gets 66 marks. Tom gives her a new pencil case as a reward.
- d) Jenny likes a dress very much which costs \$1860. She has  $m$  dollars in her wallet and she buys the dress.
- e) Joey measures the Glycemic Index (血糖指數) of her lunch, and it is a score  $y$  and she is in the category “Normal”. A score of 6.9 or below, will be in the category “Normal”.

Activity 4:

Show the solution of an algebraic inequality:

- a) Given that  $x < 8$ , write down 3 possible values of  $x$ .

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b) Can you give 4 more values for  $x$ ?

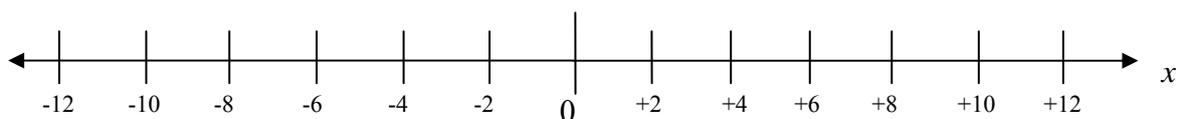
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c) Can you write down all possible values of  $x$  for the above inequality? Why?

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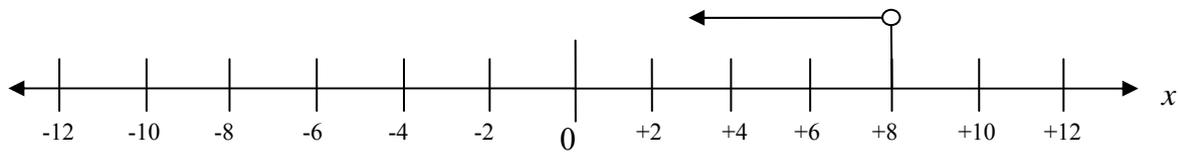
d) On the number line, what are the positions of the possible values of  $x$  for  $x < 8$ ?

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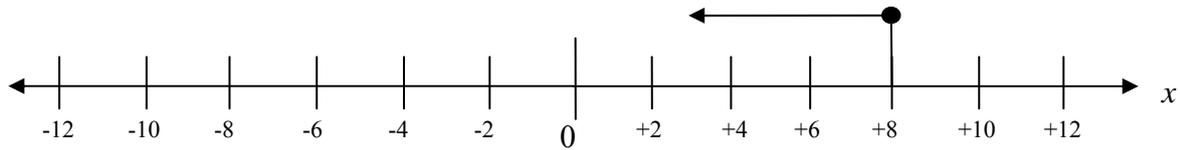
e) Is 8 a possible value? Yes / No

So we can represent all the possible values of  $x$  for  $x < 8$  as:

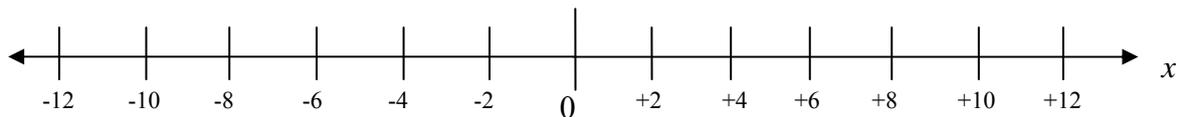


The arrow pointing to the left means the solution is on the left of 8, and the ***hollow circle*** means 8 is not included.

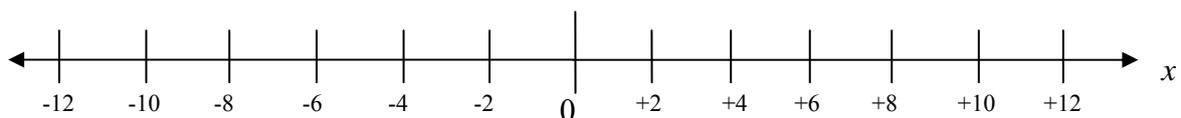
Similarly, we can represent the solution of  $x \leq 8$  on a number line with an arrow pointing to the left but use a ***filled circle*** to show that 8 is included.



Represent the solution of  $x > 8$  on the number line below.



Represent the solution of  $x \geq 8$  on the number line below.



Exercises:

Express the following condition as an algebraic inequality and represent the solution on a number line.

- 1) Jenny wants to send some samples to a client which is an overseas company. The weight of the samples is  $w$  kg. The weight should not exceed 20 kg to avoid surcharge.
  
- 2) David fails the English test and the passing mark is 35. He just gets  $x$  marks.
  
- 3) The lowest UV index on 11<sup>th</sup> May was 2.3, and the UV index at 5 p.m. is  $u$ . (UV stands for ultraviolet)
  
- 4) Peter hopes to buy an old-fashioned pen, but there is another buyer willing to pay \$650. Peter wants to own that pen, but he can do so only if he pays more than that amount ( $p$ ).

**Suggested answers:**

Activity 1:

- |                                 |   |
|---------------------------------|---|
| 1(a) $249 > 100$                | 249 is greater than 100.                  |
| (b) $29 > 9$                    | 29 is greater than 9.                     |
| (c) $5 < 120$                   | 5 is less than 120.                       |
| (d) $12.5 > 1.38$               | 12.5 is greater than 1.38.                |
| (e) $\frac{1}{2} = \frac{4}{8}$ | $\frac{1}{2}$ is equal to $\frac{4}{8}$ . |

Activity 2:

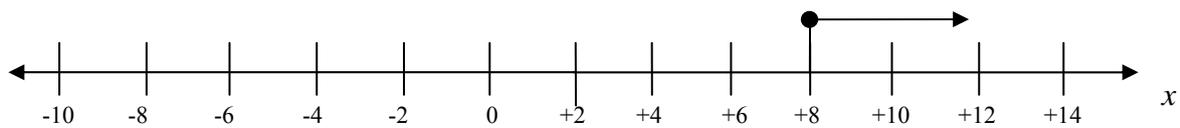
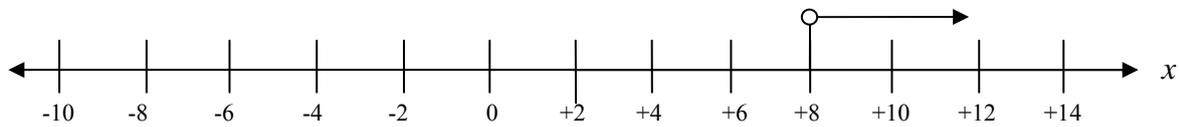
1.  $x < 60$       2.  $y < 1200$       3.  $h > 168$       4.  $c > 3$

Activity 3:

- a)  $x \geq 25.8$       b)  $c \leq 55.8$       c)  $x \geq 66$       d)  $m \geq 1860$       e)  $y \leq 6.9$

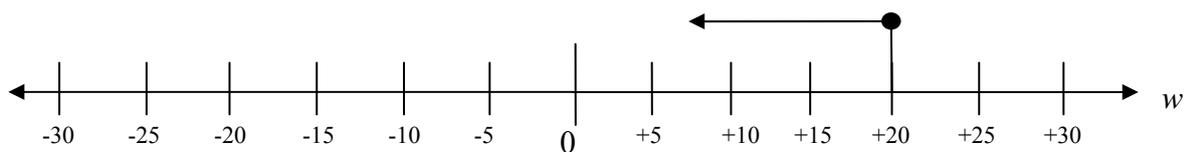
Activity 4:

- a) and b) Any number less than 8.  
c) It is impossible, as there are infinitely many solutions.  
d) All the numbers on the left side of 8. (can also use “to the left of 8”)  
e) No

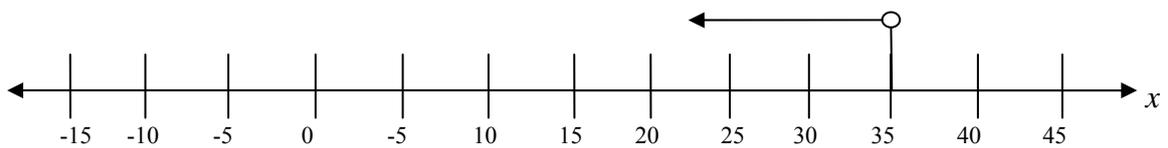


Exercise:

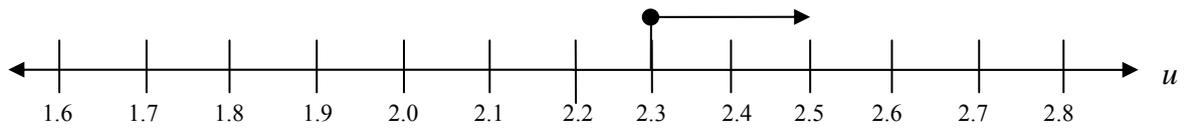
1.  $w \leq 20$



2.  $x < 35$



3.  $u \geq 2.3$



4.  $p > 650$

