

6.3 Introduction to Linear Inequalities

FOCUS Write and graph inequalities.

Less than	$<$	below, under
Less than or equal to	\leq	up to, at most, no more than, maximum
Greater than	$>$	over, more than
Greater than or equal to	\geq	at least, minimum

Example 1 Writing an Inequality to Describe a Situation

Define a variable and write an inequality to describe the situation.

a)



b) You must be at least 16 years old to get a driver's licence.

Solution

a) Let s represent the speed.

You can go up to 60 km/h, but not faster.

So, s can equal 60 or be any number less than 60.

The inequality is $s \leq 60$.

b) Let a represent the age to get a driver's licence.

"At least 16" means that you must be 16, or older.

You cannot be less than 16.

So, a can equal 16 or be greater than 16.

The inequality is $a \geq 16$.

$a \geq 16$ is read as
 a is **greater than or equal to** 16.

Check

1. Let t represent the temperature in degrees Celsius.

Write an inequality to describe each situation:

a) For temperatures less than 0°C , make sure to wear warm clothing. t ____ 0

b) The highest temperature we've had this week was 12°C . t ____ 12

Linear Inequalities

A linear inequality may be true for many values of the variable.

Example 2 Determining Whether a Number Is a Solution of an Inequality

Is each number a solution of the inequality $x \leq 3$? Justify the answers.

a) 5

b) 3

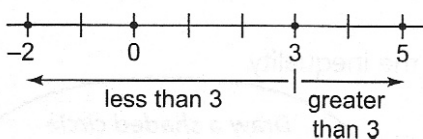
c) 0

d) -2

Solution

Use a number line to show all the numbers.

The solution of $x \leq 3$ is all numbers that are less than or equal to 3.



For a number to be less than 3, it must lie to the left of 3.

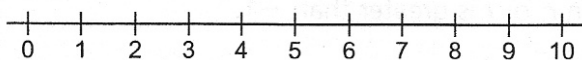
0 and -2 are to the left of 3, so they are solutions.

3 is equal to itself, so it is a solution.

5 is to the right of 3, so it is not a solution.

Check

1. a) Is 8 a solution of the inequality $x > 0$? Use the number line to help.



8 is to the _____ of 0, so 8 _____ a solution.

$x > 0$ is read as x is greater than 0.

b) What are 3 other numbers that are solutions of $x > 0$?

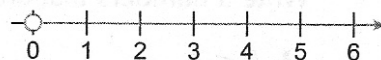
The solutions of an inequality can be graphed on a number line.

For example:

$$a > 0$$

a is greater than 0, so 0 is not included in the solution.

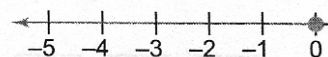
This is shown by an open circle at 0.



$$z \leq 0$$

z is less than or equal to 0, so 0 is included in the solution.

This is shown by a shaded circle at 0.



Example 3 Graphing Inequalities on a Number Line

Graph each inequality on a number line.

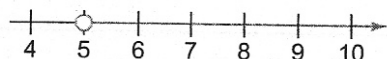
Write 3 numbers that are possible solutions of the inequality.

- a) $b > 5$ b) $y \leq -1$ c) $-4 \geq n$ d) $-1 < r$

Solution

- a) $b > 5$

Any number greater than 5 satisfies the inequality.

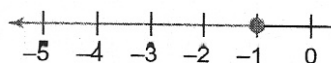


3 possible solutions are: 6, 7, 8

Draw an open circle at 5, because 5 is not part of the solution.

- b) $y \leq -1$

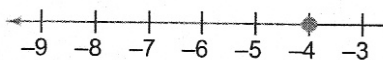
Any number less than or equal to -1 satisfies the inequality.



3 possible solutions are: -1 , -2 , -5

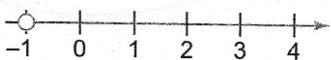
Draw a shaded circle at -1 , because -1 is part of the solution.

- c) $-4 \geq n$ means -4 is greater than or equal to n , or n is less than or equal to -4 .
 $-4 \geq n$ is the same as $n \leq -4$.



3 possible solutions are: -4 , -5 , -6

- d) $-1 < r$ means -1 is less than r , or r is greater than -1 .
 $-1 < r$ is the same as $r > -1$.



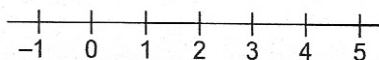
3 possible solutions are: 0, 2, 4

Check

1. Graph each inequality on a number line.

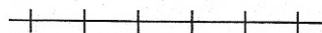
Write 3 numbers that are possible solutions for each inequality.

- a) $h \leq 4$



_____, _____, _____

- b) $-3 < x$



_____, _____, _____

Practice

1. Is each inequality true or false?

If it is false, change the sign to write a true inequality.

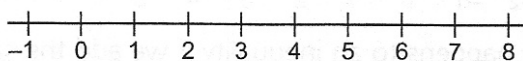
a) $3 < 10$

b) $3 < -10$

c) $0 \leq 1$

d) $1 \geq 1$

2. Is each number a solution of $x \geq 5$?



a) 5

b) -1

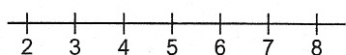
c) 0

d) 8

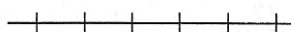
e) 6

3. a) Graph each inequality on the number line.

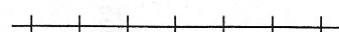
i) $m > 3$



ii) $x < 2$



iii) $y \geq -5$



b) Write 3 numbers that are possible solutions of each inequality above.

i) _____

ii) _____

iii) _____

4. Write an inequality to model each situation.

a) The maximum speed is 100 km/h.

Let s represent the speed, in km/h.

b) The elevator can hold no more than

12 people. Let n represent the number of people the elevator can hold.

c) This year, the price of gas has

always been at least 70 cents per litre. Let p represent the price of gas, in cents.

d) This pass card is good for up to 10 entries

to the amusement park. Let n represent the number of entries.

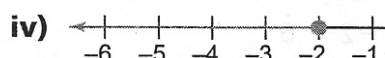
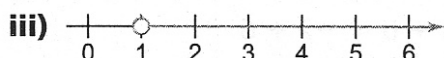
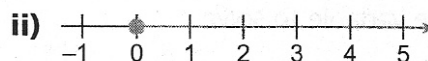
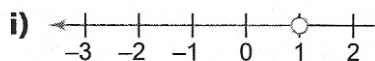
5. Match each inequality with the graph of its solution below.

a) $x > 1$

b) $x \leq -2$

c) $x < 1$

d) $x \geq 0$



6. Write an inequality whose solution is graphed on the number line.

