

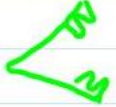
Inequalities

An **inequality** is a **mathematical sentence** that **compares quantities**.

Key Concept Inequalities

Symbols	$<$	$>$	\leq	\geq
Words	<ul style="list-style-type: none"> is less than is fewer than 	<ul style="list-style-type: none"> is greater than is more than 	<ul style="list-style-type: none"> is less than or equal to is at most 	<ul style="list-style-type: none"> is greater than or equal to is at least
Examples	$3 < 5$	$8 > 4$	$7 \leq 10$	$12 \geq 9$

Work Zone



$$7 \leq 7$$

Inequalities can be solved by finding values of the variables that make the inequality true.

1. Of the numbers 6, 7, or 8, which is a solution of the inequality $f + 2 < 9$?

Replace f with each of the numbers.

$$f + 2 < 9 \quad \text{Write the inequality.}$$

$$6 + 2 < 9 \quad \text{Replace } f \text{ with 6.}$$

$$8 < 9 \quad \checkmark \quad \text{This is a true statement.}$$

$$f + 2 < 9 \quad \text{Write the inequality.}$$

$$7 + 2 < 9 \quad \text{Replace } f \text{ with 7.}$$

$$9 < 9 \quad \times \quad \text{This is not a true statement.}$$

$$f + 2 < 9 \quad \text{Write the inequality.}$$

$$8 + 2 < 9 \quad \text{Replace } f \text{ with 8.}$$

$$10 < 9 \quad \times \quad \text{This is not a true statement.}$$

Since the number **6 is the only value that makes a true statement**, 6 is a solution of the inequality.

$f = 6$ $6 + 2 < 9$
 $8 < 9 \quad \checkmark$
 (Y)

$f = 7$ $7 + 2 < 9$
 $9 < 9 \quad \times$
 (N)

$f = 8$ $8 + 2 < 9$
 $10 < 9 \quad \times$
 (N)

$f = 4$ $4 + 2 < 9$
 $6 < 9$
 (Y)

$f = 0$ $0 + 2 < 9$
 $2 < 9$
 (Y)

$f = -3$ $-3 + 2 < 9$
 $-1 < 9 \quad \checkmark$
 (Y)

Show your work.

Got It? Do this problem to find out.

- a. Of the numbers 8, 9, or 10, which is a solution of the inequality $n - 3 > 6$?

a. 10

Determine Solutions of an Inequality

Since an inequality uses greater than and less than symbols, one-variable inequalities have infinitely many solutions. For example, any rational number greater than 4 will make the inequality $x > 4$ true.

Is the given value a solution of the inequality?

2. $4 + 3 > 9, x = 4$

$x + 3 > 9$ Write the inequality.

$4 + 3 > 9$ Replace x with 4.

$7 > 9$ Simplify.

Since 7 is not greater than 9, 4 is not a solution.

3. $12 \leq 18 - y, y = 6$

$12 \leq 18 - y$ Write the inequality.

$12 \leq 18 - 6$ Replace y with 6.

$12 \leq 12$ Simplify.

Since $12 = 12$, 12 is a solution.

4. $17 \geq 11 + x, x = 8$

$17 \geq 11 + x$ Write the inequality.

$17 \geq 11 + 8$ Replace x with 8.

$17 \geq 19$ Simplify.

Since 17 is not greater than or equal to 19, 8 is not a solution.

Got It? Do these problems to find out.

b. $8 + 7 > 15, a = 9$

d. $10 - 4 < 6, n = 10$

$16 > 15 \checkmark$
 $6 < 6 \times$

c. $22 \leq 15 + 6, b = 6$

e. $12 \geq 5 + g, g = 7$

$22 \leq 21 \times$
 $12 \geq 12 \checkmark$

Show your work.

b. yes

c. no

d. no

e. yes

Lesson 5 Inequalities 61



Example



5. Luisa works at a gift shop. She receives a bonus if she makes more than 20 balloon bouquets in a month. Which months did Luisa receive a bonus? Use the inequality $b > 20$, where b represents the number of balloon bouquets made each month, to solve.

Balloon Sales	
Month	Number Sold
July	25
August	12
September	18
October	32

Use the guess, check, and revise strategy.

Try 25. $b > 20$ Yes $25 > 20$ Try 12. $b > 20$ No $12 > 20$ Try 18. $b > 20$ No $18 > 20$ Try 32. $b > 20$ Yes $32 > 20$

So, Luisa received a bonus in July and October.

Write Inequalities

You can write an inequality to represent a situation.

Examples



Write an inequality for each sentence.

1. You must be **over 12 years old** to ride the go-karts.

Words	Your age	is over	12.
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2. A pony is **less than 14.2 hands tall**.

Words	A pony	is less than	14.2.
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Variable	Let p = the height of the pony		
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Inequality	p	$<$	14.2
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The inequality is $p < 14.2$.

3. You must be **at least 16 years old** to have a driver's license.

Words	Your age	is at least	16 years.
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Variable	Let a = your age.		
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Inequality	a	\geq	16
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The inequality is $a \geq 16$.

$$a = \text{age}$$

$$a > 12$$

STOP and Reflect

Which inequality symbol represents "is at most"?

$$p = \text{pony's height}$$

$$p < 14.2$$

$$l = \text{age for license}$$

$$l \geq 16$$

$$16 \leq l$$

Graph an Inequality

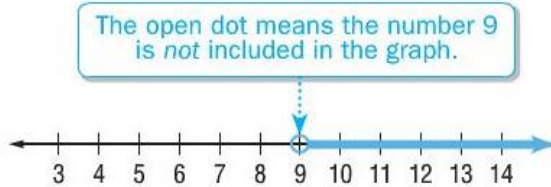
Inequalities can be graphed on a number line. Sometimes, it is impossible to show all the values that make an inequality true. The graph helps you see the values that make the inequality true.

Examples

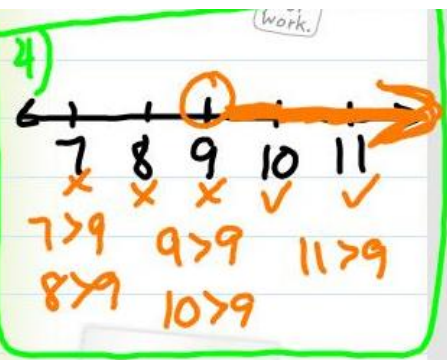
Graph each inequality on a number line.

4. $n > 9$

Place an open dot at 9. Then draw a line and an arrow to the right.



The values that lie on the line make the sentence true. All numbers greater than 9 make the sentence true.



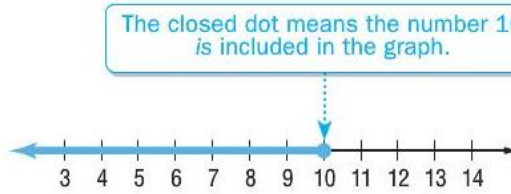
Graphing Inequalities

When inequalities are graphed, an open dot means the number is not included ($<$ or $>$) and a closed dot means it is included (\leq or \geq).

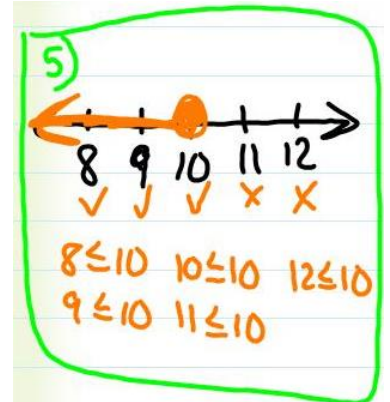
5. $n \leq 10$

Closed dot:
 \leq or \geq

Place a closed dot at 10. Then draw a line and an arrow to the left.

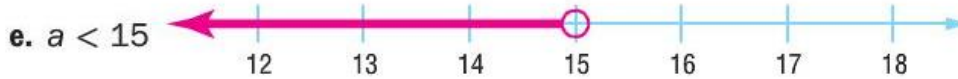


All numbers 10 and less make the sentence true.



Open dot:
 $<$ or $>$

Got It? Do these problems to find out.



Guided Practice



Write an inequality for each sentence. (Examples 1-3)

1. The movie will be no more than 90 minutes in length.

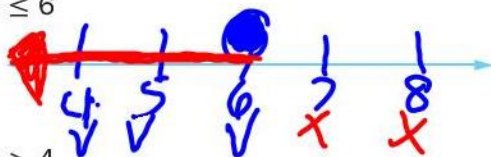
$m \leq 90$

$m = \text{min.}$

2. The mountain is at least 985 feet tall. _____

Graph each inequality on a number line. (Examples 4 and 5)

3. $a \leq 6$



4. $b > 4$