Writing and Graphing Inequalities

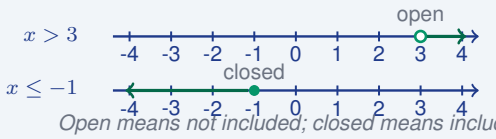
Name: _____	Date: _____	Score: _____ / 18

An **inequality** is like an equation's adventurous cousin—instead of one exact answer, it describes a whole *set* of possible values! Words like "at least," "more than," "no greater than," and "below" translate directly into the symbols $\geq$, $>$, $\leq$, and $<$. Graphing the solution on a number line lets you *see* which values work and which do not. Pay attention to open versus closed circles—they show whether the endpoint is included, and that small detail makes a big difference!

Key Concepts & Quick Review

Symbols: $x > 3$ (open $\circ$ at 3, arrow right); $x \leq -1$ (closed $\bullet$ at -1, arrow left); $x \geq 5$ (closed $\bullet$ at 5, arrow right).

Words to symbols: "at least" $\Rightarrow \geq$; "at most" $\Rightarrow \leq$; "more than" $\Rightarrow >$; "fewer than" $\Rightarrow <$.



Open means not included; closed means included.

Examples

① Write an inequality and describe its graph for: "a number x is more than -2 but at most 5."

Think It Through: Break the sentence into two parts. "More than -2" means $x > -2$, which uses an open circle because -2 is not included. "At most 5" means $x \leq 5$, which uses a closed circle because 5 is included. Together they form the compound inequality $-2 < x \leq 5$. On the graph, shade only the numbers between those two endpoints.

Answer: $-2 < x \leq 5$; *open at* -2, *closed at* 5

② A roller coaster requires riders to be *at least* 52 inches tall. Write an inequality for h (height) and describe two values that satisfy it and two that do not.

Think It Through: The phrase "at least" means the value can be exactly 52 or anything larger, so the inequality is $h \geq 52$. Values like 52 and 60 satisfy the rule, while values like 51 and 45 do not. On a number line, this is shown with a closed circle at 52 and an arrow to the right.

Answer: $h \geq 52$; *closed circle at* 52, *ray to the right*

Practice Problems

Write the inequality described, or write the word description for the given inequality.

1. Write a word description for the inequality $x > 5$. _____
2. Write a word description for the inequality $n \leq -3$. _____
3. Write a word description for the inequality $y \geq 0$. _____
4. Write a word description for the inequality $m < 7$. _____
5. Write an inequality for the phrase "at least 10." _____
6. Write an inequality for the phrase "fewer than -4." _____
7. Write an inequality for the phrase "at most 2.5." _____
8. Write an inequality for the phrase "more than -1." _____
9. For the inequality $x > -6$, state whether the graph uses an open or closed circle. _____
10. For the inequality $x \leq 8$, state whether the graph uses an open or closed circle. _____
11. Write an inequality for the phrase "no more than 100." _____
12. Write an inequality for the phrase "greater than or equal to 0." _____
13. Write a word description for the compound inequality $-3 < x \leq 4$. _____
14. Write a word description for the compound inequality $2 \leq n < 9$. _____
15. Write an inequality for the phrase "between -5 and 5, exclusive." _____

Study Tips

- **"At least"** and **"no less than"** both mean $\geq$ (include the endpoint). "More than" means $>$ (exclude it).
- The **arrow direction** on the number line matches the direction the inequality symbol points when x is on the left.
- To check a solution, substitute a value in the shaded region and confirm the inequality is true — then check a value outside and confirm it is false.

Word Problems

16. A city ordinance says a backyard trampoline must be set up *more than* 6 feet from any fence and *at most* 20 feet from the house. Let d represent the distance from the fence. Write a compound inequality for the allowable positions, graph it on a number line, and list three values of d that are allowed and two that are not.

_____

17. A theme park has a ride that has a *minimum* weight of 90 pounds and a *maximum* weight of 250 pounds for safety. Write an inequality for the allowable weight w. A visitor weighs $87\,lb$ — are they allowed on the

ride? The visitor's older sibling weighs $260\ lb$ — are they allowed? What is the range of weights that qualify?

_____

18. Write the inequality (using the variable x) shown by each number-line graph, and state whether each endpoint is included or excluded.

Graph A

Graph B

_____

Answer Keys

1) greater than 5
2) at most -3
3) at least 0
4) less than 7
5) $x \geq 10$
6) $x < -4$
7) $x \leq 2.5$
8) $x > -1$
9) open
10) closed
11) $x \leq 100$
12) $x \geq 0$
13) greater than -3 and at most 4
14) at least 2 and less than 9
15) $-5 < x < 5$
16) $6 < d \leq 20$; allowed: $7, 12, 20$; not allowed: 6 (boundary), 21.
17) $90 \leq w \leq 250$; $87\,lb$: No; $260\,lb$: No; range: $[90, 250]$ pounds.
18) Graph A: $x > -1$ (open at -1, -1 excluded); Graph B: $-2 \leq x \leq 3$ (closed at -2 and 3, both included).

Step-by-Step Explanations

Strategy: For Tips, Commissions, and Fees, treat the percent as a payment rate and connect it to the bill, sale amount, or fee base named in the problem. Money answers need labels because a tip, commission, and fee mean different things.

Practice 1: A restaurant bill is \$40. Find the tip for a 20% tip rate. **Answer:** \$8.00
In the first example, multiply the bill by the tip rate; the tip is a part of the bill, not the whole total.

Practice 15: A restaurant bill is \$50 before tax and tip. Add 9% tax and a 20% tip on the original bill. Find the total paid. **Answer:** \$64.50
Toward the end, use commission rate times sales amount, then combine it with any base pay.

Word-problem notes:

16. Answer: Tax: $\$7.68$; tip: $\$19.20$; total: $\$122.88$; per person: $\$30.72$.
Find the tax from the pre-tax bill: $96 \times 0.08 = 7.68$ dollars. The tip is also based on the pre-tax amount, so $96 \times 0.20 = 19.20$ dollars. Add bill, tax, and tip together: $96 + 7.68 + 19.20 = 122.88$ dollars. To split the total equally among four friends, divide: $122.88 \div 4 = 30.72$ dollars each. Reading carefully matters here, because the tip is not taken on the taxed amount.

17. Answer: Commissions: $\$1{,}120$, $\$1{,}380$, $\$768$; total comm.: $\$3{,}268$; total earnings: $\$5{,}768$.
A 4% commission means multiply each car's price by 0.04. For the first car, $28{,}000 \times 0.04 = 1{,}120$ dollars. For the second, $34{,}500 \times 0.04 = 1{,}380$ dollars. For the third, $19{,}200 \times 0.04 = 768$ dollars. Add the commissions to get $1{,}120 + 1{,}380 + 768 = 3{,}268$ dollars. Then add the base salary: $2{,}500 + 3{,}268 = 5{,}768$ dollars total earnings.

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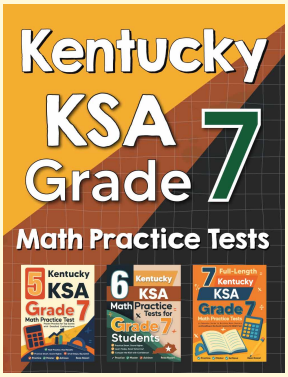

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