

# Writing and Graphing Inequalities

Name: \_\_\_\_\_

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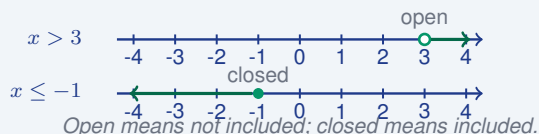
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An **inequality** is like an equation's adventurous cousin—instead of one exact answer, it describes a whole *set* of possible values! Words like “at least,” “more than,” “no greater than,” and “below” translate directly into the symbols  $\geq$ ,  $>$ ,  $\leq$ , 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”  $\Rightarrow <$ .



## 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.  
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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

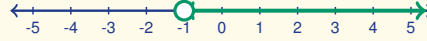


ride? The visitor's older sibling weighs  $260\text{ lb}$  — are they allowed? What is the range of weights that qualify?

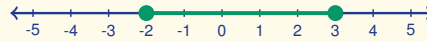
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18. Write the inequality (using the variable  $x$ ) shown by each number-line graph, and state whether each endpoint is included or excluded.

Graph A



Graph B



\_\_\_\_\_



## Answer Keys

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

### 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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