Solving One-Step and Two-Step Inequalities

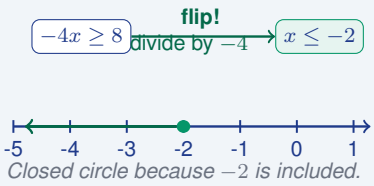
Name: _____	Date: _____	Score: _____ / 18

Solving inequalities works almost exactly like solving equations—you use inverse operations to isolate the variable—but the answer is a *range* of values instead of a single number. You will solve, graph, or write the result as an inequality just like before. Here is the one crucial rule to remember: when you multiply or divide both sides by a **negative** number, you must *flip* the inequality symbol. Keep that one change in mind and you will avoid the most common mistake in this entire topic!

Key Concepts & Quick Review

Same rules as equations with one exception:
Multiply or divide by a negative ⇒ flip the inequality symbol!

Example: $-4x + 3 \geq 11$ Step 1: $-4x \geq 8$. Step 2 (divide by -4, flip!): $x \leq -2$. Graph: closed circle at -2, arrow left.



Closed circle because -2 is included.

Examples

① Solve and graph: $-5x < 20$.

Think It Through: To isolate x, divide both sides by -5. Because you are dividing by a negative number, the inequality symbol must flip direction. So the solution is $x > -4$. On the graph, use an open circle at -4 because -4 itself is not included, and shade to the right. A quick check with $x = 0$ confirms the solution works.

Answer: $x > -4$; *open circle at -4, ray right*

② Marcus wants to spend *at most* $\$50$ at a book fair. He already put 3 books worth $\$6.50$ each in his cart. Write and solve an inequality to find how much more m he can spend.

Think It Through: The three books already cost $3 \times 6.50 = 19.50$ dollars. Since Marcus wants to spend at most \$50 total, write $19.50 + m \leq 50$. Now subtract 19.50 from both sides to get $m \leq 30.50$. So Marcus can spend up to $\$30.50$ more and still stay in budget.

Answer: $m \leq \$30.50$

Practice Problems

Solve each inequality. Write the solution and note whether the symbol flips.

1. $x + 4 > 9$ _____
2. $n - 3 \leq 5$ _____
3. $2y < 18$ _____
4. $-3m > 12$ _____
5. $\frac{t}{4} \geq -2$ _____
6. $-x \leq 7$ _____
7. $2k + 5 < 13$ _____
8. $-4n + 3 > -9$ _____
9. $3p - 1 \geq 14$ _____
10. $\frac{x}{-2} \leq 4$ _____
11. $5 - 3y > -4$ _____
12. $2a + 9 \leq 1$ _____
13. $-6 + 4t < 10$ _____
14. $\frac{n}{3} + 2 > 5$ _____
15. $7 - 2x \geq -3$ _____

Study Tips

- **Mark the flip!** Every time you multiply or divide by a negative, write "⟵ FLIP" next to that line so you never forget.
- Check your answer by plugging a **value well inside** the solution set into the original inequality — not the boundary value.
- Solutions to inequalities are **infinite sets**, not single answers. Write them as inequalities or graph them — do not list individual values.

Word Problems

16. A car's gas tank holds $14\ gal$ and already has $3\ gal$ in it. The car uses $\frac{1}{4}\ gal$ per mile. Write and solve an inequality for the number of miles m the car can travel before running *out* of gas (tank reaches $0\ gal$). Should the driver be concerned if they need to drive $42\ mi$?

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17. Anya is training for a swim meet. Her coach says she must complete more than 120 laps this week to qualify for the finals. She has already swum 35 laps on Monday and plans to swim the same number of laps ℓ each of the remaining 5 days. Write and solve an inequality for ℓ. If she swims exactly 17 laps each remaining day, does she qualify?

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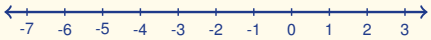
18. Solve the inequality $-2x + 5 \leq 11$ and graph the solution on the number line shown here. Then check your answer by testing $x = 0$ in the original inequality.

(graph the solution here)



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Answer Keys

1) $x > 5$
2) $n \leq 8$
3) $y < 9$
4) $m < -4$
5) $t \geq -8$
6) $x \geq -7$
7) $k < 4$
8) $n < 3$
9) $p \geq 5$
10) $x \geq -8$
11) $y < 3$
12) $a \leq -4$
13) $t < 4$
14) $n > 9$
15) $x \leq 5$
16) $m \leq 12\,mi$; yes, fuel stop needed
17) $\ell > 17$; exactly 17 does not qualify
18) $x \geq -3$; closed circle at -3, ray right

Step-by-Step Explanations

Strategy: For Percent Error: How Close Are Your Estimates?, find the absolute error first, then compare it with the actual value. The final percent error should compare the error with the actual value, not the estimate.

Practice 1: An estimate is 50 and the actual value is 40. Find the percent error. **Answer:** 25%
For the first sample, compare the error to the actual value; percent error always uses the actual value in the denominator.

Practice 15: An estimate is 7 and the actual value is 8. Find the percent error. **Answer:** 12.5%
Late in the set, find the absolute error first so the percent error is positive.

Word-problem notes:

16. Answer: Month 1: $\approx 28.9\%$ (underestimate); Month 2: $\approx 5.5\%$ (overestimate); Month 2 more accurate.
Use the percent error formula $\frac{|\text{estimate}-\text{actual}|}{\text{actual}} \times 100$. For month 1, $\frac{|3.2-4.5|}{4.5} \times 100 = \frac{1.3}{4.5} \times 100 \approx 28.9\%$. Because 3.2 is less than 4.5, that prediction was an underestimate. For month 2, $\frac{|5.8-5.5|}{5.5} \times 100 = \frac{0.3}{5.5} \times 100 \approx 5.5\%$, and since 5.8 is greater than 5.5, it was an overestimate. The smaller percent error is more accurate, so month 2 was better.

17. Answer: A: $\approx 1.3\%$; B: 10%; C: 8%. Rank: A, C, B.
Find each student's percent error using $\frac{|\text{estimate}-150|}{150} \times 100$. Student A has $\frac{|148-150|}{150} \times 100 = \frac{2}{150} \times 100 \approx 1.3\%$. Student B has $\frac{15}{150} \times 100 = 10\%$. Student C has $\frac{12}{150} \times 100 = 8\%$. Smaller percent error means greater accuracy, so the ranking from most accurate to least accurate is A, then C, then B.

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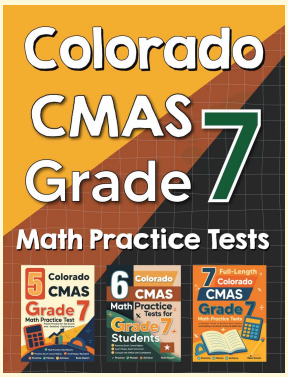

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