Writing Inequalities

Writing inequalities: Applications and decisions

Name _____ **Date** _____ **Score** _____ / 8

QUICK REVIEW

Decide which side is allowed: larger values use $>$, smaller values use $<$. Then test the boundary. Include equality for at least ($\geq$) and at most ($\leq$). For example, a temperature at most -1 includes -1 and smaller numbers such as -2. State the variable and units.

Worked example

Let x be age in whole years. Write at least 13 years. Test the boundary and nearby ages.

1. The rule admits ages above 13 and excludes younger ages, so choose the greater-than direction.
2. Test the boundary: $x = 13$ is included, so use $\geq$.
3. $14 \geq 13$ is true, while $12 \geq 13$ is false; the allowed side is right.
Answer: $x \geq 13$.

Practice Problems

Show your thinking.

1. A bus has 48 seats and reserves 6 for staff. Let x count other riders. Write a capacity inequality and decide if 42 and 43 other riders can ride.

2. For a trial, a temperature t must be at least $18°$C but strictly below $24°$C. Write two conditions for t. Test 17.5, 18, and 24.

3. Two freezer rules say below $-2°$C and no warmer than $-2°$C. Write both with x for temperature. Which accept -2 and which accept -3?

4. A plant can have a fractional height. Compare more than 6 cm and at least 7 cm for height h. Write both inequalities and give a height allowed by the first but not the second.

5. A sign allows 25 kg exactly and rejects 26 kg. The suggested rules are $x \leq 25$ and $x < 26$ for real mass x in kg. Can the two tests determine which rule the sign uses? Give a mass that distinguishes them.

6. A theater needs at least 13 paid tickets to run a show. It has sold 7. Use y for additional sales. Write the condition and check whether 5 or 6 more sales is enough.

7. A timer test accepts 30 seconds but rejects 31. A manual offers exactly three candidate rules: $x < 30$, $x \leq 30$, or $x > 30$. Which fits both tests? Explain why each other candidate fails.

8. A parcel may weigh at most 5 kg. Let m be mass in grams, using 1 kg $= 1000$ g. Write the limit in grams. Do 4950 g and 5050 g meet it?

Answer Key

1. $x + 6 \leq 48$, or $x \leq 42$ for whole rider counts. 42 fits, 43 does not.
2. $t \geq 18$ and $t < 24$. Of the three, only 18 is allowed.
3. Below: $x < -2$. No warmer: $x \leq -2$. Both accept -3; only the second accepts -2.
4. $h > 6$ and $h \geq 7$; for example, 6.5 cm satisfies only the first.
5. No. 25.5 kg is allowed by $x < 26$ but not by $x \leq 25$.
6. $7 + y \geq 13$, or $y \geq 6$. Six more is enough; five is not.
7. Only $x \leq 30$.
8. $m \leq 5000$ g. 4950 g meets it; 5050 g does not.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The total is $x + 6$. Smaller totals are allowed, and exactly 48 is allowed: $x + 6 \leq 48$.
2. Remove the reserved seats: $x \leq 48 - 6 = 42$. With 42 the total is 48, but $43 + 6 = 49$ exceeds capacity.

Problem 2

1. Use the larger side of 18, including 18: $t \geq 18$.
2. Use the smaller side of 24, excluding 24: $t < 24$.
3. 17.5 fails the first rule, 18 meets both, and 24 fails the second rule.

Problem 3

1. Both rules allow colder values, which are smaller numbers. Since $-3 < -2$, both accept -3.
2. Only no warmer than also allows the boundary -2, so it needs $\leq$ instead of $<$.

Problem 4

1. More than 6 excludes 6 and accepts every larger height. At least 7 includes 7 and every larger height.
2. $6 < 6.5 < 7$. This fractional height meets $h > 6$ but not $h \geq 7$, so the rules are not equivalent.

Problem 5

1. At 25, both rules are true. At 26, both rules are false. Those two results cannot choose between them.
2. Test 25.5: $25.5 > 25$ so the first rule rejects it, but $25.5 < 26$ so the second accepts it.

Problem 6

1. At least 13 allows larger totals and exactly 13. The total is $7 + y$, so $7 + y \geq 13$.
2. $7 + 5 = 12 < 13$, but $7 + 6 = 13$ reaches the boundary. Thus the minimum is 6 more.

Problem 7

1. $x < 30$ fails because it rejects the allowed time of 30.
2. $x > 30$ rejects 30 and accepts 31, both wrong.
3. $x \leq 30$ accepts the boundary 30 and excludes the larger 31, as required.

Problem 8

1. The allowed side is smaller masses, and exactly 5 kg is allowed. Convert the boundary: $5(1000) = 5000$ g.
2. Thus $m \leq 5000$. $4950 < 5000$ passes, while $5050 > 5000$ fails.

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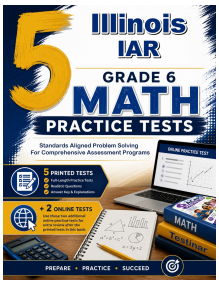

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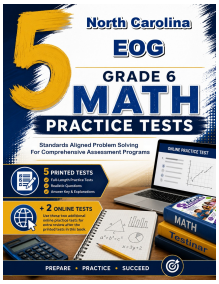

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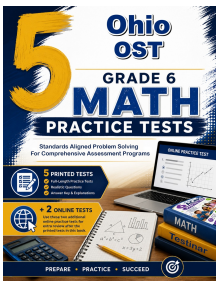

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