Over or Under: Writing and Graphing x > c and x < c

Teacher		**Class**	Grade 6
Subject	Math	**Topic**	Inequalities
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students learn to write x > c or x < c for real limits. They test values and graph all solutions on number lines.

Curriculum links

- Reason about and solve one-variable equations and inequalities [2]

Learning objectives

- Students will write x > c or x < c to show a real-world limit.
- Students will explain why x > c or x < c has infinitely many solutions.
- Students will graph x > c or x < c with open circle and arrow.

Success criteria

- I can write x < c or x > c for a limit in words.
- I can test numbers and explain why solutions never end.
- I can draw an open circle at c with the correct arrow.

What students already know

Show 2 < 4 and 3 > 0. Ask what < and > tell us, and which side is bigger.

Key words

inequality	a math statement that says two amounts are not equal [8]
greater than (>)	bigger in amount; wide end points to the bigger value [15]
less than (<)	smaller in amount; point faces the smaller value [15]
solution	a number that makes the statement true [17]
number line	a picture with values in order that shows all answers at once [9][10]
open circle	an empty ring on a diagram that means the end value is not counted [9]

Materials

- Whiteboard and markers
- Slides 1-12 as listed
- Video clip 1 (4:00-9:00) on slide 6, tested to play
- Printed Worksheet Tasks A, B and E, one copy per student
- Blank paper, pencils and rulers for number lines
- Mini whiteboards for checks

Before the lesson

- Print Worksheet Tasks A, B and E for each student
- Test Slide 6 Video clip 1 (4:00-9:00) picture and sound
- Set up whiteboard, markers, paper, pencils and rulers
- Draw a large 0 to 15 number line model for teacher use

Lesson outline

0–7 min **Starter** 7 min · Whole class

Activate > and < meanings and spark curiosity about the boundary number.

YOU DO

1. Show Slide 1 and read the hook about the backpack sign.
2. Ask for vote: if the bag weighs exactly 15 pounds, can it go.
3. Quick check of prior symbols with 2 < 4 and -2 > -4 [8].
4. Introduce w for weight and preview that one rule can have forever many answers [10].

STUDENTS DO

1. Vote yes or no, then discuss with a partner why 15 counts or not.
2. Say what < and > mean using 2 < 4 as a model.
3. Suggest weights that would work, like 14, 10, 5 and 14.5.

Say: The backpack sign says less than 15 pounds. If your bag weighs exactly 15 pounds, can you bring it? An inequality states that two quantities are unequal [8] and is often used to set bounds on something [4]. Turn and tell your partner what less than 15 must mean.

Ask: If the limit is less than 15 pounds, can the weight be exactly 15? (No, it must be under 15, so 15 itself does not work.) · What does 2 < 4 tell us? (2 is smaller than 4; point faces the smaller value.)

Check understanding: Hold up mini whiteboards with < or > for 3 __ 7. If many miss, point wide end to bigger number again before moving on.

Support: Post pairs like 2 < 4 and 3 > 0 to copy and read aloud. **Stretch:** Ask what the largest whole number under 15 is, and if a decimal could be larger than it.

Use: Slides 1-2

7–17 min **Teaching** 10 min · Whole class

Model the steps for writing x > c or x < c from limit words.

YOU DO

1. Show Slide 3 mindmap: x holds unknown amount, c is the limit number.
2. Teach Slide 4 steps: find limit words, name the variable, pick > or <.
3. Model w < 15 for weight w step by step on the whiteboard.
4. Stress the boundary: open empty ring means 15 is not counted [9].

STUDENTS DO

1. Copy the four steps and the model w < 15.
2. Say with teacher: x is less than 15, then write the symbol.
3. Test 14.5 and 15 on mini whiteboards as true or false.

Say: Find words like more than or less than. Let x stand for the unknown amount. Pick > for more and < for less. So weight w less than 15 pounds becomes w < 15. That one line can describe every number that follows the rule.

Worked example: Backpack limit less than 15 lb. Step 1: limit words = less than, limit c = 15. Step 2: let w = weight in pounds. Step 3: less than means <. Step 4: write w < 15. Check: 14 works because 14 < 15 is true; 15 does not work because 15 < 15 is false.

Ask: What do x and c stand for in w < 15? (x, here w, is the unknown amount; c, here 15, is the limit number.) · How do you choose between > and < ? (More than means >, less than means <; point faces the smaller value.)

Check understanding: All show w < 15 on boards and circle the c. Reteach symbol direction if c is on the wrong side.

Support: Give the frame x is less than __, fill c first, then write the symbol. **Stretch:** Ask why 15 is special even though numbers get as close as 14.9 and 14.99.

Use: Slides 3-4

17–30 min **Guided practice** 13 min · Whole class

Connect words to symbols and see why answers never end.

YOU DO

1. Show Slide 5 question: water slide needs riders over 48 in tall with h.
2. Play Video clip 1 (4:00-9:00) on Slide 6; students spot words to symbols.
3. Pause to list solutions: 49, 50, 60, 48.5, and note the list keeps going.
4. Show Slide 7 statement that one rule can cover every number that fits.

STUDENTS DO

1. Think, pair, share the water slide inequality and defend h > 48.
2. Watch the clip and note one words-to-symbols move.
3. Call out more solutions to show the set does not stop.

Say: A water slide needs riders to be over 48 inches tall. What inequality with h shows who can ride? Watch how they turn words into x > c. Listen for why answers never end. Unlike an equation with one exact answer, an inequality has infinite solutions that keep the statement true [17].

Worked example: Over 48 in: let h = height in inches. Over means >. Write h > 48. Check: 49 > 48 is true, 48 > 48 is false, 47 > 48 is false. Between whole numbers, 48.1 and 48.25 also work, so values keep coming.

Ask: What inequality shows over 48 inches, and why not 48 itself? (h > 48; 48 is the boundary and over means strictly bigger.) · Why can we never finish listing all solutions? (There are infinitely many numbers, including decimals, past the boundary [10].)

Check understanding: Thumbs up if h > 48 includes 100 and 48.1 but not 48. Re-play last minute of clip if confused.

Support: Keep c between 0 and 10 at first in talk, then return to 48 once symbols are firm [2]. **Stretch:** Ask for five decimals just over 48 to prove density between whole numbers.

Use: Slides 5-7, Video clip 1 (4:00–9:00)

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30–50 min **Main activity** 20 min · Pairs

Write real-world limits as x > c or x < c and graph all solutions.

YOU DO

1. Present Slide 9: Rule A backpack less than 15 lb, Rule B more than $20.00 for a game.
2. Model Slide 10 chain with s < 15 for speed: try 14, 10, even 0, then open circle at 15 arrow left [9][10].
3. Hand out Worksheet Tasks B and E; pairs write inequalities then graph with open circle and arrow.
4. Circulate to check symbol choice, boundary dot, and arrow direction; have each student add one class-life rule.

STUDENTS DO

1. Do Worksheet Task B: Practice questions: Write the inequality for each limit. Watch the symbols.
2. Do Worksheet Task E: Number line: Line 1 is for x > 3 and line 2 is for x < 8. Find the boundary and mark solutions.
3. Each writes one x < c and one x > c class rule, graphs it, and tests two values.

Say: Write the rule, then show every answer at once on a number line. Inequalities can be presented algebraically, in words, or on a number line [10]. For x < 5 the graph uses circles, arrows and lines, with an empty circle to show 5 itself is not counted [9]. Test two numbers, one on each side of your circle.

Worked example: Park speed less than 15 mph: let s = speed in mph, so s < 15. Test: 14 < 15 true, 10 < 15 true, 15 < 15 false. Draw line, make open circle at 15, draw arrow left. Arrowhead shows it continues forever for all smaller numbers [9]. Same moves for p < 20 with prices $3.50, $12.00, $19.75: all true, $20.00 false.

Ask: For p < 20, does $19.75 work? Does $20.00? ($19.75 works, $20.00 does not; boundary is not included.) · Which way does the arrow go for x > 3 and x < 8? (Right to bigger numbers for >, left to smaller numbers for <.)

Check understanding: Teacher scans graphs for open circle at c and correct arrow; two pairs show work on whiteboard. Fix direction by testing 13 versus 6 for x > 8 [9].

Support: Give the sentence frame x is less than __ and let students fill in c first, then write the symbol.
Stretch: Have students explain why 15 itself does not work and what makes the boundary special.

Use: Slides 9-10, Worksheet Tasks B and E

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50–60 min **Plenary** 10 min · Whole class

Confirm infinite solutions and correct reading of graphs and symbols.

YOU DO

1. Show Slide 11 mystery: open circle at 5, arrow to bigger numbers.
2. Elicit x > 5: every number greater than 5, but not 5.
3. Run Slide 12 true-or-false with Worksheet Task A: True or false: Tick True or False. Think about symbols and solutions.
4. Close by restating objectives and previewing exit check.

STUDENTS DO

1. Name the mystery rule and give three solutions and one non-example.
2. Do Worksheet Task A: True or false: Tick True or False. Think about symbols and solutions.
3. Self-rate: hold up 1 to 3 fingers for write, explain infinite, graph.

Say: This picture shows an open circle at 5 with an arrow to bigger numbers. What rule is hiding? Yes, x > 5. When a single inequality is used there can be an infinite number of solutions, for example an infinite number of whole numbers that are more than 4 [10]. You cannot list them one by one.

Ask: Does x < 2 have only a few solutions? (No, infinite numbers are less than 2, including decimals.) · For x < 7, where is the open circle and which way is the arrow? (Open circle at 7, arrow left to smaller numbers.)

Check understanding: Collect Worksheet Task A ticks and finger ratings - True or false: Tick True or False. Think about symbols and solutions; reteach boundary versus arrow if x > 3 with 4, 5 and 100 is missed.

Support: Allow pointing to the graph while saying less than or greater than aloud. **Stretch:** Ask students to predict the graph for x > 4.5 and place it between whole numbers.

Use: Slides 11-12, Worksheet Task A: True or false: Tick True or False. Think about symbols and solutions.

Common mistakes

Mistake	How to spot it	How to fix it
Thinking the boundary c is included, so x < 15 includes 15	Student lists 15 as working or fills in the dot at 15	Test the boundary: 15 < 15 is false. Keep the circle empty to show c itself is not counted [9].
Drawing the arrow the wrong way, such as right for x < 8	Graph for x < 8 points right, or x > 3 points left	Test a number on each side. For x > 8, 13 is greater than 8 and works, while 6 does not [9]. Point arrow to the working side.
Believing there are only a few whole-number answers	List stops at 14, 13, 12 and misses decimals like 14.5	Add decimals between wholes and stress infinite solutions that cannot be listed one by one [10][17].

Support

- Give the sentence frame x is less than __, fill c first, then write > or <.
- Start with whole dollars and whole numbers, then add cents and decimals.
- Provide half-drawn number lines with open circles already at c.

Stretch

- Have students explain why 15 itself does not work and what makes the boundary special.
- Ask for three whole-number and three decimal solutions to prove solutions do not stop.
- Add cards with decimals like x > 4.5 to force careful placement.

For the LSE or teaching assistant

Sit near pairs doing Tasks B and E. Prompt the sentence frame, point to c for the open circle, and ask them to test one number each side aloud.

Check for understanding

Question	Answer
Game costs more than $20.00. Let y = price in dollars. Write the inequality.	y > 20
Name two solutions and one non-solution for x < 8.	Solutions e.g., 7 and 0; non-solution 8 or any number 8 or above
Draw x > 3. Where is the circle and which way is the arrow?	Open circle at 3, arrow right; 3 not included, all bigger numbers included

Homework

Write one x < c and one x > c rule from home life and sketch each graph.

Sources

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