Just In Time Quick Check

Standard of Learning (SOL) 6.14b

Strand: Patterns, Functions, and Algebra

Standard of Learning (SOL) 6.14b

The student will solve one-step linear inequalities in one variable, involving addition or subtraction, and graph the solution on a number line.

Grade Level Skills:

- Apply properties of real numbers and the addition or subtraction property of inequality to solve a one-step linear inequality in one variable, and graph the solution on a number line. Numeric terms being added or subtracted from the variable are limited to integers.
- Given the graph of a linear inequality with integers, represent the inequality two different ways (e.g., x < -5 or -5 > x) using symbols.
- Identify a numerical value(s) that is part of the solution set of a given inequality.

Just in Time Quick Check

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Supporting Resources:

- VDOE Mathematics Instructional Plans (MIPS)
  - Solving One Step Inequalities with Addition and Subtraction (Word) / PDF
- VDOE Co-Teaching Mathematics Instruction Plans (MIPS)
  - Solving Inequalities (Word) / PDF
- VDOE Algebra Readiness Formative Assessments
  - SOL 6.14 (Word) / PDF
- VDOE Algebra Readiness Remediation Plans
  - Representing and Solving Practical Situations (Word) / PDF
  - Solving and Graphing Practical Situations (Word) / PDF
- VDOE Word Wall Cards: Grade 6 (Word) / PDF
  - Connecting Representations
  - Variable
  - Term
  - Inequality
- Desmos Activity
  - Inequalities Graphing and Real World Contexts

Supporting and Prerequisite SOL: 6.3a, 6.13, 6.14a

SOL 6.14b - Just in Time Quick Check

1. List three values for y that would make the inequality $3 > y + 2$ true. Explain how you know.

2. Solve the problems below. Then graph your solution on the number line. Explain how you found the solution and justify how your number line represents the solution.

$$x - 5 \leq 3$$

I found my solution by:

The graph represents the solution because:

$$n + 4 > -5$$

I found my solution by:

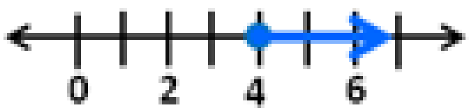
The graph represents the solution because:

3. Solve the following for variable *t*.

$$t - (-4) \geq 11$$

Explain the steps you used to solve this inequality.

4. Write an inequality that represents the graph in two different ways.



SOL 6.14b - Just in Time Quick Check Teacher Notes

Common Errors/Misconceptions and their Possible Indications

1. List three values for y that would make the inequality $3 > y + 2$ true. Explain how you know.

   Students may have confusion about what their solutions to an inequality mean. The explanation here is important for evaluating whether students recognize that the value of y and two more will always be less than 3. If students are struggling with critically thinking about the meaning of solutions, continue to work with linking contextual problems that relate to their daily lives (6.14a). As they are connecting inequalities to practical problems, also have them list out possible solutions and plot them on a number line. Have in depth discussions on about the meaning of the symbols themselves in connection to a balance scale. How are these different from the equal symbol? What does it mean for something to be greater than or equal to something else?

   It can also be helpful to have students create non-examples of solutions. Which solutions would NOT work? How do you know? Students could be given activities where they sort solutions and non-solutions, providing justification for their responses and creating graphs as proof.

2. Solve the problems below. Then graph your solution on the number line. Explain how you found the solution and how your number line shows the solution.

   $x - 5 \leq 3$

I found my solution by:

The graph shows the solution because:

In this problem, look for how students explain their thinking in how they found their solution. A common misconception that arises for students when solving inequalities is to treat inequalities as equalities and follow procedural steps instead of applying relational thinking. Here, students may say they "added 5 to each side" without an understanding of what is happening between the two values on either side of the inequality symbol. Instead, we want students to have an explanation that includes descriptions of this relationship. For example, a student with relational understanding might say, when x has 5 fewer it is less than or equal to 3. So, if x is 8 and there are 5 less, that would be equal to three. As x gets smaller than 3, it will always make this equation true because it will always be less than 3.

To help students develop relational thinking with inequalities, they need many opportunities seeing and using inequalities in different ways. Connecting to practical situations, such as with 6.14a, is imperative in helping them build contextual understanding of the inequality symbols and how each side can relate to the other. Additionally, students can work with inequalities on a balance scale. By giving them two different expressions and having them model those either concretely or pictorially on a scale, students can determine if the scale would "tilt" or "balance." If it tilts, which symbols could we use? Encourage them to write the inequalities both ways and say them aloud. It is often misunderstood that we "have to read from left to right," but because it's a relationship it is important for students to know we can read it AND write it both ways. Here, while x – 5 is less than or equal to 3, 3 is ALSO greater than or equal to x – 5. How does the balance scale show us what this means? If it balances, which symbol would we use? Why? Students can also write their own inequalities and have a partner test out it out to prove if it is true or not.

Additionally, when solving for a variable, students can utilize the balance scale. Our goal is no longer to keep the scale balanced but instead to focus on keeping it imbalanced, with a specific side being heavier than the other.

This idea of imbalance can be tied to many different tasks and activities where students discuss their solutions. For example, for this specific question, students can change out the value of x and take 5 away each time to see if it remains true to being less than or equal to 3. They should realize the patterns that continue to maintain the imbalance and then be encouraged to transfer those to the number line. What pattern do you notice? What would happen if we kept going? What would this look like on the number line?

$n + 4 > -5$

I found my solution by:

The graph shows the solution because:

In students' explanations, they may present misunderstandings about the connection between the number line and the graph of their solution. For example, a student in this problem may start with n and "jump" 4 to try to get a solution. This would be confusing elementary uses of number lines as a tool for modeling addition and subtraction as opposed to using the graph to just show the possible values of n.

To build strong understanding of graphing solutions on a number line, students should have many experiences having in depth discussion with their peers about how they are related to one another. How does your number line connect to the inequality? How do you know? Why are we able to include a line? How would this look different if we graphed an equality? Why? Again, adding context first helps students to make meaning between how all of these are connected to one another. Additionally pull in a balance scale for concrete experiences where students can model their thinking and then move to directly plotting it on the number line graph. This is best done with positive numbers at first so that students can physically see the relationship between each side of the scale as items are removed or added and can then be modeled with a tilted picture of a balance scale where students use integer counters or drawings.

Additionally, students should be asked regularly to analyze the reasonableness of their solutions. Does your graph make sense? How do you know? They should be encouraged to convince a friend. Consider asking questions that get them to think critically about the value connected to context as they reason about its validity. Could n ever be 10? -10? For more ideas for how to ask these types of questions in context, look at the "Understanding the Standard" section of the VDOE Curriculum Framework.

**Note: This problem might also show underlying misconceptions about integer operations. See 6.6 for more information.*

3. Solve the following for variable *t*.

$$t - (-4) \geq 11$$

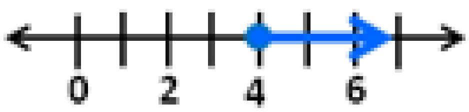
Explain the steps you used to solve this inequality.

A student's explanation will indicate whether he/she is applying the properties of real numbers and inequalities to solve for the variable. Some students may attempt to solve this inequality mentally rather than apply properties to solve it algebraically.

While students are not responsible for being able to identify the properties of real numbers by name, they should have many experiences that apply the properties in both elementary and middle school. If students are not able to connect the properties to apply them to solving inequalities, consider engaging students in tasks and Number

Talks that allow for work with specific properties where they are prompted with questions such as: Is this rule always true? How do you know? Could you write it with variables? Is it true for all types of numbers (fractions, decimals, integers)? Have in-depth discussions using these types of questions to help students make sense of and reason about the properties.

5. Write an inequality that represents the graph in two different ways.



A student may state that x>4 and 4>x. This may indicate that the student has difficulty conceptualizing the meaning of the inequality sign, or has used tricks like "alligator eats the bigger number," which impedes conceptual understanding. Encourage the student to read both inequalities aloud, while also discussing solutions for each inequality to show that x > 4 is not equivalent to 4>x. Provide many opportunities for students to practice writing inequalities two different ways with practical examples.