Name: _____   Date: _____

Student Exploration: Exploring Linear Inequalities in One Variable

Vocabulary: boundary point, inequality, solution

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

1. Michelle is thinking of a number. The sum of her number and 3 is less than 8.

    A. What are three different numbers Michelle could be thinking of? _____

    B. What are three different numbers she is definitely not thinking of? _____

2. An **inequality** compares two quantities that are not equal.

    A. Use <, ≤, >, or ≥ to write an inequality for Michelle's number x. _____

    B. What range of numbers makes this inequality true? _____

Gizmo Warm-up
In the *Exploring Linear Inequalities in One Variable* Gizmo, you will explore inequalities like $x + 3 < 8$ and find their **solutions**, the values that make the inequalities true.

In the Gizmo, select **x + a > b**. Set **a** to 3, **b** to 8, and select **<**. (To quickly set the value of a slider, type the number into the text box to the right of the slider and press **Enter**.) The inequality $x + 3 < 8$ should now be shown in the Gizmo. Be sure **Test different values for x** is selected.
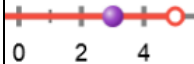

1. Drag the purple dot on the number line to 5. Then drag the purple dot to the left of 5. Look at

    the test shown in the right pane. Are the points to the left of 5 solutions of $x + 3 < 8$? _____

    Explain. _____

2. Place the purple dot at 5 and drag it to the right. Are the points to the right of 5 solutions of

    $x + 3 < 8$? _____ Explain. _____

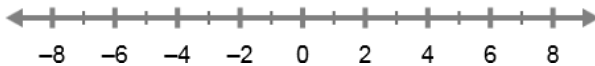| Activity A: **Addition and subtraction inequalities**	Get the Gizmo ready: • Be sure **Test different values for *x*** is selected and that the inequality $x + 3 < 8$ is still shown.	

1. The inequality shown in the Gizmo should be $x + 3 < 8$.

   A. The red open point shown on the number line is the **boundary point** of the graph. Is

   the boundary point a solution of $x + 3 < 8$? _____ Explain. _____

   _____

   B. To solve $x + 3 < 8$ using algebra, you need to get *x* by itself. What do you have to do

   to each side to get *x* by itself? _____

   C. Solve $x + 3 < 8$ for *x*. Show your work to the right.
   Then sketch your solution on the number line
   below. Select **Show solution** to check your work.

   $$\overleftarrow{\quad\underset{-8}{|}\quad\underset{-6}{|}\quad\underset{-4}{|}\quad\underset{-2}{|}\quad\underset{0}{|}\quad\underset{2}{|}\quad\underset{4}{|}\quad\underset{6}{|}\quad\underset{8}{|}\quad}\rightarrow$$

   D. How does the graph relate to the algebraic solution? _____

   _____
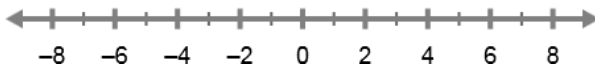
2. Select **Test different values for *x***. With $x + a < b$ selected, set *a* to –3 and *b* to –2. Select the ≥ button. The inequality shown in the Gizmo should be $x - 3 \geq -2$.

   A. Drag the purple dot to two points in the shaded part of the graph. Substitute each of these values for *x* to see if they make $x - 3 \geq -2$ true. Show your work below.

   Do these values make $x - 3 \geq -2$ true? _____

   B. What do you have to do to each side of $x - 3 \geq -2$ to get *x* by itself? _____

   C. Solve $x - 3 \geq -2$ for *x*. Show your work to the right.
   Then sketch your solution on the number line
   below. Select **Show solution** to check your work.

   $$\overleftarrow{\quad\underset{-8}{|}\quad\underset{-6}{|}\quad\underset{-4}{|}\quad\underset{-2}{|}\quad\underset{0}{|}\quad\underset{2}{|}\quad\underset{4}{|}\quad\underset{6}{|}\quad\underset{8}{|}\quad}\rightarrow$$

(Activity A continued on next page)

Activity A (continued from previous page)

3. Be sure $x - 3 \geq -2$ is still shown in the Gizmo and that **Test different values for x** is still selected. Select `>` , `<` , and then `≤` , and compare the graphs.

   A. When is the boundary point of the graph solid? _____

     _____

   B. When is the boundary point of the graph open? _____

     _____

   C. When is the graph shaded to the right of the boundary point? _____

     _____
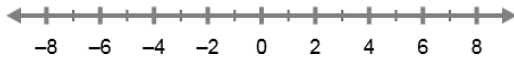
   D. When is the graph shaded to the left of the boundary point? _____
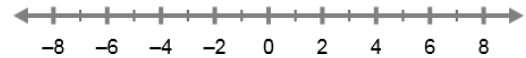
     _____

4. Use algebra to find the solution of each inequality. Show your work in the space below each problem. Then graph the solution and check your answer in the Gizmo.
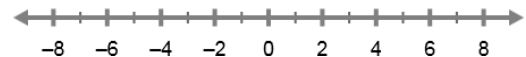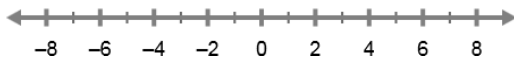
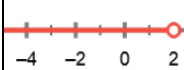   A. $x - 4 \leq 2$ C. $x - 6 < -3$

        –8 –6 –4 –2 0 2 4 6 8   –8 –6 –4 –2 0 2 4 6 8

   B. $x + 1 > -5$ D. $x - 7 \geq -8$

        –8 –6 –4 –2 0 2 4 6 8   –8 –6 –4 –2 0 2 4 6 8

Activity B: **Multiplication and division inequalities**	Get the Gizmo ready: • Select **ax ≥ b**. Set **a** to 2, **b** to 4, and select the ⟨<⟩ button. • Select **Test different values for x**.	

1. The inequality shown in the Gizmo should be $2x < 4$.

   A. Based on the graph, what are two values of x that make $2x < 4$ true? _____

   B. What do you have to do to each side of $2x < 4$ to get x by itself? _____

   C. Solve $2x < 4$ for x. Show your work to the right.
   Then sketch your solution on the number line below
   Select **Show solution** to check your work.
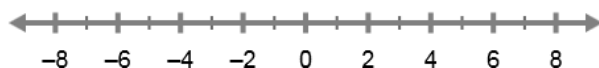
2. Select **Test different values for x**. Set the Gizmo so the inequality shown is $\frac{x}{3} > 2$.

   A. Based on the graph, what are two values of x that make $\frac{x}{3} > 2$ true? _____

   B. What do you have to do to each side of $\frac{x}{3} > 2$ to get x by itself? _____

   C. Solve $\frac{x}{3} > 2$ for x. Show your work to the right.

   Then sketch your solution on the number line
   below. Select **Show solution** to check your work.
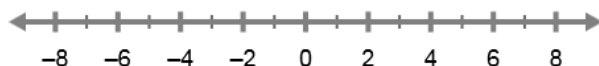
3. Solving inequalities can be tricky when the coefficient of x is negative. Consider $-x < -3$.

   A. If $x = 4$, what is $-x$? _____

   B. Is this value of $-x$ less than -3? _____

   C. Fill in the table for the values of x shown.

      What do you notice? _____

      _____

x	$-x$	Is $-x < -3$ true?
2		
3		
4		
5		
6		

   D. If $-x < -3$ is true, what do you know about x and 3? _____

(Activity B continued on next page)

Activity B (continued from previous page)

4. Set the Gizmo so the inequality shown is $-x < -3$. Be sure **Show solution** is selected.

    A. What is the solution of $-x < -3$? _____

    B. To solve the inequality $-x < -3$, you divide (or multiply) each side by -1. What happens to the inequality sign when you divide (or multiply) each side by -1?
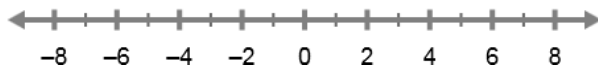
    _____

5. Set the Gizmo so $-3x \geq 6$ is shown. Select **Test different values for x**.

    A. Use the graph. What are two values of x that make $-3x \geq 6$ true? _____

    B. What do you need to do to each side of $-3x \geq 6$ to get x by itself? _____

    C. What do you think will happen to the $\geq$ sign when you divide each side by a negative

    number? _____

    D. Solve $-3x \geq 6$ for x. Show your work to the right.
    Then sketch your solution on the number line
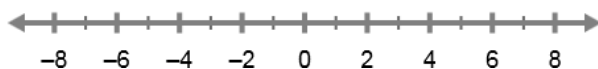   below. Select **Show solution** to check your work.

    $$-8 \quad -6 \quad -4 \quad -2 \quad 0 \quad 2 \quad 4 \quad 6 \quad 8$$

6. Set the Gizmo so the inequality is $\dfrac{x}{-2} < 3$. Select **Test different values for x**.

    A. Use the graph. What are two values of x that make $\dfrac{x}{-2} < 3$ true? _____

    B. What do you need to do to each side of $\dfrac{x}{-2} < 3$ to get x by itself? _____

    C. What do you think will happen to the $<$ sign when you multiply each side by a

    negative number? _____

    D. Solve $\dfrac{x}{-2} < 3$ for x. Show your work to the right.
    Then sketch your solution on the number line
    below. Select **Show solution** to check your work.

    $$-8 \quad -6 \quad -4 \quad -2 \quad 0 \quad 2 \quad 4 \quad 6 \quad 8$$

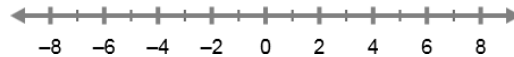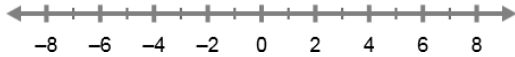| **Activity C:**	Get the Gizmo ready:	
Solving inequalities	• Be sure **Show solution** is selected.	

Use algebra to find the solution of each inequality. Show your work in the space below each problem. Then graph the solution and check your answer in the Gizmo.
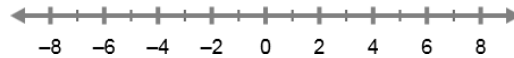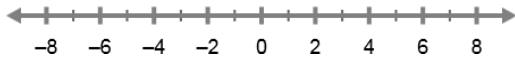
1. $x + 5 \leq 1$

(number line from −8 to 8)

2. $x - 8 > -4$

(number line from −8 to 8)

3. $2x \geq 8$

(number line from −8 to 8)

4. $-3x < 3$

(number line from −8 to 8)

5. $\dfrac{x}{4} > 1$

(number line from −8 to 8)

6. $\dfrac{x}{-3} \leq -2$

(number line from −8 to 8)