F – Inequalities, Lesson 2, Interpreting Solutions (r. 2018)

INEQUALITIES
Interpreting Solutions

Common Core Standard	Next Generation Standard
A-REI.3 Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	**AI-A.REI.3** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. **Note: Algebra I tasks do not involve solving compound inequalities**.

LEARNING OBJECTIVES

Students will be able to:

1) Identify solutions to inequalities as sets of solutions that can be plotted on a number line.
2) Use proper notation to define solution sets.
3) Identify integer values within solution sets.
4) Determine if a specified integer value is within a solution set.

Overview of Lesson

Teacher Centered Introduction	Student Centered Activities
Overview of Lesson **- activate students' prior knowledge** **- vocabulary** **- learning objective(s)** **- big ideas: direct instruction** **- modeling**	**guided practice ← Teacher: anticipates, monitors, selects, sequences, and connects student work** **- developing essential skills** **- Regents exam questions** **- formative assessment assignment (exit slip, explain the math, or journal entry)**

VOCABULARY

integer	open dot	curved parentheses	number line
solution set	closed dot	square parentheses	

BIG IDEAS

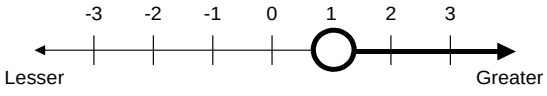
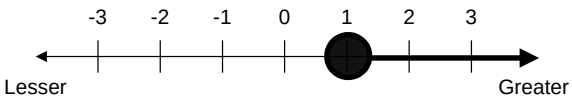
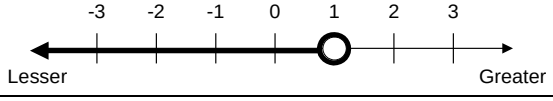
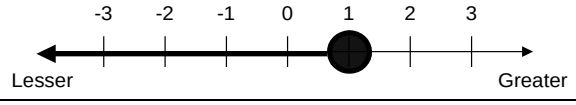
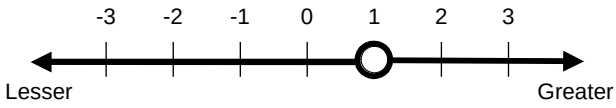
Inequality Symbols:

$<$	less than	$>$	greater than
$\leq$	less than or equal to	$\geq$	greater than or equal to
$\neq$	not equal to		

The **solution of an inequality** includes any values that make the inequality true.
Solutions to inequalities can be graphed on a number line using open and closed dots.

Open Dots v Closed Dots

Square vs Curved Parentheses

When the inequality sign does not contain an equality bar beneath it, the dot is open.	When the inequality sign contains includes an equality bar beneath it, the dot is closed, or shaded in.
Graph of $x > 1$ or (1... means 1 *is not* included in the solution set. 	Graph of $x \geq 1$ or [1... means 1 *is* included in the solution set 
Graph of $x < 1$ or ...1) means 1 *is not* included in the solution set 	Graph of $x \leq 1$ or ...1] means 1 *is* included in the solution set 
Graph of $x \neq 1$ 	

DEVELOPING ESSENTIAL SKILLS

Solve for the smallest integer value of x: $3+\frac{2}{5}x \geq 4-6x$

Notes	Left Hand Expression	Sign	Right Hand Expression
Given	$3+x$	$\geq$	$4-6x$
Add 6x	3+7x	$\geq$	4
Subtract 3	7x	$\geq$	1
Divide by 7	x	$\geq$	$\frac{1}{7}$
Answer	1 is the smallest integer that is in the solution set.		
Check	0 is less than $\frac{1}{7}$ and should *not* be in the solution set. $3+x \geq 4-6x$ $3+(0) \geq 4-6(0)$ $3 \geq 4$ *not* true		1 is greater than or equal to $\frac{1}{7}$ and *should* be in the solution set. $3+x \geq 4-6x$ $3+(1) \geq 4-6(1)$ $4 \geq 4-6$ $4 \geq -2$ true

REGENTS EXAM QUESTIONS (through June 2018)

A.REI.B.3: Interpreting Solutions

145) Given $2x + ax - 7 > -12$, determine the largest integer value of *a* when $x = -1$.

146) Solve the inequality below to determine and state the smallest possible value for *x* in the solution set.

$$3(x + 3) \leq 5x - 3$$

147) Determine the smallest integer that makes $-3x + 7 - 5x < 15$ true.

148) Solve for *x* algebraically: $7x - 3(4x - 8) \leq 6x + 12 - 9x$

If *x* is a number in the interval $[4, 8]$, state all integers that satisfy the given inequality. Explain how you determined these values.

149) Which value would be a solution for *x* in the inequality $47 - 4x < 7$?

1) -13
2) -10
3) 10
4) 11

150) Given the set $\{x | -2 \leq x \leq 2, \text{where } x \text{ is an integer}\}$, what is the solution of $-2(x - 5) < 10$?

1) 0, 1, 2
2) 1, 2
3) $-2, -1, 0$
4) $-2, -1$

SOLUTIONS

145) ANS:

The largest integer value for *a* is 2.

Strategy: Use the four column method.

Notes	Left Expression	Sign	Right Expression
Given	$2x + ax - 7$	>	-12
Substitute -1 for *x*	$2(-1) + a(-1) - 7$	>	-12
Simplify	$-2 - a - 7$	>	-12
Combine like terms	$-a - 9$	>	-12
Add +9 to both expressions (Addition property of equality)	$-a$	>	-3
Divide both expressions by -1 and reverse the sign	a	<	3

The largest integer value that is less the 3 is 2.

PTS: 2 NAT: A.REI.B.3 TOP: Solving Linear Inequalities

146) ANS:

6 is the smallest possible value for *x* in the solution set.

Strategy: Use the four column method.

Notes	Left Expression	Sign	Right Expression
Given	$3x + 9$	$\leq$	$5x - 3$
Subtract 3x from both expressions	9	$\leq$	$2x - 3$

(Subtraction property of equality)			
Add +3 to both expressions (Addition Property of equality)	12	$\leq$	$2x$
Divide both expressions by 2 (Division property of equality)	6	$\leq$	x
Rewrite	x	$\geq$	6

PTS: 2 NAT: A.REI.B.3 TOP: Solving Linear Inequalities

147) ANS:

0 is the smallest integer in the solution set.

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Strategy: Use the four column method to solve the inequality, then interpret the solution.

STEP 1: Solve the inequality.

Notes	Left Expression	Sign	Right Expression
Given	$-3x+7-5x$	<	15
Simplify (Combine like terms)	$-8x+7$	<	15
Add +8x to both expressions (Addition Property of Equality)	7	<	8x+15
Subtract 15 from both expressions (Subtraction Property of Equality)	-8	<	8x
Divide both expressions by +8 (Division property of equality)	-1	<	x
Rewrite	x	>	-1

STEP 2: Interpret the solution set for the smallest integer.

The smallest integer greater than -1 is 0.

PTS: 2 NAT: A.REI.B.3 TOP: Solving Linear Inequalities

148) ANS:

6, 7, 8 are the numbers greater than or equal to 6 in the interval.

Strategy: Use the four column method to solve the inequality, then interpret the solution.

STEP 1: Solve the inequality.

Notes	Left Expression	Sign	Right Expression
Given	$7x-3(4x-8)$	$\leq$	$6x+12-9x$
Clear parentheses	$7x-12x+24$	$\leq$	$6x+12-9x$

(Distributive property)			
Simplify (Combine like terms)	$-5x+24$	$\leq$	$-3x+12$
Add 5x to both expressions (Addition property of equality)	24	$\leq$	$2x+12$
Subtract 12 from both expressions (Subtraction property of equality)	12	$\leq$	2x
Divide both expressions by 2 (Division property of equality)	6	$\leq$	x
Rewrite	x	$\geq$	6

STEP 2: Interpret the solution set for the interval $[4, 8]$.
The interval $[4, 8]$ contains the integers 4, 5, 6, 7, and 8.
If $x \geq 6$, then the solution set of integers is $\{6, 7, 8\}$.

PTS: 4 NAT: A.REI.B.3 TOP: Solving Linear Inequalities

149) ANS: 4

$$47 - 4x < 7$$

$$-4x < -40$$

Remember to change the direction of the sign when multiplying or dividing an inequality by a negative number.

$$x > \frac{-40}{-4}$$

$$x > 10$$

11 is the only answer choice that is greater than 10.

PTS: 2 NAT: A.REI.B.3 TOP: Interpreting Solutions

150) ANS: 2

STEP 1: Solve the inequality $-2(x-5) < 10$

$$-2(x-5) < 10$$

$$\frac{-2(x-5)}{-2} < \frac{10}{-2}$$

$$x - 5 > -5$$

$$x > 0$$

STEP 2: Select integers from the interval $\{x | -2 \leq x \leq 2, \text{where } x \text{ is an integer}\}$ that satisfy the inequality.
The integers in the interval are: {-2, -1, 0, 1, 2}.

-2 is not greater than 0
-1 is not greater than 0
0 is not greater than 0
1 is greater than 0
2 is greater than zero.

PTS: 2 NAT: A.REI.B.3 TOP: Interpreting Solutions