Grade 6 Math Circles
November 7/8/9, 2023
Inequalities and Absolute Values - Problem Set

1. Place a $<$, $>$, or a number in each blank to make the inequality true.

   (a) 14 _____ 20

   (b) $|-14| >$ _____

   (c) $|-19|$ _____ $|-3|$

   (d) $|2 \times (-4)| <$ _____

   (e) $2 - 5$ _____ $|2 - 5|$

   (f) $|x|$ _____ -1

2. The city is planning the finances of the buildings they need to construct. They know:

   - Ice rinks are more expensive than apartments.
   - Garages are less expensive than houses.
   - Houses are less expensive than apartments.

   Write a single compound inequality that lists the cost of constructing the buildings from least to greatest.

3. Evaluate the following expressions to a single integer or fraction. Ensure you follow the correct order of operations.

   (a) $\dfrac{3 \times (2 + 4)}{3 - 1}$

   (b) $2|1 - 4 \times 3|$

   (c) $-3 \div |-6 - 3 \times 3|$

   (d) $|10 \times (-2)(3)| \div (-|3 - 6|)$

4. Determine all values of x in the following mix of equations and inequalities.

   (a) $2x + 10 = -2$

   (b) $2 - x > 1$

   (c) $\frac{9}{2}x - \frac{5}{2}x - 7 = 1$

   (d) $|(-4)(-2)(x) \div 8| = 48$

   (e) $|x + 1| < 5$

   (f) $|x - 2| > 6$

5. (a) Try you find a value for x such that $|x - 2| = -1$?

      If you find a number, substitute it back into the orignal equation to check if it is correct.

      If you cannot find a number, explain why!

   (b) Find all values of x such that $|x - 2| > -1$.

6. Complete the following HANGMAN activity that tests most of the skills you learned today!

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WHAT IS NEXT WEEK'S TOPIC?

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| $x > 10$ | No Solutions | $x > 5$ OR $x < -3$ | $x = 5$ OR $x = -13$ | $x \geq -28$ | $x = -\frac{1}{2}$ | $x = 3$ | $x > -9$ AND $x < -5$ | $x < \frac{7}{5}$ | No Solutions |

A	B	C	E	I
$5x - 3x + 1 = 2$	$x + 5 > 2x + 1$	$|x - 1| > 4$	$x + 7 < 2x - 3$	$|x + 7| < 2$
L	M	N	O	P
$x = |2 + 7 \times 6| - 1$	$3x - 5 < 5x + 1$	$|2x + 1| = -4$	$-3.5x + 7 > 1.5x$	$2x + 1 = 0$
R	T	U	Y	Z
$|x + 4| = 9$	$2x = |4 - 10|$	$2x + 7 = 2$	$9 \times 3 + 2x \geq x - 1$	$x^2 - 1 = 0$

7. What do you think the symbols $\leq$ and $\geq$ mean?

8. Combine the following inequalities with an "and" or an "or".

   (a) $x < 3$, $x > 5$ (b) $x > -4$, $x < 10$ (c) $x > 7$, $x > -3$, $x < 4$

9. CHALLENGE QUESTION

   The goal for this question is to solve an inequality with multiplication inside the absolute value, instead of just addition or subtraction.

   (a) Remember that both $|9| = 9$ and $|-9| = 9$. Use this to determine all values of x such that $|2x - 2| = 9$ and label them on a number line.

   (b) Determine all values of x such that $|2x - 2| < 9$ and label them on a number line. Part (a) should help with this.

   (c) Use the same steps/ideas from part (a) and (b) to determine all values of x such that $|4x + 8| > 12$.