Grade 7/8 Math Circles
March 30th, 2022
Inequalities and Absolute Values Problem Set

1. Insert the correct inequality symbols to make each equation true.

   (a) 0 ____ 8

   (b) -5 ____ 4

   (c) $(5 - 7)$ ____ 0

   (d) $|-3|$ ____ $|-9|$

   (e) 0 ____ $|-2|$

   (f) -1 ____ $|-5|$

2. In a group of five friends:

   - Amy is taller than Carla
   - Eric is shorter than Ahmed but taller than Yin
   - Ahmed is shorter than Carla

   Use inequality symbols in a chain to list the friends from shortest to tallest.

3. Five children had dinner. Chris ate more than Max. Brandon ate less than Kayla. Kayla ate less than Max but more than Tanya. Use inequality symbols in a chain to list the children from who ate the most to who ate the least.

4. Solve for x in the following inequalities.

   (a) $4x > 12$

   (b) $-2x < 8$

   (c) $3x + 4 < 22$

   (d) $2x + 9 < 6x + 1$

   (e) $1 + 2x \times 2 + 2 < 5 + 2x + 2 - 2x$

   (f) $2x + 4 + x - 3 < 4 - 2x + 3 + 5x$

5. Solve for x in the following absolute value problems.

   (a) $6 = |3x|$

   (b) $|6x| > 18$

   (c) $|x + 7| < 18$

   (d) $9 > |6 - 3x|$

   (e) $|3x + 2 \times 2| < 2 \times 5$

   (f) $9 \div 3 < |3 + 2x \times 2 + 4|$

6. Solve for x in the following.

(a) $3 < x \div 2$

(b) $x \div 2 + 9 < 12$

(c) $4 < (x + 6) \div 3$

(d) $|(3x + 6) \div 2| < 6$

(e) $-2 < 6x - 2 < 4$

(f) $2 > x \div 2 + 3$ or $x \div 2 + 3 > 5$

7. Based on your knowledge of the equal sign and inequality symbols, what do you think is the meaning of the symbols $\leq$ and $\geq$?

8. Simplify the following lists of conditions for x into an "and" or an "or" statement of two conditions.

(a) $x > 3$, $x > 4$, $x < -2$, $x < 0$

(b) $x > -8$, $x > -3$, $x < 9$, $x < 1$

(c) $|-2x - 2| > 4$, $3x - 4 > 5$, $|5x| > 15$

9. Try to explain the reasoning behind the fact that $|x| = \sqrt{x^2}$.

10. **Challenge:** Solve for x in the inequality $|x - 9| < |x + 5|$.