Name: _____ Date: _____

Notes: Solving Inequalities

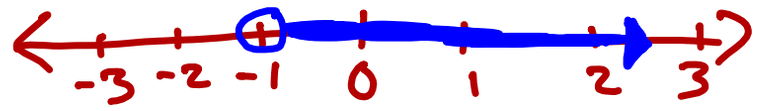
Do Now: Solve the following inequality. Draw a number line to represent the answer.

$$4h - 7 > -11$$

$+7 \quad +7$

$$\frac{4h}{4} > \frac{-4}{4}$$

$$h > -1$$



$>$ Greater Than
$\geq$ Greater Than or Equal To
$<$ Less Than
$\leq$ Less Than or Equal To

What inequality represents each verbal expression?

1) All real numbers x less than or equal to -7

$x \leq -7$

2) All real numbers at most 47

$x \leq 47$

3) 6 is less than a number k is less than 13

$6 < k < 13$

Solve the following inequality:

$-\frac{1}{3}k + 9 > -6$ vs $\frac{1}{3}k + 9 > -6$

$-9 \quad -9$ $\qquad$ $-9 \quad -9$

$\left(\frac{-3}{1}\right) -\frac{1}{3}k > -15 \left(\frac{-3}{1}\right)$ $\qquad$ $\left(\frac{3}{1}\right) \frac{1}{3}k > -15 \left(\frac{3}{1}\right)$

$k < 45$ $\qquad$ $k > -45$

Only flip the sign when you multiply or divide by a negative number on BOTH sides of the inequality.

I.N. $(-\infty, 45)$

S.B. $\{k \mid k < 45\}$

I.N. $(-45, \infty)$

S.B. $\{k \mid k > -45\}$

Interval Notation:

- (or) ⇒ parentheses do NOT include the number
- [or] ⇒ bracket DO include the number
- always use parentheses for ∞ or $-\infty$
- smaller number, larger number

Set Builder Notation:

$\{k \mid k > -45\}$

variable $\quad$ such that $\quad$ conditions

Write the following solutions in interval notation and set builder notation.

1) $x < 8$

I.N. $(-\infty, 8)$

S.B. $\{x \mid x < 8\}$

2) $-5x + 7 \leq 17$

$-7 \quad -7$

$\frac{-5x}{-5} \leq \frac{10}{-5}$

$x \geq -2$

I.N. $[-2, \infty)$

S.B. $\{x \mid x \geq -2\}$

Before we go on...

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

$-8x+7<15$
$-7 \quad -7$
$\frac{-8x}{-8} < \frac{8}{-8}$
$x > -1$
0

Connor wants to attend the town carnival. The price of admission to the carnival is \$4.50, and each ride costs an additional 79 cents. If he can spend at most \$16.00 at the carnival, which inequality can be used to solve for r, the number of rides Connor can go on, and what is the maximum number of rides he can go on?

(1) $0.79 + 4.50r \leq 16.00$; 3 rides
(2) $0.79 + 4.50r \leq 16.00$; 4 rides
(3) $4.50 + 0.79r \leq 16.00$; 14 rides
(4) $4.50 + 0.79r \leq 16.00$; 15 rides

$4.50+0.79r \leq 16.00$
$\frac{0.79r}{0.79} \leq \frac{11.50}{0.79}$
$r \leq 14.5569\overline{62}$

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

possible solutions

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

$-2 \quad -2$
$x-5>-5$
$+5 \quad +5$
$x > 0$

Vocab Breakdown

Compound Inequalities: Two inequalities that can be separated by an "and" or "or."

Examples: $x > 6$ or $x < 2$

$x > 1$ and $x < 8$ → $1 < x < 8$

Compound Inequalities

How about....

$$-3 < m - 4 < -1$$

a) How would I verbally say this inequality?

Negative 3 is less than m minus 4 which is less than -1

* Since this can be written as $-3 < m-4 < -1$ this is an "and" compound inequality.

$-3 < m-4$ and $m-4 < -1$

b) Now solve it.

$-3 < m-4 < -1$

$+4 \quad +4 \quad +4$

$1 < m < 3$

And...

$$16 \leq -2x + 6 < 20$$

$-6 \quad -6 \quad -6$

$10 \leq -2x < 14$

$\frac{}{-2} \quad \frac{}{-2} \quad \frac{}{-2}$

$-5 \geq x > -7$

$x > -7$ and $x \leq -5$

$-7 < x \leq -5$

Compound Inequalities

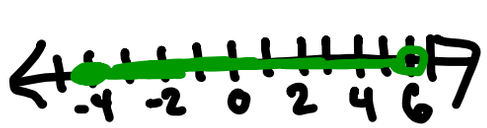
AND

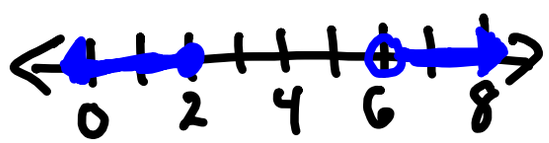
All real numbers that are greater than or equal to -4 AND less than 6

OR

All real numbers that are less than or equal to 2 OR greater than 6

a) Represent each scenario with a number line.





b) Write each scenario as an inequality.

$x \geq -4$ and $x < 6$

$-4 \leq x < 6$

$x \leq 2$ or $x > 6$

c) Represent each inequality in interval notation.

$[-4, 6)$

$(-\infty, 2) \cup (6, \infty)$

↑ "in union with"

d) Represent each inequality in set builder notation.

$\{x \mid -4 \leq x < 6\}$

$\{x \mid x \leq 2 \text{ or } x > 6\}$

Before the Classwork...

Given that $a > b$, solve for x in terms of a and b:

$$b(x - 3) \geq ax + 7b$$

$bx - 3b \geq ax + 7b$

$-ax + 3b \quad -ax + 3b$ ← get x on one side above on one side

$bx - ax \geq 10b$

$\frac{x(b-a)}{b-a} \geq \frac{10b}{b-a}$

$x \geq \frac{10}{b-a}$ BUT WAIT! if $a > b$ then $b-a$ is a negative value ∴

$x \leq \frac{10}{b-a}$

Name: _____ Date: _____

Classwork: Solving Inequalities

1)

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

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

$-47 \quad -47$

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

$x > 10$

2)

The inequality $7 - \frac{2}{3}x < x - 8$ is equivalent to

(1) $x > 9$
(2) $x > -\frac{3}{5}$
(3) $x < 9$
(4) $x < -\frac{3}{5}$

$+8 \quad +\frac{2}{3}x \quad +\frac{3}{3}x \quad +8$

$(\frac{3}{5})15 < \frac{5}{5}x (\frac{3}{5})$

$9 < x$

$x > 9$

3)

The acidity in a swimming pool is considered normal if the average of three pH readings, p, is defined such that $7.0 < p < 7.8$. If the first two readings are 7.2 and 7.6, which value for the third reading will result in an overall rating of normal?

(1) 6.2
(2) 7.3
(3) 8.6
(4) 8.8

4)

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

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

$3x + 9 \leq 5x - 3$

$-3x + 3 \quad -3x + 3$

$\frac{12}{2} \leq \frac{2x}{2}$

$6 \leq x$

$x \geq 6$

6

5)

Solve the inequality below:

$$1.8 - 0.4y \geq 2.2 - 2y$$

$-1.8 \quad +2y \qquad +1.8 \quad +2y$

Provide your answer in inequality form, interval notation, and set builder notation.

$$\frac{1.6y}{1.6} \geq \frac{0.4}{1.6}$$

$$y \geq 0.25$$

Inequality:

$y \geq 0.25$

Interval Notation:

$[0.25, \infty)$

Set Builder Notation

$\{y \mid y \text{ is a real number}, y \geq 0.25\}$

6)

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

$7x - 12x + 24 \leq 6x + 12 - 9x$

$-5x + 24 \leq -3x + 12$

$12 \leq 2x$

$6 \leq x$

$x \geq 6$

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

As x must be greater than or equal to 6, integers that would satisfy the inequality from $[4, 8]$ would be 6, 7, and 8.

7)

Sarah wants to buy a snowboard that has a total cost of $580, including tax. She has already saved $135 for it. At the end of each week, she is paid $96 for babysitting and is going to save three-quarters of that for the snowboard.

Write an inequality that can be used to determine the *minimum* number of weeks Sarah needs to babysit to have enough money to purchase the snowboard.

let x = number of weeks

$\frac{3}{4}(96)x + 135 \geq 580$

$72x + 135 \geq 580$

Determine and state the *minimum* number of full weeks Sarah needs to babysit to have enough money to purchase this snowboard.

$72x + 135 \geq 580$

$-135 \quad -135$

$\frac{72x}{72} \geq \frac{445}{72}$

$x \geq 6.1805$

∴ 7 weeks

8)

Given $7x + 2 \geq 58$, which number is *not* in the solution set?

(1) 6

(2) 8

(3) 10

(4) 12

$7x \geq 56$

$x \geq 8$

$6 \geq 8$ ✗

$8 \geq 8$ ✓

$10 \geq 8$ ✓

$12 \geq 8$ ✓