Name: MTH 103 Section 65 Quiz 3 2/11/14

Make sure to **clearly show all your work** (except on number 1). Grades will be based on your intermediate steps as well as the final answer.

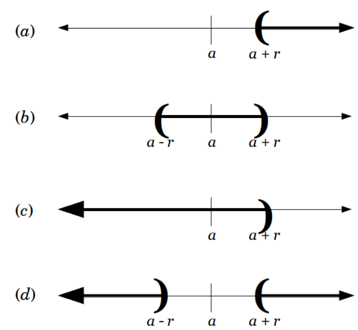
1. (4 points) In the blanks to the right of each inequality in parts $(i) \sim (iv)$, choose the diagram below $(a, b, c,$ or $d)$ which depicts the solution set.

(i) $x - a > r$ __________

(ii) $x - a < r$ __________

(iii) $|x - a| > r$ __________

(iv) $|x - a| < r$ __________



2. (4 points) Solve the following polynomial inequality and write the solution set **in interval notation**.

$$2x - 3 \leq 7x + 5$$

3. (4 points) Find all solutions to the equation:

$$|2x - 6| + 1 = 9$$

4. (4 points) Solve the following rational inequality and write the solution set **in interval notation**.

$$\frac{2-x}{3x+1} > 0$$

5. (4 points) Solve the following inequality and write the solution set **in interval notation**:

$$|5x-1| < 2$$

Solutions

1.

$$\begin{array}{rl} (i) & (a) \\ (ii) & (c) \\ (iii) & (d) \\ (iv) & (b) \end{array}$$

2. Solve the following polynomial inequality and write the solution set **in interval notation**.

$$2x - 3 \leq 7x + 5$$

$$\begin{aligned} 2x - 3 &\leq 7x + 5 \\ 2x - 8 &\leq 7x && \text{(subtract 5)} \\ -8 &\leq 5x && \text{(subtract } 2x\text{)} \\ -\frac{8}{5} &\leq x && \text{(divide)} \end{aligned}$$

The solution set is described by $x \geq -\frac{8}{5}$, which in interval notation is $\left[-\frac{8}{5}, \infty\right)$.

3. Find all solutions to the equation:

$$|2x - 6| + 1 = 9$$

Begin by isolating the absolute value expression. So subtract 1 to get

$$|2x - 6| = 8$$

Now we just solve the two equations $2x - 6 = 8$ and $2x - 6 = -8$:

$$\begin{array}{ccr|ccr} 2x - 6 & = & 8 & 2x - 6 & = & -8 \\ 2x & = & 14 & 2x & = & -2 \\ x & = & 7 & x & = & -1 \end{array}$$

The only two solutions are then $x = 7$ and $x = -1$.

4. Solve the following rational inequality and write the solution set **in interval notation**.

$$\frac{2-x}{3x+1} > 0$$

We need to start by identifying the boundary points. These will be the zeros of the numerator and denominator. The only number that makes the numerator zero is $x = 2$. The only number that makes the denominator zero is $x = -\frac{1}{3}$. So those will be our two boundary points. This partitions the number line into three intervals: $\left(-\infty, -\frac{1}{3}\right)$, $\left(-\frac{1}{3}, 2\right)$, and $(2, \infty)$. We just need to test a point in each interval now.

Interval	**Test Point**	**Evaluate**
$\left(-\infty, -\frac{1}{3}\right)$	-1	$\frac{2-(-1)}{3(-1)+1} = \frac{3}{-2} < 0$
$\left(-\frac{1}{3}, 2\right)$	0	$\frac{2-0}{3(0)+1} = 2 > 0$
$(2, \infty)$	3	$\frac{2-3}{3(3)+1} = \frac{-1}{10} < 0$

We want to get a number that is positive in the **Evaluate** column, and so we see that only happens in the second row. So our solution is just the interval $\left(-\frac{1}{3}, 2\right)$.

5. Solve the following inequality and write the solution set **in interval notation**:

$$|5x-1| < 2$$

Whenever we have $|x| < a$, this means $x < a$ **and** $x > -a$. So we can re-write our original inequality as:

$$\begin{array}{ccccc} -2 & < & 5x-1 & < & 2 \\ -1 & < & 5x & < & 3 \\ -\frac{1}{5} & < & x & < & \frac{3}{5} \end{array}$$

Our solution set is then the open interval $\left(-\frac{1}{5}, \frac{3}{5}\right)$.