Section 1.7

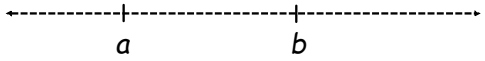
Solving Linear Inequalities

Sep 27-10:57 AM

$a < b$

"a is (strictly) less than b."

a lies to the left of b on the number line.



$a \leq b$

"a is less than or equal to b"

a and b could be the same number.

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Example of a *linear inequality*:

$$3x - 7 < 2x - 5$$

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$a < b$ and $b > a$

are equivalent(they mean the same thing).

It is best to write an inequality sign so that the sign points to the left.

"points this way"

left $<$

left $\leq$

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a) $x > 2$

$2 < x$ Rewrite so the sign points left.

$2 < x < \infty$ There is no limit on how big x can be.

$(2, \infty)$ INTERVAL NOTATION.

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b) $2 < x < 5$

$(2, 5)$ <----- INTERVAL NOTATION.

c) $2 \leq x < 5$

$[2, 5)$ <---- INTERVAL NOTATION.

d) $2 < x \leq 5$

$(2, 5]$ <--------- INTERVAL NOTATION.

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e) $2 \leq x \leq 5$

$[2, 5]$ <---- INTERVAL NOTATION.

f) $-\infty < x \leq -3$

$(-\infty, -3]$ <---- INTERVAL NOTATION.

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The previous sets are infinite in size since x is a REAL NUMBER.

If x could only be an integer, then this would not be true.

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The sets in a) and f) are UNBOUNDED.

This means there is no limit on the size of the numbers.

The other sets are BOUNDED.

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Solving a linear inequality

is just like solving a

linear equation, except

if you multiply or divide by a negative number, you must reverse the direction the inequality sign points.

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Properties of Inequalities

1. Transitive Property: If $a < b$ and $b < c$ then $a < c$

2. Addition of inequalities: If $a < b$ AND $c < d$ then $a + c < b + d$

3. Addition of constant: If $a < b$ then $a + c < b + c$

4. Switch the direction of the inequality sign if you multiply or divide by a negative number.

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EX: Solving a linear inequality

$$3x - 7 < 2x - 5$$

$$3x - 7 < 2x - 5$$

$-2x \quad -2x$ Minus $2x$ from both sides

$$x - 7 < -5$$

$+7 \quad +7$ Add 7 to both sides

$$x < 2$$

$-\infty < x < 2$ Write answer

$(-\infty, 2)$ Write answer in INTERVAL NOTATION.

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EX: Solving a linear inequality with a fraction.

$-2x-7 \leq \frac{x}{3} - 5$

Hint: Multiply by 3 to "clear the denominator."

$3(-2x-7) \leq 3\left(\frac{x}{3} - 5\right)$

$-6x - 21 \leq x - 15$

$+6x \quad +15 \qquad +6x \quad +15$

$\frac{-6}{7} \leq \frac{7x}{7}$

$-\frac{6}{7} \leq x < \infty$

$[-\frac{6}{7}, \infty)$

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EX: Solving a double linear inequality

$-4 \leq 5x-2 < 7$

$+2 \quad +2 \quad +2$

$-\frac{2}{5} \leq \frac{5x}{5} < \frac{9}{5}$

$-\frac{2}{5} \leq x < \frac{9}{5}$

$\left[-\frac{2}{5}, \frac{9}{5}\right)$

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EX: Solving a linear inequality

$0 \leq \frac{3-x}{2} < 5$

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EX: Solving a linear inequality

$0 \leq \frac{3-x}{2} < 5$

$2(0) \leq 2\left(\frac{3-x}{2}\right) < 2 \cdot 5$

$0 \leq 3-x < 10$

$-3 \quad -3 \quad -3$

$-3 \leq -x < 7$

Sep 25-2:14 PM

$-3 \leq -x < 7$

$-1(-3) \geq (-1)(-x) > (-1)7$

multiply by -1

$3 \geq x > -7$

switch direction of signs!

$-7 < x \leq 3$

$(-7, 3]$

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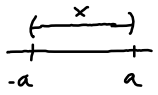
Absolute Value Inequalities

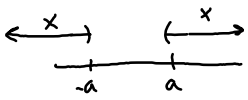
Let $a > 0$ "That means positive."

1. $|x| < a$ means $-a < x < a$



2. $|x| > a$ $a < |x|$

$x < -a$ OR $a < x$



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$|x-5| < 2$

$-2 < x-5 < 2$

$3 < x < 7$

$(3, 7)$

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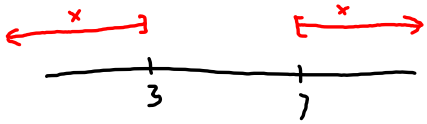
$|x-5| \geq 2$

$x-5 \leq -2$ OR $2 \leq x-5$

$x \leq 3$ $7 \leq x$



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$|x-5| < -1$

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$|x-5| < -1$ Looks like Type 1

$-(-1) < x-5 < -1$

$1 < x-5 < -1$

$6 < x < 4$

IMPOSSIBLE!

Feb 22-11:27 AM

The End.

Feb 14-4:19 PM