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Linear Inequalities

Unit 6 Lesson 5

LINEAR INEQUALITIES

Students will be able to:

Solve a single inequality on a number line and express the solutions using interval and set notation

Key Vocabulary:

- Solve Linear Inequalities
- Interval notation
- Set notation
- Graph representation

LINEAR INEQUALITIES

LINEAR INEQUALITY

Looks exactly like a linear function, with the inequality sign replacing the equality sign.

Inequalities are useful for describing real world situations. The symbols used in inequalities are:

$>$ *greater than*

$<$ *less than*

\geq *greater than or equal to*

\leq *less than or equal to*

LINEAR INEQUALITIES

INTERVAL NOTATION We write the beginning and ending numbers of the interval, like follows:

Use $[-]$ for closed dots \geq, \leq

Use $(-)$ for open dots $>, <$

SET NOTATION Represents a form to describe which items belong in a set and which do not.

$$\{x|x \in R, x < a\} = (-\infty, a)$$

$$\{x|x \in R, x > a\} = (a, \infty)$$

$$\{x|x \in R, x \leq a\} = (-\infty, a]$$

$$\{x|x \in R, x \geq a\} = [a, \infty)$$

$$\{x|x \in R, a \leq x \leq b\} = [a, b]$$

$$\{x|x \in R, a < x \leq b\} = (a, b]$$

$$\{x|x \in R, a \leq x < b\} = [a, b)$$

$$\{x|x \in R, a < x < b\} = (a, b)$$



LINEAR INEQUALITIES

Sample Problem 1: Express the following intervals as sets

- $[-6, 0]$
- $(2, 5]$
- $\left(\frac{3}{2}, \infty\right)$

LINEAR INEQUALITIES

Sample Problem 1: Express the following intervals as sets

The set representation is given by: $\{x|x \in R, \text{ "the interval"}\}$, that means “all x such that x belongs to Real Numbers”, and then substitute the extremes of the interval .

- $[-6, 0] = \{x|x \in R, -6 \leq x \leq 0\}$
- $(2, 5] = \{x|x \in R, 2 < x \leq 5\}$
- $(\frac{3}{2}, \infty) = \{x|x \in R, x > \frac{3}{2}\}$

LINEAR INEQUALITIES

Sample Problem 2: Express the following sets as intervals

- $\{x|x \in R, x < 9\}$
- $\{x|x \in R, -3 \leq x < 1\}$
- $\{x|x \in R, x \geq 2\}$

LINEAR INEQUALITIES

Sample Problem 2: Express the following sets as intervals

Remember that:

Use $[-]$ for closed dots \geq, \leq

Use $(-)$ for open dots $>, <$

- $\{x|x \in R, x < 9\} = (-\infty, 9)$
- $\{x|x \in R, -3 \leq x < 1\} = [-3, 1)$
- $\{x|x \in R, x \geq 2\} = [2, \infty)$

LINEAR INEQUALITIES

Sample Problem 3: Solve the following inequalities:

- $3x - 2 \leq x + 4$

$$3x - 2 \leq x + 4 \quad \rightarrow 3x - x \leq 4 + 2 \quad \rightarrow 2x \leq 6$$

Multiplying by $\frac{1}{2}$ and solving for x:

$$\frac{1}{2}(2x) \leq \frac{1}{2}(6) \quad x \leq 3$$



LINEAR INEQUALITIES

Sample Problem 4: Solve the following inequalities:

- $$\begin{aligned} 2x + 1 &> 5x + 7 \\ 2x - 5x &> 7 - 1 && \rightarrow -3x > 6 && \rightarrow -1(-3x > 6) \\ &&& 3x > -6 \end{aligned}$$

Note. In inequalities the coefficient of x can not be negative, so we have to multiply all the expression by -1 . When we do that the inequality symbol changes direction.

Multiplying by $1/3$ and solving for x :

$$\frac{1}{3}(3x) > \frac{1}{3}(-6) \qquad x \leq -2$$

