

Algebra 1
Chapter 2

Solving
and
Graphing
Linear
Inequalities

Section 2.1 Graphing Inequalities

Vocabulary

Directions: Match the correct definition with its corresponding vocabulary term.

<p>Inequality:</p> <p>Solution of an inequality:</p> <p>Solution set:</p> <p>Graph of an inequality:</p>	<ul style="list-style-type: none"> • A value that when substituted in for a given variable, will still satisfy the inequality • A visual representation on a number line that describes a solution set. • A number sentence that includes $<$, $>$, \leq, and \geq. • A set of values that describes the solutions to an inequality or equation.
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Important: Remember With Inequalities, order matters!

Variable	Symbol	Value
X	$<$	3

Core Concepts

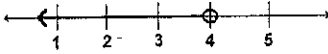
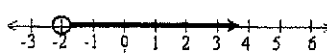
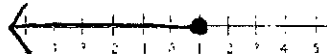

Representing Linear Inequalities

Words	Algebra	Graph
A number is less than 2	$\{x x < 2\}$	
A number is greater than 2	$\{x x > 2\}$	
A number is less than or equal to 2	$\{x x \leq 2\}$	
A number is greater than or equal to 2	$\{x x \geq 2\}$	

*** ● (Closed): \leq or \geq *** ○ (Open): $<$ or $>$

$<$	$>$	\leq	\geq
less than	greater than	less than or equal to	Greater than or equal to

Directions: Glue sorted responses into the correct column.

$<$	$>$	\leq	\geq
			
A freezer chills at a temperature below 30 degrees fahrenheit	Margaret read over 150 books	A number is not above 35.	A number is no fewer than -19.
There are less than 30 bins of paper left.	A number exceeds 72.	A number does not exceed -5.	Brock is not under 6ft tall.
A number is fewer than 20.	A number is larger than 10.	You should spend no more than \$50.	You need to be 16 or older to drive a car.
Children under 2 get in free	The Essay must be more than 200 words.	The elevator can hold at most 200 lbs.	There are no less than 150 varieties of candy at the store
A rope is shorter than 15 feet.	The road is beyond 4 miles.	The weight limit on the bridge is 70,000 lbs.	Alex eats at least 2000 calories every day.

Extra Practice

Write the sentence as an inequality.

1. Twelve is greater than or equal to five times a number n .

$$12 \geq 5n \quad \rightsquigarrow \quad 5n \leq 12$$

2. One-third of a number h is less than 15.

$$\frac{1}{3}h < 15$$

3. Seven is less than or equal to the difference of a number q and 6.

$$7 \leq q + 6 \quad \rightsquigarrow \quad q + 6 \geq 7$$

4. The sum of a number u and 14 is more than 6.

$$u + 14 > 6$$

Tell whether the value is a solution of the inequality.

5. $d - 7 < 12$; $d = 19$

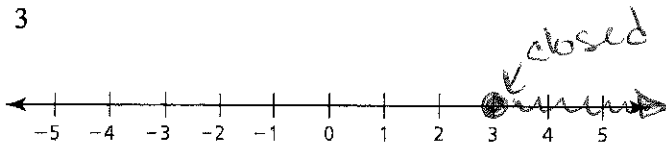
$$\begin{aligned} (19) - 7 &< 12 \\ 12 &< 12 \\ \text{Not a soln} \end{aligned}$$

6. $9 \geq 3n + 6$; $n = 1$

$$\begin{aligned} 3(1) + 6 &\leq 9 \\ 9 &\leq 9 \\ \text{yes, soln} \end{aligned}$$

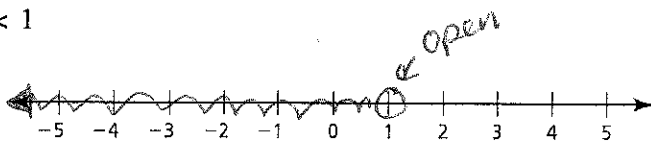
Graph the inequality.

7. $x \geq 3$



$$\begin{aligned} \checkmark 5 &\geq 3 \\ \text{yes} \end{aligned}$$

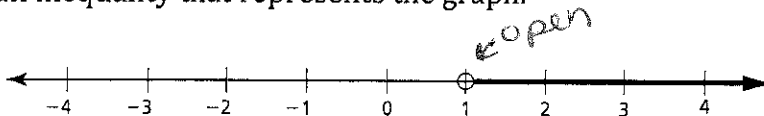
8. $x < 1$



$$\begin{aligned} \checkmark -4 &< 1 \\ \text{yes} \end{aligned}$$

Write an inequality that represents the graph.

- 9.



$$\{x \mid x > 1\}$$

$$\begin{aligned} \checkmark 3 &> 1 \\ \text{yes} \end{aligned}$$

- 10.



$$\{x \mid x \leq 1\}$$

$$\begin{aligned} \checkmark 0 &\leq 1 \\ \text{yes} \end{aligned}$$

Section 2.2 Solving Inequalities Using Addition or Subtraction

equivalent inequalities: inequalities that have the same solutions

Core Concepts

* Addition Property of Inequality

Adding the same number to each side of an inequality produces an equivalent inequality.

* Subtraction Property of Inequality

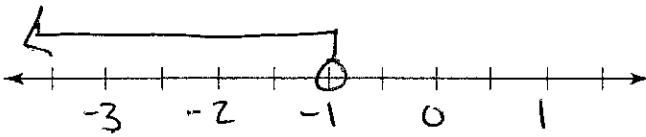
Subtracting the same number from each side of an inequality produces an equivalent inequality.

Extra Practice

Solve the inequality. Graph the solution.

1. $x + 3 < -4$
 $\quad +3 \quad +3$

$\{x \mid x < -1\}$

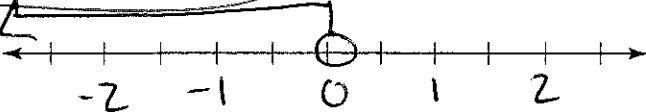


$\checkmark -3 - 3 < -4$
 $-6 < -4$
 yes

2. $-3 > -3 + h$ Flip Flop!

$h - 3 < -3$
 $\quad +3 \quad +3$

$\{h \mid h < 0\}$

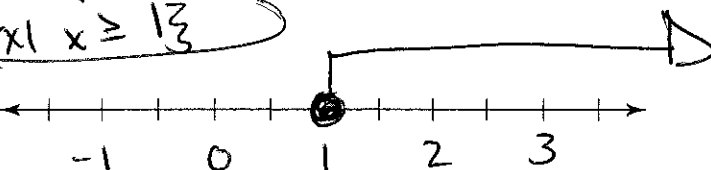


$-3 > -3 + (-2)$
 $-3 > -5$
 yes

3. $x - (-1) \geq 2$

$x + 1 \geq 2$
 $\quad \quad -1$

$\{x \mid x \geq 1\}$



$\checkmark 3 - (-1) \geq 2$
 $4 \geq 2$
 yes

Section 2.2 Solving Inequalities by Adding/Subtracting
2.3 Solving Inequalities by Multiplying/dividing

To solve inequalities, you follow the same properties as solving equations. Except, you must **Flip Flop** the inequality sign when...

Ex:
 $6 \geq x$ to $x \leq 6$

If you reverse the inequality so that the variable is to the left, you must Flip Flop the inequality sign.

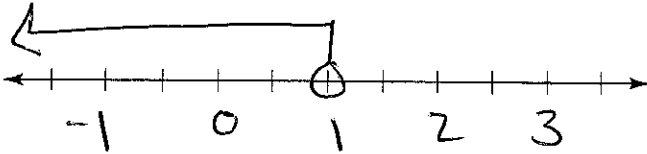
Ex
 $-2x \geq 6$ to $x \leq -3$

If you multiply or divide a negative coefficient, when solving, you must Flip Flop the inequality sign.

4. $6 - 9 + u < -2$

$\cancel{6} + u < \cancel{-2}$
 $\phantom{\cancel{6}} + 3 + 3$

$\{u \mid u < 1\}$



✓ $6 - 9 + 10 < -2$
 $-3 < -2$
 yes

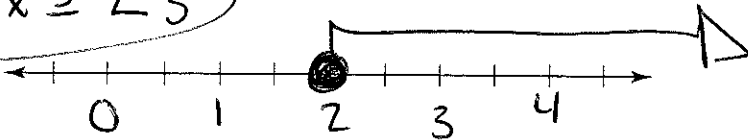
5. $12 \leq 4c - 3c + 10$

$12 \leq c + 10$

Flip flop!

$c + 10 \geq 12$

$\{x \mid x \geq 2\}$

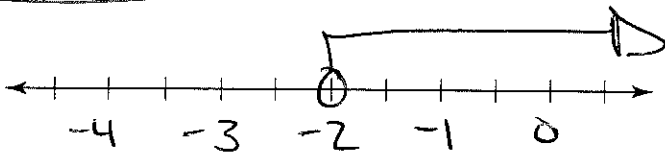


✓ $12 \leq 16 - 12 + 10$
 $12 \leq 4 + 10$
 $12 \leq 14$
 yes

6. $15 - 7p + 8p > 15 - 2$

$\cancel{15} + p > \cancel{15}$
 $\phantom{\cancel{15}} - 15 - 15$

$\{p \mid p > -2\}$



✓ $15 \geq 13$
 yes!

7. You have \$15 to spend on groceries. You have \$12.25 worth of groceries already in your cart.

a. Write an inequality that represents how much more money m you can spend on groceries.

$12.25 + x \leq 15$

b. Solve the inequality.

$\cancel{-12.25} $

$\{x \mid x \leq \$2.75\}$

Section 2.3 Solving Inequalities Using Multiplication or Division

Core Concepts

* Multiplication and Division Properties of Inequality ($c > 0$)

Multiplying or dividing each side of an inequality by the same *positive* number produces an equivalent inequality.

* Multiplication and Division Properties of Inequality ($c < 0$)

When multiplying or dividing each side of an inequality by the same *negative* number, the direction of the inequality symbol must be reversed to produce an equivalent inequality.

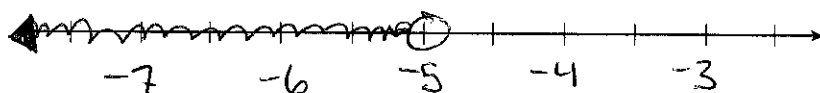
In the inequalities above, you can replace $<$ with \leq and $>$ with \geq .

Extra Practice

Solve the inequality. Graph the solution.

1. $\frac{x}{6} < \frac{-30}{6}$

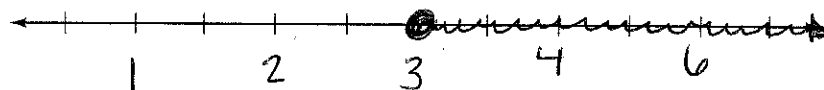
$$x < -5$$



2. $48 \leq 16f$ Flip Flop

$$\frac{16f}{16} \geq \frac{48}{16}$$

$$f \geq 3$$

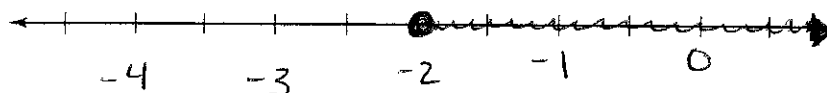


3. $-\frac{6}{7} \leq \frac{3}{7}f$ Flip Flop

$$\frac{3}{7}f \geq \frac{-6}{7} \quad (\div 3)$$

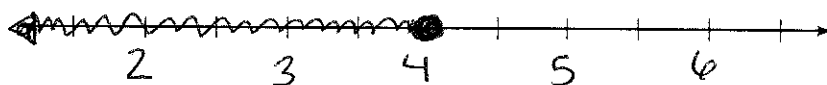
$$f \geq \frac{-6}{3}$$

$$f \geq -2$$



4. $\frac{-4m}{-4} \geq \frac{-16}{-4}$ Flip Flop

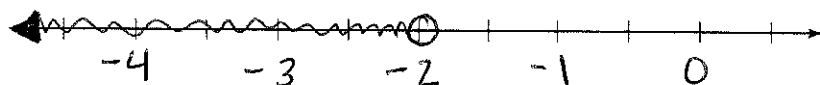
$m \leq 4$



5. $(-6)\frac{x}{-6} > \frac{1}{3}(-6)$ Flip Flop

$x < -\frac{6}{3}$

$x < -2$

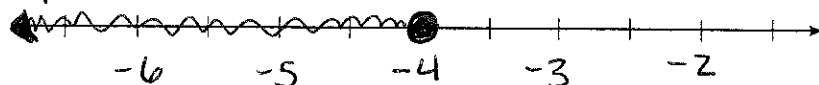


6. $1 \leq -\frac{1}{4}y$

$(-4)-\frac{1}{4}y \geq 1(-4)$ Flip Flop

$y \leq -4$

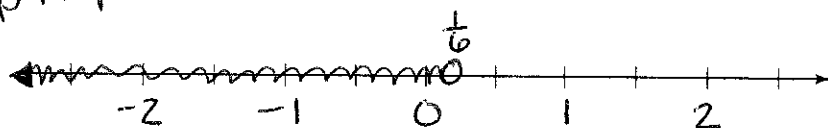
Flip Flop



7. $\frac{2}{3} < -4x$ Flip Flop

$(+\frac{1}{4})+4x > -\frac{2}{3}(-\frac{1}{4})$ Flip Flop

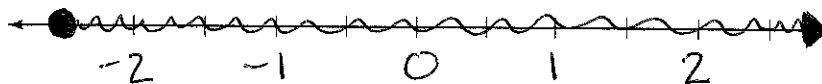
$x < \frac{1}{6}$



8. $(5)\frac{4}{5}x \geq -2(5)$

$\frac{4}{4}x \geq \frac{-10}{4}$

$x \geq -\frac{5}{2}$



9. There are at most 36 red and blue marbles in a bag. The number of red marbles is twice the number of blue marbles. Write and solve an inequality that represents the greatest number of red marbles r in the bag.

$r = 2b$

$r = 24$

$r + b \leq 36$

$2b + b \leq 36$

$3b \leq 36$

$b \leq 12$

The greatest number of red marbles is 24 and 12 blue marbles.

Section 2.4 Solving Multi-Step Inequalities

Extra Practice

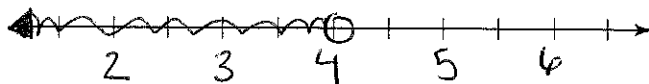
Solve the inequality. Graph the solution.

$$1. \quad 3x - 2 < 10$$

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

$$\frac{3x}{3} < \frac{12}{3}$$

$$x < 4$$



$$2. \quad 4a + 8 \geq 0$$

$$\quad \quad \quad -8 \quad -8$$

$$\frac{4a}{4} \geq \frac{-8}{4}$$

$$a \geq -2$$



$$3. \quad b + \frac{b}{-3} \leq 3$$

$$\quad \quad \quad -2 \quad -2$$

$$\frac{b}{3} \leq 1 \quad (-3) \text{ Flip Flop}$$

$$b \geq -3$$

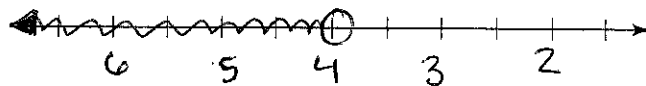


$$4. \quad -\frac{c}{2} - 6 > -8$$

$$\quad \quad \quad +6 \quad +6$$

$$\frac{c}{2} > -2 \quad (-2) \text{ Flip Flop}$$

$$c < 4$$



$$5. \quad 8 \leq -4(d + 1)$$

$$-4(d+1) \geq 8 \quad \text{Flip Flop}$$

$$\quad \quad \quad -4 \quad -4$$

$$d+1 \leq -2 \quad \text{Flip Flop}$$

$$d \leq -3$$



Solve the inequality.

$$6. \quad \begin{array}{r} 5 - 2n > 8 - 4n \\ +4n \quad +4n \end{array}$$

$$\begin{array}{r} 5 + 2n > 8 \\ -5 \quad -5 \end{array}$$

$$2n > 3$$

$$\frac{2n}{2} > \frac{3}{2}$$

$$n > \frac{3}{2}$$

$$7. \quad 6n - 18 < 6n + 1$$

$$-18 < 1 \text{ True}$$

INF. Many Solns

$$8. \quad \begin{array}{r} 3p + 4 \geq -4p + 25 \\ +4p \quad +4p \end{array}$$

$$\begin{array}{r} 7p + 4 \geq 25 \\ -4 \quad -4 \end{array}$$

$$\frac{7p}{7} \geq \frac{21}{7}$$

$$p \geq 3$$

$$9. \quad 7j - 4j + 6 < -2 + 3j$$

$$\cancel{3j} + 6 < -2 + \cancel{3j}$$

$$6 < -2 \text{ False}$$

No Soln

$$10. \quad \frac{12}{3} \left(\frac{1}{4}w + 3 \right) \leq \frac{1}{3}(w - 4)$$

$$4 \left(\frac{1}{4}w + 3 \right) \leq w - 4$$

$$\cancel{w} + 12 \leq \cancel{w} - 4$$

$$12 \leq -4 \text{ False}$$

No Soln

Section 2.5 Solving Compound Inequalities

two Ineq's Separated by "and", "or"

Compound Inequality:

AND

"Connectors"

OR

"Separators"

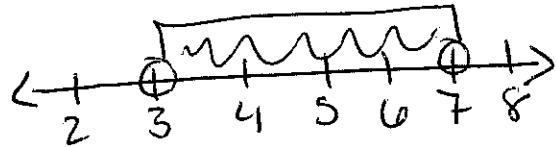
Section 2.5 Solving Compound Inequalities

two Ineq's Separated by

Compound Inequality:

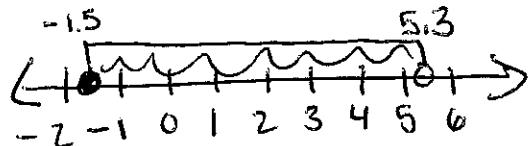
1. A number u is less than 7 and greater than 3

$$\{3 < u < 7\}$$



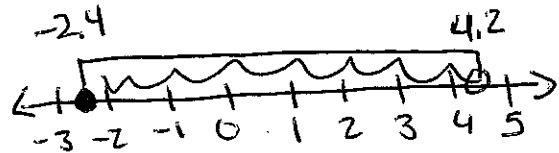
2. A number c is no less than -1.5 and less than 5.3.

$$\{-1.5 \leq c < 5.3\}$$



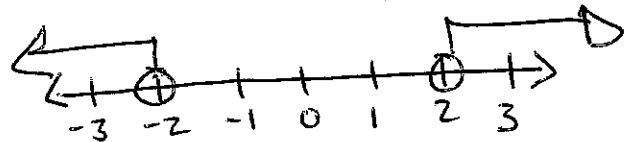
3. A number s is no less than -2.4 and fewer than 4.2.

$$\{-2.4 \leq s < 4.2\}$$



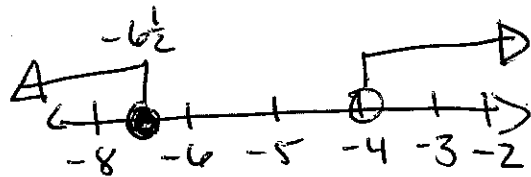
1. A number d is less than -2 or greater than or equal to 2.

$$\{d < -2 \text{ or } d \geq 2\}$$



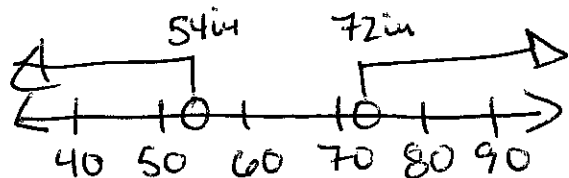
2. A number c is more than -4 or at most $-6\frac{1}{2}$.

$$\{c > -4 \text{ or } c \leq -6\frac{1}{2}\}$$



3. A person may not ride the King Chaos ride at Six Flags Great America if he/she is under 54 in. or above 72 in.

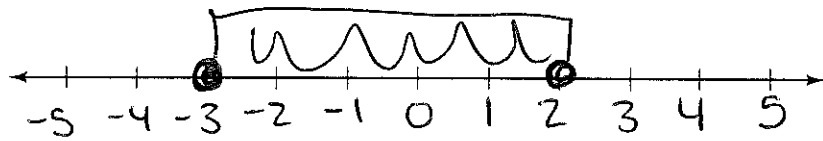
$$\{p < 54 \text{ or } p > 72\}$$



Solve the inequality. Graph the solution.

6. $15 \geq \frac{5g}{-5} \geq \frac{-10}{-5}$ Flip Flop!

$\{-3 \leq g \leq 2\}$

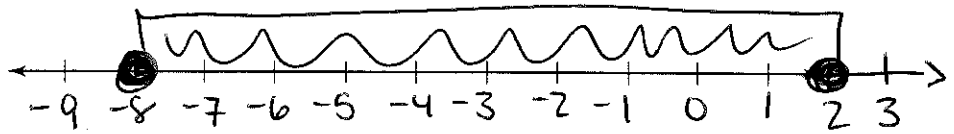


7. $-8 \leq \frac{1}{3}(6x + 24) \leq 12$

$-8 \leq 2x + 8 \leq 12$
 $-8 \quad -8 \quad -8$

$\frac{-16}{2} \leq \frac{2x}{2} \leq \frac{4}{2}$

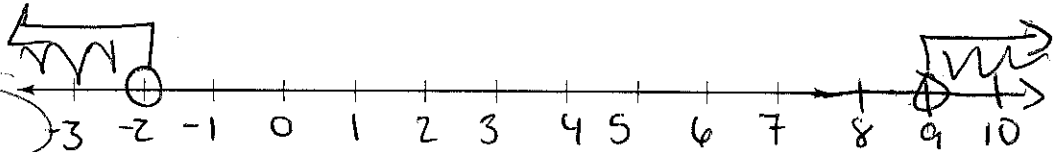
$\{-8 \leq x \leq 2\}$



8. $z + 4 < 2$ or $\frac{-3z}{-3} < \frac{-27}{-3}$ Flip flop!

$z < -2$ | $z > 9$

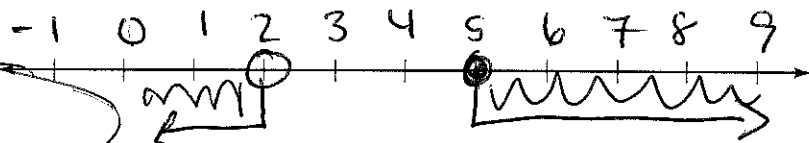
$\{z < -2 \text{ OR } z > 9\}$



9. $2t + 6 < 10$ or $t + 7 \geq 2$ Flip flop!

$2t < 4$ | $t \geq 5$
 $\frac{2t}{2} < \frac{4}{2}$
 $t < 2$

$\{t < 2 \text{ OR } t \geq 5\}$



10. A certain machine operates properly when the relative humidity h satisfies the inequality $-60 \leq 2(h - 50) \leq 60$. Solve for h to find the range of values for which the machine operates properly.

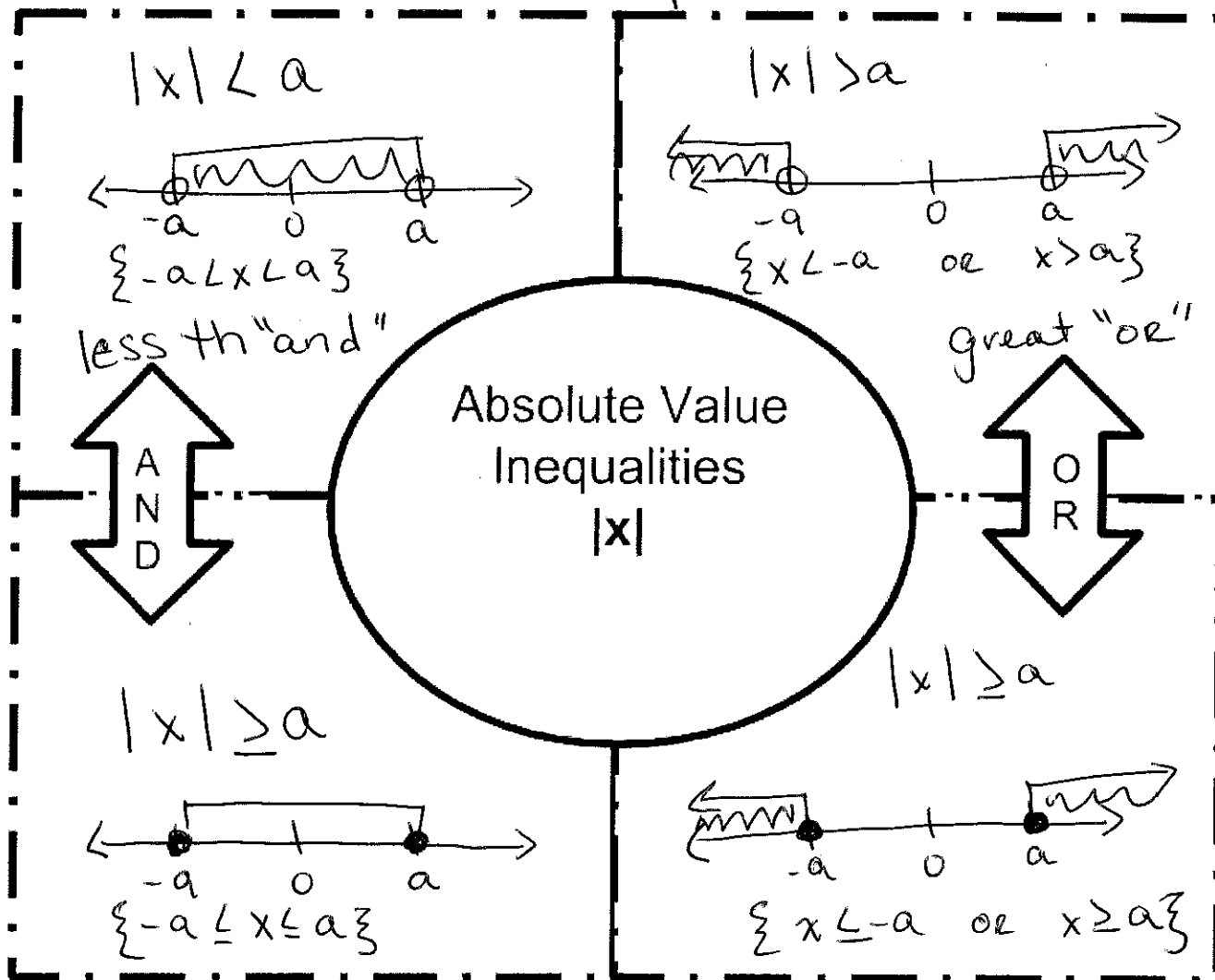
$\frac{-60}{2} \leq \frac{2(h-50)}{2} \leq \frac{60}{2}$

$-30 \leq h - 50 \leq 30$
 $+50 \quad +50 \quad +50$

$\{h \mid 47 \leq h \leq 80\}$
 units

2.6 Solving Absolute Value Inequalities

* a is a pos. # *



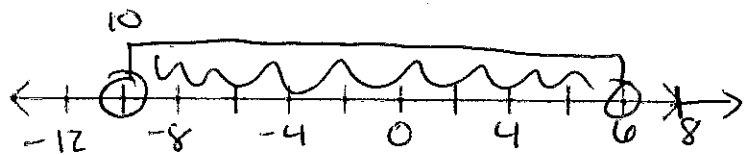
Extra Practice

Solve the inequality. Graph the solution, if possible.

1. $|y+2| < 8$ less th "and"

$$\begin{array}{l|l} y+2 > -8 & y+2 < 8 \\ \hline y > -10 & y < 6 \end{array}$$

$\{-10 < y < 6\}$



2. $|\frac{q}{3}| > 2$ great "or"

$$\begin{array}{l|l} \frac{q}{3} < -2 & \frac{q}{3} > 2 \\ \hline q < -6 & q > 6 \end{array}$$

$\{q < -6 \text{ OR } q > 6\}$

