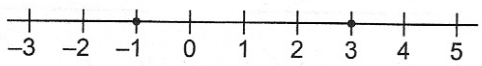
6.4 Solving Linear Inequalities by Using Addition and Subtraction

FOCUS **Use addition and subtraction to solve inequalities.**

Consider the inequality $-1 < 3$.



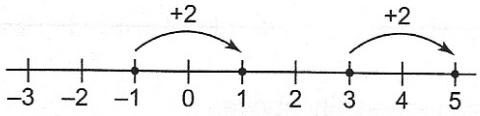
What happens to an inequality if we add the same number to each side?

$-1 < 3$ Add 2 to each side.

Left side: $-1 + 2 = 1$

Right side: $3 + 2 = 5$

The resulting inequality is still true: $1 < 5$



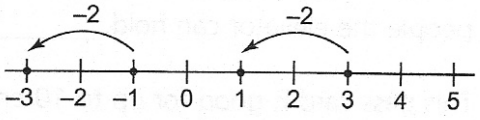
What happens to an inequality if we subtract the same number from each side?

$-1 < 3$ Subtract 2 from each side.

Left side: $-1 - 2 = -3$

Right side: $3 - 2 = 1$

The resulting inequality is still true: $-3 < 1$



Property of Inequalities

When the same number is added to or subtracted from each side of an inequality, the resulting inequality is still true.

The strategy that we used to solve an equation can be used to solve an inequality. Isolate the variable to solve.

Equation

$$r - 6 = -2$$
$$r - 6 + 6 = -2 + 6$$
$$r = 4$$

There is only 1 solution: $r = 4$

Inequality

$$r - 6 < -2$$
$$r - 6 + 6 < -2 + 6$$
$$r < 4$$

Any number less than 4 is part of the solution. The solution includes 3, 2, and 1, for example.

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Example 1 Solving an Inequality

a) Solve the inequality $6 \leq x - 4$.

b) Graph the solution on a number line.

Solution

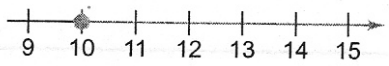
a) $6 \leq x - 4$ Add 4 to each side to isolate x.

$6 + 4 \leq x - 4 + 4$

$10 \leq x$

This is the same as $x \geq 10$.

b)



Place a shaded circle on 10 because 10 is part of the solution.

Check

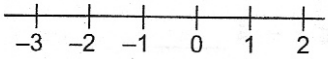
1. Solve each inequality. Graph the solution on the number line.

a) $p + 3 \leq 4$

$p + 3$ ____ ≤ 4 ____

$p \leq$ _____

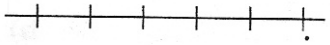
_____



b) $-5 > 2 + a$

_____

_____



Example 2 Solving an Inequality with Variables on Both Sides

a) Solve the inequality $3d + 2 < 2d - 2$.

b) Graph the solution on a number line.

Solution

a) $3d + 2 < 2d - 2$ Subtract $2d$ from each side.

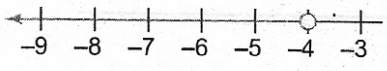
$3d + 2 - 2d < 2d - 2 - 2d$

$d + 2 < -2$ Subtract 2 from each side.

$d + 2 - 2 < -2 - 2$

$d < -4$

b)

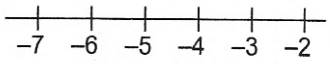


Place an open circle on −4 because −4 is not part of the solution.

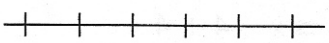
Check

1. Solve each inequality. Graph the solution on a number line.

a) $3z + 1 \leq 2z - 2$



b) $4 - 4x > 6 - 5x$



Practice

1. Which operation will you perform to each side of the inequality to isolate the variable?

a) $a + 1 > 3$

b) $2 < m - 3$

c) $x - 4 \geq 5$

d) $6 > 1 - z$

2. Fill in the missing steps to get to the solution.

a) $x + 5 > 10$

$x + 5$ ____ > 10 ____

$x >$ __

b) $12 \leq x - 4$

12 ____ $\leq x - 4$ ____

__ $\leq x$

3. Solve each inequality.

Match each inequality with the graph of its solution, below.

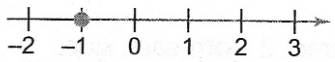
a) $n - 4 > -2$

b) $p + 6 < -2$

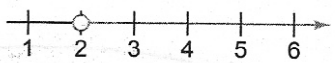
c) $u - 3 \geq -4$

d) $2 + y > -2$

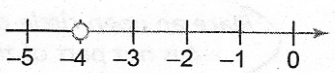
i)



ii)



iii)



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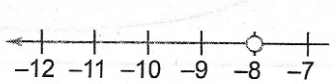
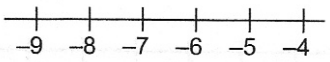
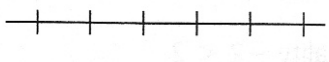


4. a) Solve each inequality. Graph the solution on a number line.

i) $y + 3 \leq -2$

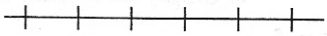


ii) $2 + b < 5$



iii) $4 \geq n - 2$

iv) $3 < t - 3$



b) Write 3 numbers that are possible solutions for each inequality.

i) _____ **ii)** _____

iii) _____ **iv)** _____

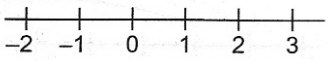
c) Write a number that is NOT a solution of each inequality.

i) _____ **ii)** _____

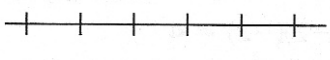
iii) _____ **iv)** _____

5. Solve, then graph each inequality.

a) $6a + 2 \geq 5a + 1$

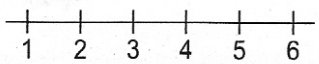


b) $3 + 2s > s - 3$



6. a) Solve the equation: $4v - 6 = 3v - 3$

Graph the solution.



b) Solve the inequality: $4v - 6 > 3v - 3$

Graph the solution.