Solving Inequalities by Adding or Subtracting

What You'll Learn

To solve inequalities by adding or subtracting

🔊 **New Vocabulary** Addition Property of Inequality, Subtraction Property of Inequality
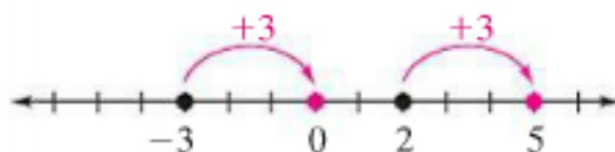
Why Learn This?

Buildings and buses have limits on the number of people they can hold. You can use inequalities to find how many people can fit safely.

You can solve inequalities using properties similar to those you used solving equations.

If you add 3 to each side of the inequality $-3 < 2$, the resulting inequality, $0 < 5$, is also true.

Addition Property of Inequality

You can add the same value to each side of an inequality.

Arithmetic	Algebra
Since $7 > 3$, $7 + 4 > 3 + 4$.	If $a > b$, then $a + c > b + c$.
Since $1 < 3$, $1 + 4 < 3 + 4$.	If $a < b$, then $a + c < b + c$.

EXAMPLE   **Solving Inequalities by Adding**

1 Solve $n - 10 > 14$. Graph the solution.

$$n - 10 > 14$$
$$n - 10 + 10 > 14 + 10 \quad \leftarrow \text{ Add 10 to each side.}$$
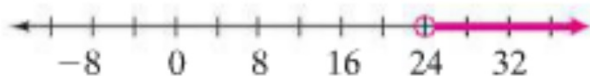$$n > 24 \quad \leftarrow \text{ Simplify.}$$

Table talk about how to solve and graph this:

Solve $q - 2 \geq -6$. Graph the solution.

Table talk about this problem, including what numbers to put on the numberline:

✓ Quick Check

1. Solve $y - 3 < 4$. Graph the solution.

To solve an inequality involving addition, use subtraction.

KEY CONCEPTS **Subtraction Property of Inequality**

You can subtract the same value from each side of an inequality.

Arithmetic	Algebra
Since $9 > 6$, $9 - 3 > 6 - 3$.	If $a > b$, then $a - c > b - c$.
Since $15 < 20$, $15 - 4 < 20 - 4$.	If $a < b$, then $a - c < b - c$.

Note: The Properties of Inequality also apply to $\leq$ and $\geq$.

EXAMPLE **Solving Inequalities by Subtracting**

2 Solve $y + 7 \geq 12$. Graph the solution.

$$y + 7 \geq 12$$

$$y + 7 - 7 \geq 12 - 7 \qquad \leftarrow \text{Subtract 7 from each side.}$$

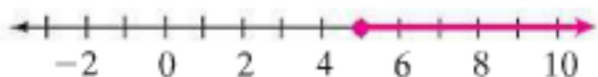$$y \geq 5 \qquad \leftarrow \text{Simplify.}$$

Table talk about how to solve and graph this:

② Solve $d + 9 < 8$. Graph the solution. ▬
▬▬▬▬▬▬▬▬

2. Solve each inequality. Graph the solution.

    a. $x + 9 > 5$ **b.** $y + 3 < 4$ **c.** $w + 4 \le -5$

EXAMPLE   Application: Transportation

A school bus can safely carry as many as 76 students. If 19 students are already on the bus, how many more can board the bus?

Words	students already on bus	plus	students remaining	is at most	76

Let s = the number of students remaining.

Expression	19	+	s	$\leq$	76

$$19 + s \leq 76$$

$$19 - 19 + s \leq 76 - 19 \quad \leftarrow \text{Subtract 19 from each side.}$$

$$s \leq 57 \quad \leftarrow \text{Simplify.}$$

At most 57 more students can board the bus.

③ The Drama Club can spend no more than $120 for costumes. They spent $79. How much more can they spend? ⬛ ⬛

3. To get an A, you need more than 200 points on a two-part test. You score 109 on the first part. How many more points do you need?

1. **Vocabulary** The _?_ states that you can add the same value to each side of an inequality. █████████████████

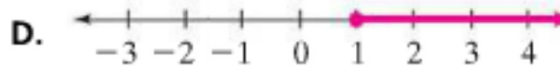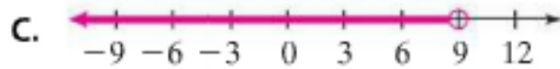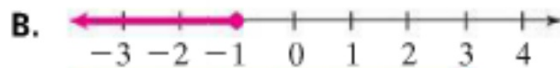2. **Reasoning** What value is a solution of $y + 7 \geq 12$ but is not a solution of $y + 7 > 12$? █
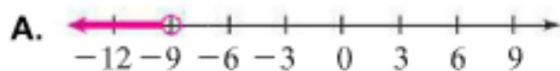
Match each inequality with the graph of its solution.

3. $h - 4 < 5$ █

4. $h + 4 \geq 5$ █

5. $h - 4 \leq -5$ █

6. $h + 4 < -5$ █

A.
$$\xleftarrow{\quad} \begin{array}{cccccccc} & \oplus & & & & & & \\ -12 & -9 & -6 & -3 & 0 & 3 & 6 & 9 \end{array} \xrightarrow{\quad}$$

B.
$$\xleftarrow{\quad} \begin{array}{cccccccc} & & \bullet & & & & & \\ -3 & -2 & -1 & 0 & 1 & 2 & 3 & 4 \end{array} \xrightarrow{\quad}$$

C.
$$\xleftarrow{\quad} \begin{array}{cccccccc} & & & & & \oplus & & \\ -9 & -6 & -3 & 0 & 3 & 6 & 9 & 12 \end{array} \xrightarrow{\quad}$$

D.
$$\xleftarrow{\quad} \begin{array}{cccccccc} & & & & \bullet & & & \\ -3 & -2 & -1 & 0 & 1 & 2 & 3 & 4 \end{array} \xrightarrow{\quad}$$

Practice 3-2

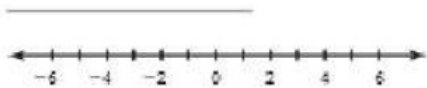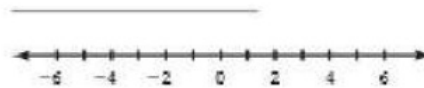Solving Inequalities by Adding or Subtracting

Solve each inequality. Graph each solution.

1. $w + 4 < -2$

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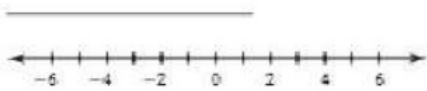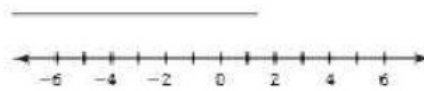**2.** $a - 4 \geq 0$

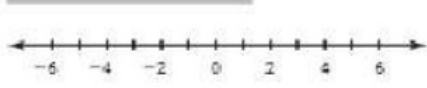_____

3. $a + 19 > 13$

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4. $x + 7 \leq 12$

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5. $a + 2 > -3$

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6. $t - 6 < 3$

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7. $r - 3.4 \leq 2.6$

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8. $a + 5.7 \geq -2.3$

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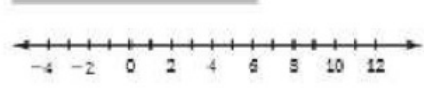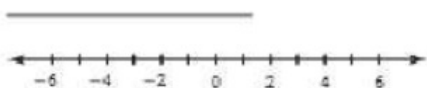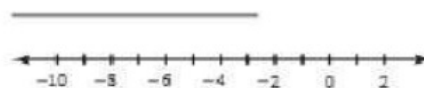
9. $h - 4.9 > -0.9$

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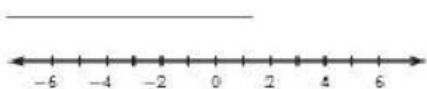
10. $y + 3.4 < -4.6$

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Write an inequality for each problem. Solve the inequality.

11. The school record for the most points scored in a football season is 85. Lawrence has 44 points so far this season. How many more points does he need to break the record?

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12. The maximum weight limit for a fully loaded truck is 16,000 pounds. The truck you are loading currently weighs 12,500 pounds. How much more weight can be added and not exceed the weight limit?

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