Solve Inequalities Involving Combining Like Terms

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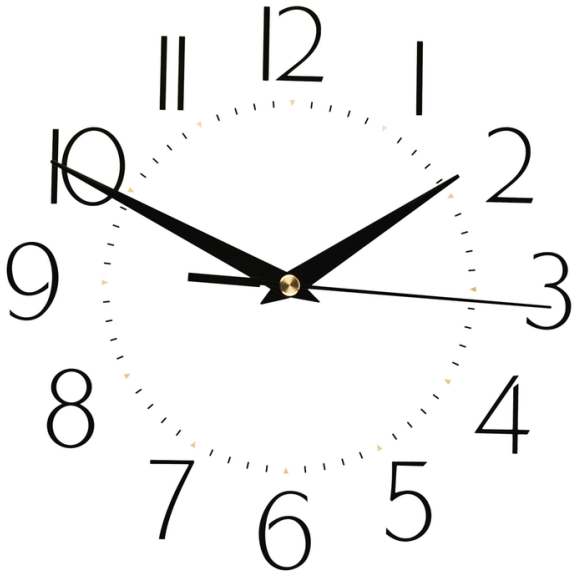
CHAPTER 1 Solve Inequalities Involving Combining Like Terms

Here you'll learn to solve inequalities involving combining like terms.



"We have a lot to do to get ready for the big parade," Mrs. Kline announced on Monday.

And Mrs. Kline was definitely correct. The students in the band had learned three new routines that they didn't quite have down yet. It was going to take extra marching practice to put all of the pieces together. To do this, Mrs. Kline had the students outside marching for extra time.

On Tuesday, the band spent thirty fewer minutes marching than they did on Thursday. All in all, everyone was tired.

"We marched for more than three hours between Tuesday and today," Juan said on the ride home on Thursday. His feet could definitely tell how long they had been marching, but all in all the hard work was paying off because the pieces were looking much better.

Given this information, what are three possible times that the band marched on Thursday?

You will need to know about inequalities to solve this problem. This problem will require you to write and solve an inequality that will have more than one step. This Concept will give you all the information that you need to accomplish this task.

Guidance

We can solve inequalities in many ways. Some inequalities can be solved in a single step. We could solve $b+4<10$ in one step—by subtracting 4 from each side.

However, two or more steps may be required to solve some inequalities. Inequalities that need more than one inverse operation to solve them can be called multi-step inequalities.

Let's start by looking at combining like terms when we solve an inequality.

$4x + 3x < 21$

First, you can see that we **have two terms that have the same variable.** These are ***like terms***. To solve an inequality with like terms, we will need to combine the like terms and then we can solve the inequality using the methods that we have already learned.

$7x < 21$

Here we divide both sides of the inequality by 7. Multiplication is the inverse operation of division.

$x < 3$

This is our answer.

Solve for b: $3b + 4 < 10$.

Notice that there are two terms on the left side of the inequality, $3b$ **and 4. Our first step should be to use inverse operations to get the term that includes a variable,** $3b$**, by itself on one side of the inequality.**

In the inequality, 4 is *added* to $3b$. So, we can use the inverse of addition—subtraction. **We can subtract 4 from both sides of the inequality.** We do not need to change the inequality symbol during this step because we are subtracting a number, not multiplying or dividing by a negative number.

$$\begin{aligned} 3b + 4 &< 10 \\ 3b + 4 - 4 &< 10 - 4 \\ 3b + 0 &< 6 \\ 3b &< 6 \end{aligned}$$

Now, the term that includes a variable, $3b$, is by itself on one side of the equation.

We can now use inverse operations to get the b **by itself. Since** $3b$ **means** $3 \times b$**, we can divide both sides of the inequality by 3 to isolate the variable.** Since we are dividing by a positive number, not a negative number, the inequality symbol should not change.

$$\begin{aligned} 3b &< 6 \\ \frac{3b}{3} &< \frac{6}{3} \\ 1b &< 2 \\ b &< 2 \end{aligned}$$

The solution is $b < 2$**.**

Example A

$4x + 5 < 21$

Solution: $x < 4$

Example B

$3x - 6 > 30$

Solution: $x > 12$

Example C

$-3a+2<14$

Solution: $a>-4$

Now let's go back to the dilemma from the beginning of the Concept.

First, write an inequality using the given information.

$m-30$ is the time that the students practiced on Tuesday

m is the time that they practiced on Thursday

>3 hours is the time that they practiced in all.

Here is the inequality.

$m+m-30>3$ hours or 180 minutes

It makes sense to work with minutes because the given times are in minutes.

Now we solve the inequality.

$$\begin{aligned} 2m-30&>180\\ 2m&>210\\ m&>105\ minutes \end{aligned}$$

The band marched for more than 105 minutes on Thursday. You could assume that they marched for 110 minutes, 115 minutes or 120 minutes. There are many possible options.

Guided Practice

Here is one for you to try on your own.

Solve for n: $7n-8n-3>23$.

Solution

First, subtract $7n-8n$ because $7n$ and $8n$ are like terms. Remember, you will need the rules for working with positive and negative integers when solving these inequalities.

$$\begin{aligned} 7n-8n-3&>23\\ 7n+(-8n)-3&>23 \end{aligned}$$

n+(-8n)

$$\begin{aligned} -3&>23\\ -1n-3&>23\\ -n-3&>23. \end{aligned}$$

The expression on the left side of the inequality, $-n-3$, is now in simplest form. The 3 cannot be subtracted from the $-n$ because they are *not* like terms.

The next step is to isolate the term with the variable, $-n$, on one side of the inequality. Since 3 is *subtracted* from $-n$, we should add 3 to both sides of the inequality to do this.

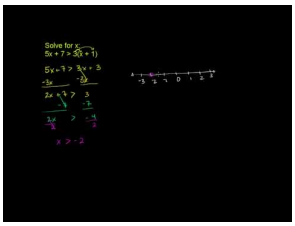
$$\begin{aligned} -n-3 &> 23 \\ -n-3+3 &> 23+3 \\ -n+(-3+3) &> 26 \\ -n+0 &> 26 \\ -n &> 26 \end{aligned}$$

Since $-n$ means $-1n$ or $-1 \times n$, we can divide each side of the inequality by -1 to get a positive n by itself on one side of the equation. Since that involves dividing both sides of the inequality by a negative number, we must reverse the inequality symbol.

$$\begin{aligned} -n &> 26 \\ -1n &> 26 \\ \frac{-1n}{-1} &< \frac{26}{-1} \\ 1n &< -26 \\ n &< -26 \end{aligned}$$

The solution for this inequality is $n < -26$.

Video Review



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Directions: Solve each inequality.

1. $2x+5>13$
2. $4x-2<10$
3. $6y+9>69$
4. $2x-3\leq -4$
5. $5x+2\geq -8$
6. $2x-9\leq -5$
7. $\frac{x}{3}+1>5$
8. $\frac{x}{2}-1<-3$
9. $\frac{x}{5}+3>-9$
10. $\frac{x}{2}-5>-10$

11. $6k - 3 > 15$
12. $11 + \frac{x}{4} \leq 12$
13. $12 + 9j + j < 72$
14. $12b - 3b + 5 \geq -31$
15. $18 + 7n + 3 + 6n \leq 86$
16. $3z - 15z - 30 > 54$