



Lesson C5

Solving Two-Step Equations & Inequalities

Steps and Lines



Learning Goals

After this lesson, you should understand

- the properties of equality can be used to solve equations and inequalities.
- solving equations and inequalities involves isolating a variable.

After this lesson, you should be able to

- solve two-step equations and inequalities.
- graph solution sets of inequalities on the number line

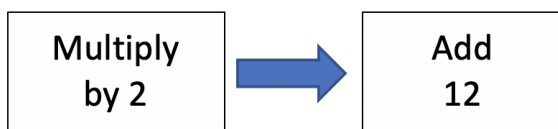


Solving Two-Step Equations

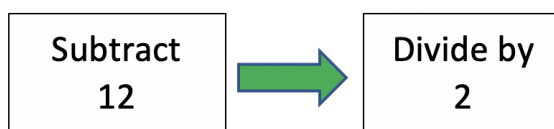
The equation $2x + 12 = 40$ is an example of an equation that can be solved in two-steps. The variable expression is on the left-hand side. The variable x has two operations applied to it: (a) it is first multiplied by 2, and (b) 12 is added to the result.

To isolate x on the left-hand side, we must perform the opposite operations in reverse order.

Evaluate the expression



Solve the equation for x



Solve the equation $2x + 12 = 40$.

$$\begin{array}{rcl}
 2x + 12 & = & 40 \\
 \underline{-12} & & \underline{-12} \\
 2x & = & 28 \\
 \underline{\div 2} & & \underline{\div 2} \\
 x & = & 14
 \end{array}$$

We want to isolate the variable x on the left-hand side of the equation.

We first **subtract 12** from both sides.

We then **divide 2** from both sides.

The solution of the equation is $x = 14$. We can check this by substituting 14 into the equation for x . When we do, we obtain a true statement.

$$\begin{aligned}
 2(14) + 12 &= 40 \\
 28 + 12 &= 40 \\
 40 &= 40
 \end{aligned}$$



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(Q1) Use the properties of equality to solve the following **two-step** equations. After finding the solution, use the equation to check that you have the correct solution. Identify the two operations being applied to the variable, and then perform the opposite operations in the reverse order.

(a) $3x + 9 = -24$

(b) $-4y + 12 = 36$

(c) $8x - 12 = -20$

(d) $\frac{w}{4} + 20 = 26$



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- (Q2)** Kevin solved the equation below? Did he perform the correct steps? If not, solve the equation correctly. Discuss with your partner or in your group.

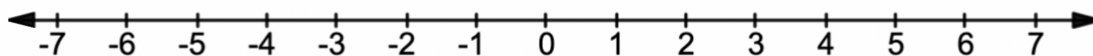
$$\begin{array}{r}
 4x + 8 = 30 \\
 +8 \quad +8 \\
 \hline
 4x = 38 \\
 \div 4 \quad \div 4 \\
 \hline
 x = \frac{38}{4} = 9.5
 \end{array}$$



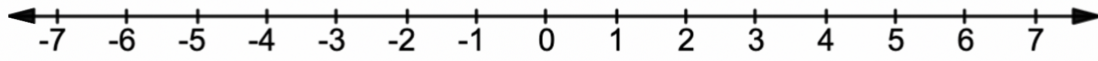
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- (Q3)** Use the properties of equality to solve the following *two-step* inequalities. After finding the solution, graph the solution set on the number line. Identify the two operations being applied to the variable, and then perform the opposite operations in the reverse order.

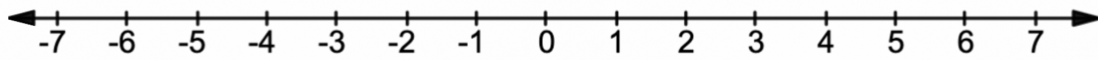
(a) $3x - 5 > -20$



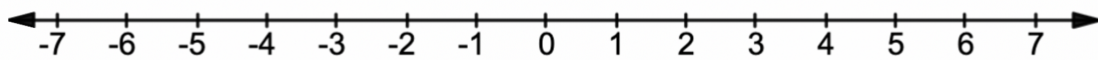
(b) $-2y - 14 \leq -26$



(c) $9x + 27 < 27$



(d) $\frac{y}{-2} + 8 \geq 6$





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(Q4) Jill solved the inequality below. Did she perform the correct steps? Explain.

$$\begin{array}{rcl}
 -2y + 14 & > & -10 \\
 \underline{-14} & & \underline{-14} \\
 -2y & > & -24 \\
 \underline{\div -2} & & \underline{\div -2} \\
 y & > & 12
 \end{array}$$



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Closing Reflections

Please reflect on the following questions **independently** and **then discuss** them with your group:

- Why is it important to isolate a variable when solving an equation?