

### Solve & Discuss It!

Rico and Halima are shopping for craft sticks, glue, and electrical tape for a science project. Together, they have \$30 to spend on supplies. How should they spend their \$30 if they need at least 1,000 craft sticks?



#### Lesson 5-6

### Solve Two-Step Inequalities

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**I can...**  
write and solve two-step inequalities.

**Focus on math practices**

**Make Sense and Persevere** At the store, Rico and Halima find boxes of 500 craft sticks for \$7.50. Which boxes of craft sticks should they buy?

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### Essential Question


How is solving a two-step inequality similar to and different from solving a two-step equation?

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#### EXAMPLE 1 Solve Two-Step Inequalities

Hamish has \$25.97 in his pocket to spend at the craft store. He wants to buy a paint canvas and some paint pens. How many paint pens,  $p$ , can Hamish buy?

**Use Structure** How are inverse relationships and properties used to solve equations and inequalities?



Write an inequality to represent the situation.

Cost of the canvas	+	Cost of one pen	·	Number of pens	=	Money available
14		3.15		$p$		$\leq 25.97$

The total cost can be equal to but not more than \$25.97.

Solve the inequality as you would an equation. Then graph the solution.

$$14 + 3.15p \leq 25.97 - 14$$

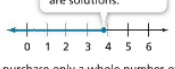
Use the Subtraction Property of Inequality.

$$\frac{3.15p}{3.15} = \frac{11.97}{3.15}$$

Use the Division Property of Inequality.

$$p \leq 3.80$$

Only whole numbers are solutions.



Hamish can purchase only a whole number of paint pens. So, Hamish can buy 3 or fewer paint pens.

**Try It!**

Erin has \$52 to spend at the florist. She wants to buy a vase for \$11.75 and several roses for \$3.50 each. What are the possible numbers of roses Erin can buy?

+   $\cdot$    $\leq 52$

$r \leq$

Erin can buy up to  roses

**Convince Me!** What properties did you use to solve the inequality?

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**EXAMPLE 2** Solve More Two-Step Inequalities

Members of the science club are selling coupon booklets for \$17.95 as a fundraiser. They hope to exceed the amount of money they raised last year. How many more coupon booklets,  $b$ , must the club members sell to achieve their goal?

Write an inequality to represent the situation. Then solve.

Current funds raised	+	Cost of one booklet	·	Number of booklets	>	Last year's total funds raised
498.75	+	17.95	·	$b$	>	658.35

The amount raised this year should exceed last year's amount.

$$498.75 + 17.95b > 658.35$$

$$498.75 + 17.95b - 498.75 > 658.35 - 498.75$$

$$17.95b > 159.6$$

$$\frac{17.95b}{17.95} > \frac{159.6}{17.95}$$

$$b > 8.89$$

**Make Sense and Persevere** What values for  $b$  make sense in the context of the problem?

The members of the science club must sell at least 9 booklets to exceed last year's total fundraising amount.



**Try It!**

The Jazz Band needs to raise at least \$600 to travel to an upcoming competition. The members of the band have already raised \$350. If they sell calendars for \$8 each, how many calendars would they need to sell to exceed their goal?

**EXAMPLE 3** Solve Inequalities with Negative Values

Solve the inequality  $-10 - \frac{9}{2}x < 80$ .

$$-10 + 10 - \frac{9}{2}x < 80 + 10$$

$$-\frac{9}{2}x < 90$$

$$\frac{-2}{9} \cdot -\frac{9}{2}x > \frac{-2}{9} \cdot 90$$

$$x > -20$$

Remember: When you multiply or divide by a negative value, the inequality symbol is reversed.

**Try It!**

Solve the inequality  $5 - \frac{1}{2}x > 30$ .

**KEY CONCEPT**

Like two-step equations, solving two-step inequalities involves carrying out two different operations—addition or subtraction, and multiplication or division. Unlike two-step equations, which have a single solution, two-step inequalities have multiple solutions.

**Do You Understand?**

- Essential Question** How is solving a two-step inequality similar to and different from solving a two-step equation?
- Reasoning** What is the difference between the number of solutions for a two-step equation and for a two-step inequality?
- Why are inverse relationships between operations used to solve two-step inequalities?

**Do You Know How?**

- Joe ran 3 miles yesterday and wants to run at least 12 miles this week. Write an inequality that can be used to determine the additional number of days Joe must run this week if each run is 3 miles. Then solve the inequality.



- Solve  $4 + 6.5x < 36.5$ .
- Tomas has \$1,000 to spend on a vacation. His plane ticket costs \$348.25. If he stays 5.5 days at his destination, how much can he spend each day? Write an inequality and then solve.
- Solve  $12 - \frac{3}{5}x > 39$ .

Practice & Problem Solving

Levelled Practice For 8 and 9, fill in the boxes to write and solve each inequality.

8. Eight less than the product of a number  $n$  and  $\frac{1}{3}$  is no more than 95.

9. Seven more than the quotient of a number  $b$  and 45 is greater than 5.

10. Solve the inequalities and compare.

a. Solve  $2x + 6 < 10$  — see notes

b. Solve  $-2x + 22 < 18$ .

c. Which is the correct comparison of solutions for  $2x + 6 < 10$  and  $-2x + 22 < 18$ ?

11. Make Sense and Persevere Talla has a daily budget of \$94 for a car rental. Write and solve an inequality to find the greatest distance Talla can drive each day while staying within her budget.

12. Model with Math A manager needs to rope off a rectangular section for a private party. The length of the section must be 7.6 meters. The manager can use no more than 28 meters of rope. What inequality could you use to find the possible width,  $w$ , of the roped-off section?

$x = \text{miles driven daily}$

Car Rental: \$20 per day plus \$0.20 per mile

$\$30 + \$0.20x \leq \$94$

$30 + 0.20x \leq 94$

$0.20x \leq 64$

$x \leq \frac{64}{0.2}$

$0.2 \overline{) 64.0}$

$\begin{array}{r} 320 \\ 2 \overline{) 640} \\ \underline{-64} \phantom{0} \\ \phantom{0} 0 \phantom{0} \\ \underline{-00} \\ \phantom{0} 0 \phantom{0} \end{array}$

PEMDAS Start

10) a)  $2x + 6 < 10$

$\frac{2x}{2} < \frac{4}{2}$

$x < 2$  ✓

b)  $-2x + 22 < 18$

$\frac{-2x}{-2} < \frac{-4}{-2}$

$x > 2$  ✓

There are no values that are solutions for both inequalities.

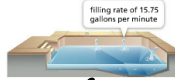
The value 2 does not work for either inequality.

PEMDAS Start

13. Higher Order Thinking Andrea went to the store to buy a sweater that was on sale for 40% off the original price. It was then put on clearance at an additional 25% off the sale price. She also used a coupon that saved her an additional \$5. Andrea did not spend more than \$7.60 for the sweater. What are the possible values for the original price of the sweater?



14. A pool can hold 850 gallons. It now has 598 gallons of water and is being filled at the rate shown. How many more minutes,  $m$ , can water continue to flow into the pool before it overflows? Write and solve an inequality.



**Assessment Practice**

15. Use the rectangle diagram at the right.

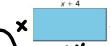
$$A = l \cdot w$$

$$P = 2l + 2w$$

Write and solve an inequality to find the values of  $x$  for which the perimeter of the rectangle is less than 120.

$$x + 4 + x + x + 4 + x < 120$$

$$2(x + 4) + 2(x) < 120$$



$$x + 4 + x + x + 4 + x < 120$$

Based on your answer to Part A, are there any values that can be eliminated from the solution set? Explain.

Any values 28 or higher will not work, since the solution set says values under 28 are correct.

$$4x + 8 < 120$$

$$+ \quad -8$$


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$$4x < 112$$

$$\frac{4x}{4} < \frac{112}{4}$$

16. Write and solve the inequality.  $\frac{1}{3}$  times a number minus 8.5 is no more than 11.5.

$$4 \overline{) 112}$$

$$\underline{40}$$

$$72$$

$$\underline{72}$$

$$0$$

ok

$$x < 28$$

units

