English Spanish

1.2 Solving Multi-Step Equations

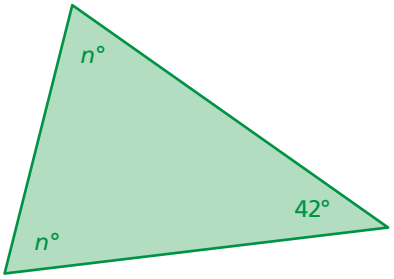
STATE STANDARDS
MA.8.A.1.1

Essential Question How can you solve a multi-step equation? How can you check the reasonableness of your solution?

1 ACTIVITY: Solving for the Angles of a Triangle

Work with a partner. Write an equation for each triangle. Solve the equation to find the value of the variable. Then find the angle measures of each triangle. Use a protractor to check the reasonableness of your answer.

a.



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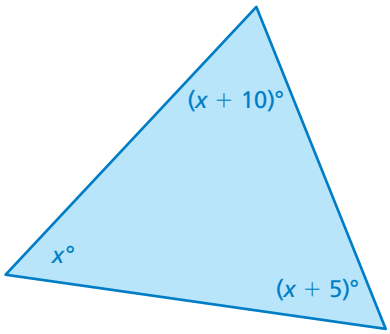

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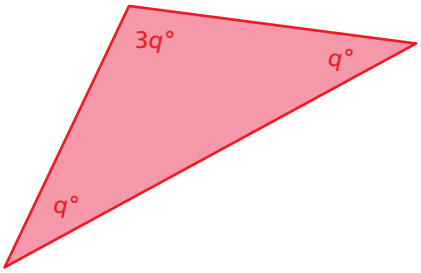

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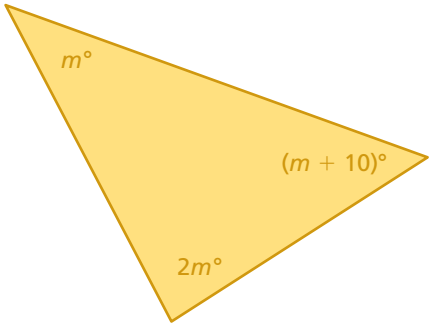

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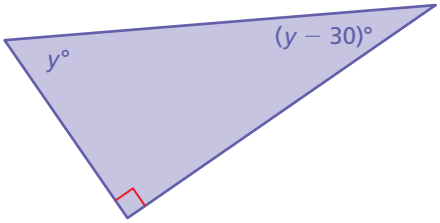

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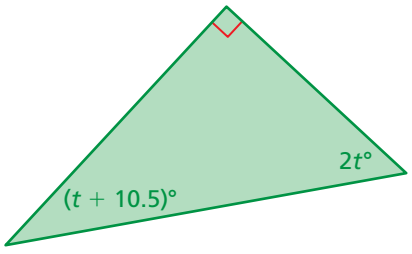

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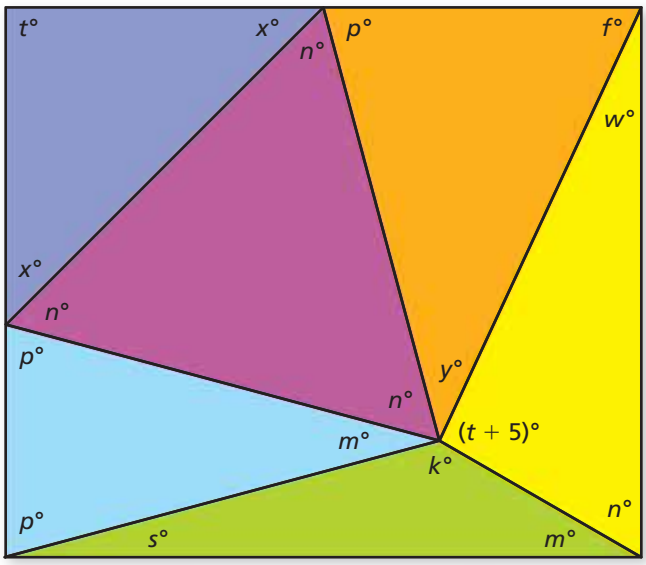
2 ACTIVITY: Problem-Solving Strategy

Work with a partner.

The six triangles form a rectangle.

Find the angle measures of each triangle. Use a protractor to check the reasonableness of your answers.



3 ACTIVITY: Puzzle

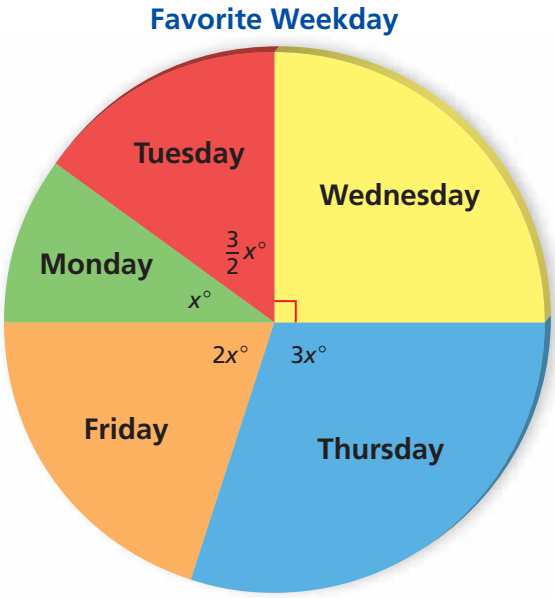
Work with a partner. A survey asked 200 people to name their favorite weekday. The results are shown in the circle graph.

a. How many degrees are in each part of the circle graph?

b. What percent of the people chose each day?

c. How many people chose each day?

d. Organize your results in a table.



What Is Your Answer?

4. IN YOUR OWN WORDS How can you solve a multi-step equation? How can you check the reasonableness of your solution?

Practice Use what you learned about solving multi-step equations to complete Exercises 3–5 on page 14.

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1.2 Lesson

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Key Idea

Solving Multi-Step Equations

To solve multi-step equations, use inverse operations to isolate the variable.

EXAMPLE 1 Solving a Two-Step Equation

The height (in feet) of a palm tree after x years is $1.5x + 15$. After how many years is the tree 24 feet tall?

$1.5x + 15 = 24$ Write an equation.

Undo the addition. → $-15 \quad -15$ Subtract 15 from each side.

$1.5x = 9$ Simplify.

Undo the multiplication. → $\frac{1.5x}{1.5} = \frac{9}{1.5}$ Divide each side by 1.5.

$x = 6$ Simplify.

∴ The tree is 24 feet tall after 6 years.

EXAMPLE 2 Combining Like Terms to Solve an Equation

Solve $8x - 6x - 25 = -35$.

$8x - 6x - 25 = -35$ Write the equation.

$2x - 25 = -35$ Combine like terms.

Undo the subtraction. → $+25 \quad +25$ Add 25 to each side.

$2x = -10$ Simplify.

Undo the multiplication. → $\frac{2x}{2} = \frac{-10}{2}$ Divide each side by 2.

$x = -5$ Simplify.

∴ The solution is $x = -5$.

On Your Own

Now You're Ready
Exercises 6–9

Solve the equation. Check your solution.

1. $-3z + 1 = 7$
2. $\frac{1}{2}x - 9 = -25$
3. $-4n - 8n + 17 = 23$

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EXAMPLE 3 Using the Distributive Property to Solve an Equation

Solve $2(1 - 5x) + 4 = -8$.

$2(1 - 5x) + 4 = -8$	Write the equation.
$2(1) - 2(5x) + 4 = -8$	Use Distributive Property.
$2 - 10x + 4 = -8$	Multiply.
$-10x + 6 = -8$	Combine like terms.
$-6 \quad -6$	Subtract 6 from each side.
$-10x = -14$	Simplify.
$\frac{-10x}{-10} = \frac{-14}{-10}$	Divide each side by –10.
$x = 1.4$	Simplify.

Study Tip

Here is another way to solve the equation in Example 3.

$2(1 - 5x) + 4 = -8$
$2(1 - 5x) = -12$
$1 - 5x = -6$
$-5x = -7$
$x = 1.4$

EXAMPLE 4 Real-Life Application

Use the table to find the number of miles x you need to run on Friday so that the mean number of miles run per day is 1.5.

Day	Miles
Monday	2
Tuesday	0
Wednesday	1.5
Thursday	0
Friday	x

Write an equation using the definition of mean.

sum of the data → $\frac{2 + 0 + 1.5 + 0 + x}{5} = 1.5$ Write the equation.

number of values →

$\frac{3.5 + x}{5} = 1.5$ Combine like terms.

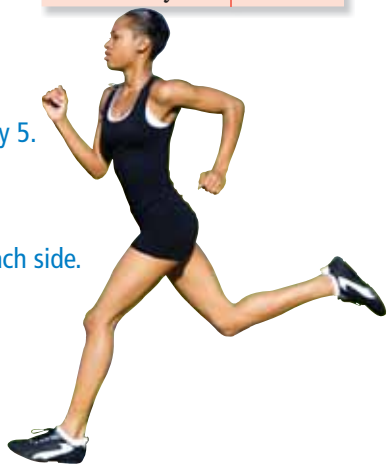
Undo the division. → $5 \cdot \frac{3.5 + x}{5} = 5 \cdot 1.5$ Multiply each side by 5.

$3.5 + x = 7.5$ Simplify.

Undo the addition. → $-3.5 \quad -3.5$ Subtract 3.5 from each side.

$x = 4$ Simplify.

∴ You need to run 4 miles on Friday.



On Your Own

Now You're Ready
Exercises 10 and 11

Solve the equation. Check your solution.

4. $-3(x + 2) + 5x = -9$

5. $5 + 1.5(2d - 1) = 0.5$

6. You scored 88, 92, and 87 on three tests. Write and solve an equation to find the score you need on the fourth test so that your mean test score is 90.

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1.2 Exercises

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Vocabulary and Concept Check

1. **WRITING** Write the verbal statement as an equation. Then solve.

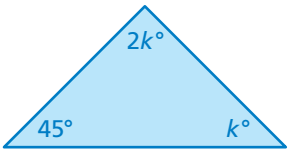
   2 more than 3 times a number is 17.

2. **OPEN-ENDED** Explain how to solve the equation $2(4x - 11) + 9 = 19$.

Practice and Problem Solving

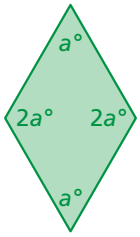
Find the value of the variable. Then find the angle measures of the polygon. Use a protractor to check the reasonableness of your answer.

3.



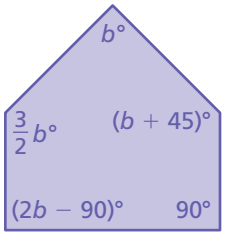
Sum of angle measures: 180°

4.



Sum of angle measures: 360°

5.



Sum of angle measures: 540°

Solve the equation. Check your solution.

1 2 6. $10x + 2 = 32$

7. $19 - 4c = 17$

8. $1.1x + 1.2x - 5.4 = -10$

9. $\frac{2}{3}h - \frac{1}{3}h + 11 = 8$

3 10. $6(5 - 8v) + 12 = -54$

11. $21(2 - x) + 12x = 44$

12. **ERROR ANALYSIS** Describe and correct the error in solving the equation.

$$\begin{aligned} -2(7 - y) + 4 &= -4 \\ -14 - 2y + 4 &= -4 \\ -10 - 2y &= -4 \\ -2y &= 6 \\ y &= -3 \end{aligned}$$

13. **WATCHES** The cost (in dollars) of making n watches is represented by $C = 15n + 85$. How many watches are made when the cost is \$385?

14. **HOUSE** The height of the house is 26 feet. What is the height x of each story?

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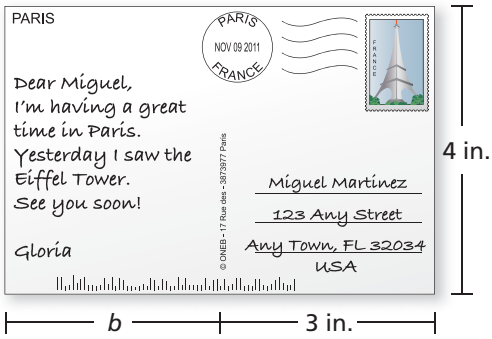
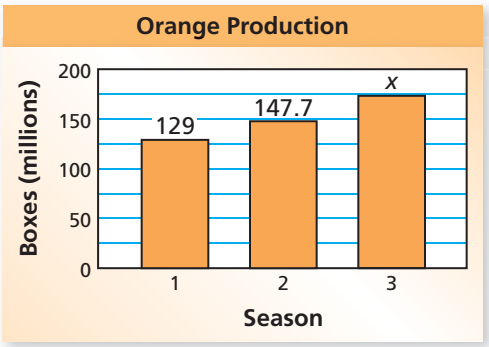
In Exercises 15–17, write and solve an equation to answer the question.

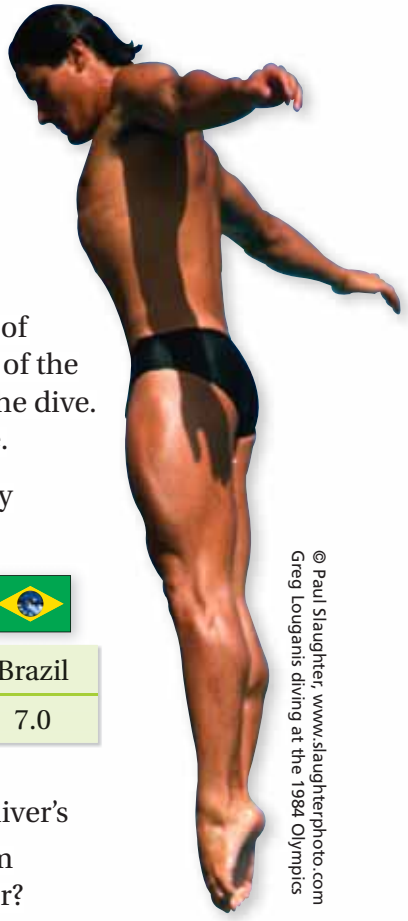
15. POSTCARD The area of the postcard is 24 square inches. What is the width b of the message (in inches)?



16. BREAKFAST You order two servings of pancakes and a fruit cup. The cost of the fruit cup is $1.50. You leave a 15% tip. Your total bill is $11.50. How much does one serving of pancakes cost?



17. ORANGES How many boxes x of oranges must Florida produce in the third season to average 150 million boxes over the three seasons?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Greg Louganis diving at the 1984 Olympics

18. DIVING Olympic divers are scored by an international panel of judges. The highest and lowest scores are dropped. The total of the remaining scores is multiplied by the degree of difficulty of the dive. This product is multiplied by 0.6 to determine the final score.

a. A diver's final score is 77.7. What is the degree of difficulty of the dive?

Judge	Russia	China	Mexico	Germany	Italy	Japan	Brazil
Score	7.5	8.0	6.5	8.5	7.0	7.5	7.0

b. Critical Thinking The degree of difficulty of a dive is 4.0. The diver's final score is 97.2. Judges award half or whole points from 0 to 10. What scores could the judges have given the diver?

Fair Game Review What you learned in previous grades & lessons

Let $a = 3$ and $b = -2$. Copy and complete the statement using <, >, or =.

SKILLS REVIEW HANDBOOK

19. $-5a$ ☐ 4 **20.** 5 ☐ $b + 7$ **21.** $a - 4$ ☐ $10b + 8$

22. MULTIPLE CHOICE What value of x makes the equation $x + 5 = 2x$ true?

SKILLS REVIEW HANDBOOK

(A) -1 (B) 0 (C) 3 (D) 5