Simplifying Expressions

Objectives
- Identify, write, simplify, and evaluate expressions with a variable.

Books & Materials
- *Math in Focus* 5A
- *Workbook* 5A
- 10 craft sticks *(Optional)*

Assignments 📖
- ❏ Complete Warm-up.
- ❏ Read and complete pp. 219–223 and 225, *Math in Focus* 5A.
- ❏ Complete pp. 183–186, *Workbook* 5A.
- ❏ Complete Math Checkpoint.

Warm-up.

Write these addition expressions as multiplication expressions and solve.

1. $5 + 5 + 5 + 5 + 5 + 5 + 5$

2. $6 + 6 + 6$

3. $9 + 9 + 9 + 9$

4. $2 + 2 + 2 + 2 + 2$

5. $8 + 8 + 8 + 8 + 8 + 8$

6. $7 + 7 + 7$

Instruction

Read **Learn** on pp. 219–220 in *Math in Focus*. As you saw in the Warm-up activity, multiplication is a simpler way to write repeated addition. You can simplify addition expressions with the same variable by writing a single multiplication expression. For example, $a + a + a$ is simplified by writing the algebraic expression $3a$. Complete **Guided Practice** on p. 220.

Read **Learn** in the middle of p. 220. You can only simplify variables with *like terms*. For example, you can simplify $x + 4x$ by writing $5x$, but you cannot simplify $x + 4y$ because the variables are not alike; they are not like terms. Complete **Guided Practice** on p. 220.

Read **Learn** on p. 221. If you subtract $y - y$, the answer is 0. Complete **Guided Practice** on p. 221.

Read **Learn** on p. 221. Like terms can be subtracted from one another. For example, in $4y - y$, think *4 groups of y minus 1 group of y*. Complete **Guided Practice** on p. 222.

Read **Learn** on p. 222. When you see an algebraic expression that has multiple operations, remember the order of operations when you simplify the expression. Complete **Guided Practice** on p. 222.

Read **Learn** on p. 223. When you simplify an expression, make sure to combine like terms. It may be helpful to change the order of the problem before you combine the terms. Complete **Guided Practice** on p. 223.

Helpful Online Resources

▣ **Instructional Video:** *Simplifying Algebraic Expressions*

To the Learning Guide

When your student simplifies an expression, he may need to change the order of the terms in the expression. For example, in a problem like $4x + 7 + x + 3$, he should group like terms. $4x + x + 7 + 3$ is the same as $5x + 10$.

The Commutative Property of Addition will show your student that he can change the order of the addends and still get the same answer.

The optional **Hands-On Activity** on pp. 224–225 provides your student with an opportunity to practice simplifying algebraic expressions. If he struggles with the concept of simplifying expressions, continue working with the craft sticks to model some additional problems.

Watch For These Common Errors

❗ Some students may want to simplify an answer like $5x + 7$ further. Explain this expression cannot be further simplified because it does not contain like terms.

Practice

Complete **Let's Practice** on p. 225 in *Math in Focus*. Then complete pp. 183–186 in *Workbook*.

Wrap-up

Today you learned how to simplify algebraic expressions.

$$m + m + m = 3 \times m = 3m \qquad 3p - p = 2p \qquad 5k + 4 + k - 1 = 6k + 3$$

☑ **Complete Math Checkpoint**

Working with Algebraic Expressions, Equations, and Inequalities

Objectives
- Write and evaluate inequalities.
- Use the properties of equality to solve equations.

Books & Materials
- *Math in Focus* 5A
- *Workbook* 5A
- pan balance
- marbles, connecting cubes, pennies, or other small items that have nearly-identical masses *(Optional)*

Assignments 📖
- ❑ Complete Warm-up.
- ❑ Read and complete pp. 226–231 *Math in Focus* 5A.
- ❑ Complete Math Checkpoint.

Warm-up

1. Place two pennies on both sides of the pan balance. What happens?

2. Now put four pennies on both sides of the pan balance. What happens?

3. Now, take one penny away from each side. Explain what happens.

Instruction

Read **Learn** on p. 226 in *Math in Focus*. As you read, watch how the terms *equation* and *inequality* are used. An *equation* is a mathematical statement with equal values on both sides. For example, in 2 + 2 = 4, the value on each side of the equal sign equals 4.

An *inequality* is a statement that is not equal; each side has a different value. For example, in 2 + 3 > 4, one side of the inequality has a value of 5, and the other side has a value of 4.

Think about the pan balance when deciding if you have an equation or inequality. If the values are the same on either side, it is an *equation*. If they are not the same, it is an *inequality*. Complete **Guided Practice** at the top of p. 227.

Then read **Learn** on p. 227. You can compare algebraic expressions when you are given a value for the variable. Complete **Guided Practice** on p. 228.

Read **Learn** on pp. 228–231. Study the pictures of the balances carefully. Then complete **Guided Practice** on p. 231.

Helpful Online Resources

📖 **Instructional Video:** *One-Step Equations with Addition and Subtraction*
📖 **Instructional Video:** *One-Step Equations with Multiplication and Division*
📖 **Instructional Video:** *Inequalities*

> **To the Learning Guide**
>
> The pan balance is a helpful tool for demonstrating balanced equations. It is a concrete way to help your student understand this foundational algebraic concept.
>
> If your student would like more practice, with equations, try this activity. Have him cover his eyes or turn around so he cannot see the pan balance. On one pan place 5 pennies and then cover them with a small piece of tissue. Next to the covered pennies place 2 pennies that are visible. On the other pan put 7 pennies. Ask your student to open his eyes or turn around.
>
> First, make sure he notes the balance is level. Tell him that under the tissue is a certain number of pennies. Point out that he does not know the number of pennies and have him assign a variable to this unknown value. Next, ask him to write an *equation* for what he sees ($x + 2 = 7$) and to solve the equation. He can lift the tissue to check his answer.
>
> Finally, have your student take 1 penny away from each side and to write this equation. ($5 + 2 - 1 = 7 - 1$) Continue the activity with different numbers of pennies until your student feels confident about these concepts.

Practice

Complete **Guided Practice** on p. 228 in **Math in Focus**.

Wrap-up

Today you worked with a pan balance to show algebraic expressions as inequalities and equations. When you know the value of the variable, you can compare expressions.

$$p = 4$$
$$4p = 16$$
$$2 + p > 5$$

☑ **Complete Math Checkpoint**

05M-LMA

Solving Equations

Objectives
• Use the properties of equality to solve equations.

Books & Materials
• *Math in Focus* 5A
• *Workbook* 5A
• counters *(Optional)*
• connecting cubes *(Optional)*
• small paper cups *(Optional)*
• ruler *(Optional)*

Assignments 📖
❑ Complete Warm-up.
❑ Read and complete pp. 232–235, *Math in Focus* 5A.
❑ Complete pp. 187–188, *Workbook* 5A.
❑ Complete Math Checkpoint.

Warm-up

Complete each number statement with >, <, or =.

1. $x = 6$ $5x + 1$ _____ $15 + x$

2. $y = 3$ $7y - 1$ _____ $25 - y$

3. $a = 5$ $4 + 2a$ _____ $2a + 4$

Instruction

Read **Learn** on pp. 232–233. When you have variables on both sides of the equal sign, isolate the variable, or rename the equation until the variable is on one side of the equation and the numerical value is on the other. When you find an answer, check your solution by substituting the number for the variable in the original equation. When you simplify the expression, you should have a true number statement.

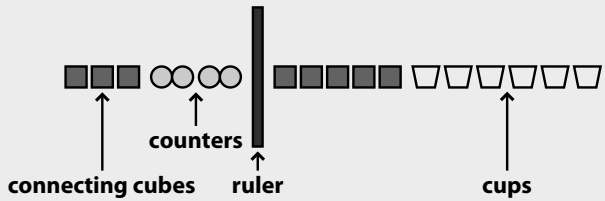Complete **Guided Practice** on p. 234.

Helpful Online Resources

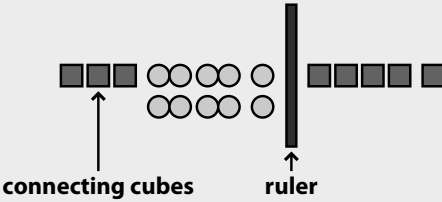📖 **Instructional Video:** *Solving Equations with Variables on Both Sides*

To the Learning Guide

Your student may still need help visualizing how to solve the equation. Show him how to model the problem by using connecting cubes to represent the variables, empty paper cups to represent numbers being subtracted, and counters to represent numbers being added. Set down a ruler to separate the 2 sides of the equation.
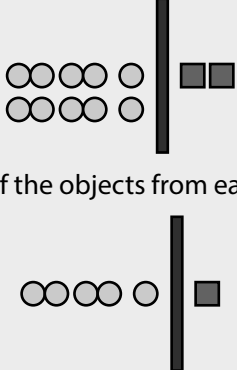
The equation $3p + 4 = 5p - 6$ would be modeled as follows:

connecting cubes　**ruler**　**counters**　**cups**

First your student must place 1 counter in each cup. This adds 6 counters to the right side of the model, which means he must also add 6 counters to the left side. The filled cups can now be removed.

connecting cubes　**ruler**

Your student can now remove 3 connecting cubes from each side of the model.

The final step is to remove half the objects from each side of the model.

Now have your student compare what he did with the steps on p. 233 of *Math in Focus*. If necessary, allow him to model his solutions to equations until he is able to manipulate the numbers and symbols alone.

Practice

Complete **Let's Practice** on p. 235 in *Math in Focus*. Complete pp. 187–188 in *Workbook*.

Wrap-up

Today you learned how to find the value of a variable to make an equation true.

$$4x + 1 = 2x + 5$$
$$4x = 2x + 4$$
$$2x = 4$$
$$x = 2$$

☑ **Complete Math Checkpoint**

Real-Life Algebra Problems

Objectives
• Answer real-life problems by solving algebraic expressions.

Books & Materials
• *Math in Focus* 5A
• *Workbook* 5A
• Math Journal

Assignments 📖
❑ Complete Warm-up.
❑ Read and complete pp. 236–241, *Math in Focus* 5A.
❑ Complete pp. 189–194, *Workbook* 5A.
❑ Complete Math Checkpoint.

Warm-up

Write an algebraic expression.

1. x less than 12

2. half of p

3. Multiply 5 by h and add 9

Instruction

Read the two **Learn** sections on pp. 236 and 237 in *Math in Focus*. After reading through the lesson, try writing the expressions without looking at the answers. Then check your work with what is shown in the book. If your solution is different, review the process and try again.

Complete the two **Guided Practice** sections on pp. 236–237.

Read **Learn** on p. 238. Work through the problem step-by-step with the book. You may find it helpful to draw a sketch or use a model. Be sure to label your model. Refer back to the problem after each step to make sure your expression and inequality help you compare the number of pencils Andy and Cathy each have and to solve the equation.

Complete **Guided Practice** on p. 239. Respond to the **Math Journal** questions on p. 241.

Helpful Online Resources

📖 **Instructional Video:** *Writing Equations for Word Problems*

> **FUN FACT**
>
> Your heart beats between 50 and 100 beats per minute. How many times does it beat in a day?

To the Learning Guide

Encourage your student to label the parts of his expression as he works. This will help him focus and stay organized as he finds an expression or solves for a variable.

Watch For These Common Errors

! Some students may not solve for the correct information. When your student thinks he is finished, encourage him to review the question and make sure he has found what was asked.

Practice

Complete **Let's Practice** on pp. 239–240 in *Math in Focus*. Then complete pp. 189–194 in *Workbook*.

Wrap-up

Today you solved real-life problems using algebraic expressions. As you work through these problems, be sure to read the problem carefully. Then define the variable and label each part of the expression. Finally, solve for the variable and add the appropriate label to your answer. Make sure the value of your variable makes sense and answers the original question.

☑ **Complete Math Checkpoint**

5.2 Simplifying Algebraic Expressions

Lesson Objective
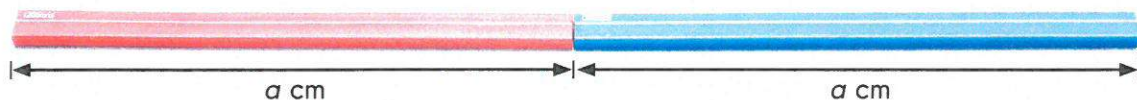
- Simplify algebraic expressions in one variable.

Learn **Algebraic expressions can be simplified.**

A rod of length a centimeters is joined to another rod of the same length. What is the total length of the 2 rods?

a cm a cm

$a + a = 2 \times a$

Simplify $(a + a)$ by writing:

$a + a = 2a$

The total length of the 2 rods is $2a$ centimeters.

| 3 | 3 |

$3 + 3 = 2 \times 3$

| 4 | 4 |

$4 + 4 = 2 \times 4$

| a | a |

$a + a = 2 \times a$

$2 \times a$ is the same as $2a$.

The picture shows 3 rods, each b centimeters long. What is the total length of the 3 rods?

b cm b cm b cm
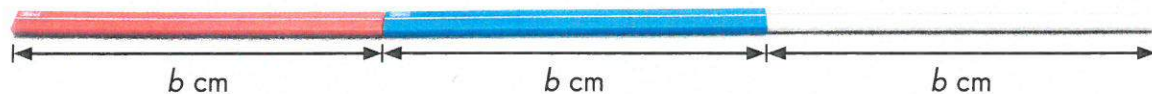
$b + b + b = 3 \times b$

Simplify $(b + b + b)$ by writing:
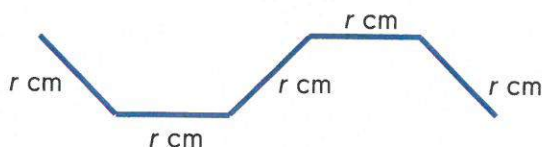
$b + b + b = 3b$

| 5 | 5 | 5 |

$5 + 5 + 5 = 3 \times 5$

| b | b | b |

$b + b + b = 3 \times b$

$3 \times b$ is the same as $3b$.

The total length of the 3 rods is $3b$ centimeters.
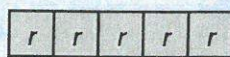
The figure shows 5 sticks, each r centimeters long.
What is the total length of the 5 sticks?

$$r + r + r + r + r = 5 \times r$$
$$= 5r$$

$r + r + r + r + r = 5 \times r$

$5 \times r$ is the same as $5r$.

The total length of the 5 sticks is $5r$ centimeters.

Guided Practice

Simplify each expression.
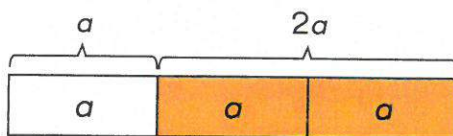
1 $x + x$

2 $y + y + y$

3 $a + a + a + a + a$

4 $b + b + b + b + b + b$

5 $c + c + c + c + c + c + c$

Learn **Like terms** can be added.

Simplify $a + 2a$.
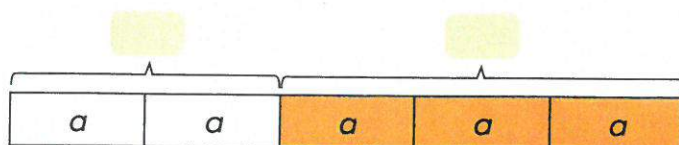
$$a + 2a = a + a + a$$
$$= 3a$$

a and $2a$ are the terms of the expression, $a + 2a$. You call a and $2a$ like terms because they are both multiples of a.

Guided Practice

Complete.

6 Simplify $2a + 3a$.

$$2a + 3a = \boxed{}$$

Simplify each expression.

7 $a + 3a$

8 $4x + x$

9 $2z + 5z$

10 $3y + 6y$

11 $b + 2b + 3b$

12 $4c + 2c + 10c$

A variable subtracted from itself results in zero.

A ribbon is a centimeters long. Jenny uses the whole ribbon to decorate a present.

How much ribbon is left?

$a - a = 0$

There are 0 centimeters of ribbon left.

Compare this with:
$2 - 2 = 0$
$7 - 7 = 0$
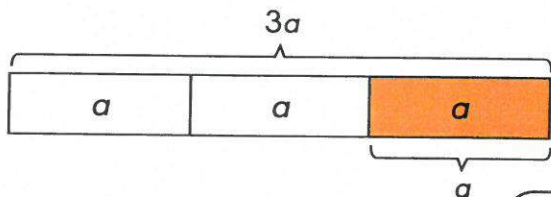$14 - 14 = 0$

Guided Practice

Simplify each expression.
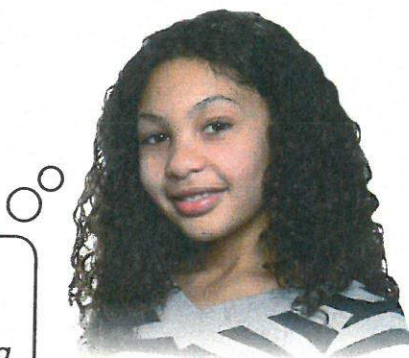
13 $x - x$

14 $2y - 2y$

15 $10z - 10z$

Like terms can be subtracted.

Simplify $3a - a$.

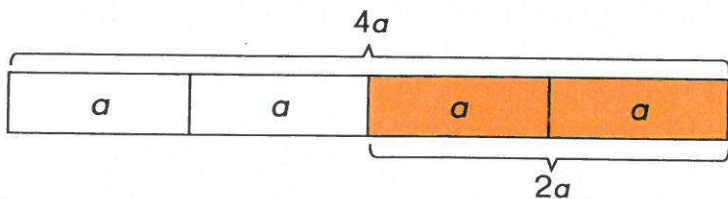$3a - a = 2a$

From the model,
$3a - a = a + a$
$a + a = 2 \times a = 2a$
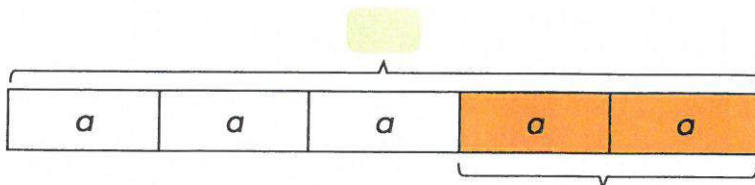So, $3a - a = 2a$

Simplify $4a - 2a$.

$4a - 2a = 2a$

From the model,
$4a - 2a = a + a$
$a + a = 2 \times a = 2a$
So, $4a - 2a = 2a$

Lesson 5.2 Simplifying Algebraic Expressions

Guided Practice

Complete.

16 Simplify $5a - 2a$.

$5a - 2a = $

Simplify each expression.

17 $4a - a$

18 $7a - 3a$

19 $5x - 4x$

20 $10x - 6x$

21 $8y - 3y - 5y$

22 $12y - 7y - y$

Learn Use order of operations to simplify algebraic expressions.

a Simplify $6a + 3a - 2a$.

Working from left to right,
$$6a + 3a - 2a = 9a - 2a$$
$$= 7a$$

b Simplify $6a - 2a + 3a$.

Working from left to right,
$$6a - 2a + 3a = 4a + 3a$$
$$= 7a$$

Guided Practice

Simplify each expression.

23 $2x + 3x - 4x$

24 $x + 5x - 6x$

25 $9a - 3a + 4a$

26 $12a - 7a + 2a$

Collect like terms to simplify algebraic expressions.

Find the distance between point A and point B.

```
      a km           4 km          a km      2 km
  A |--------|----------------|----------|---------| B
```

$a + 4 + a + 2$ ← Identify like terms.

$= a + a + 4 + 2$ ← Change the order of terms to collect like terms. Then simplify.

$= 2a + 6$

The distance between point A and point B is $(2a + 6)$ kilometers.

> **Commutative Property of Addition:**
>
> Two numbers can be added in any order.
>
> So, $4 + a = a + 4$.

Simplify $4x + 6 - 2x$.

$4x + 6 - 2x$ ← Identify like terms.

$= 6 + 4x - 2x$ ← Change the order of terms to collect like terms. Then simplify.

$= 6 + 2x$

$4x + 6 = 6 + 4x$

Guided Practice

Simplify each expression.

27 $b + 5 + b + 5$

28 $3b + 4b + 2 + 6$

29 $5s + 9 - 3s$

30 $8s + 6 - 2s - 1$
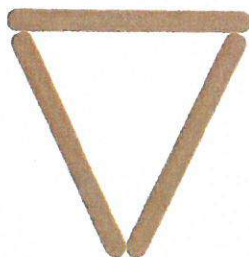
Hands-On Activity

Materials:
• 20 craft sticks

Let the length of each craft stick equal p units.

STEP 1 Form a closed figure using 3 or more craft sticks.

Example

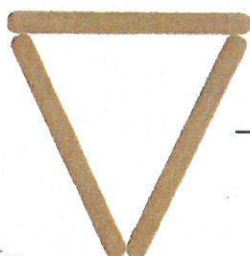**STEP 2** Write the total length of the craft sticks used.

Example

$$\text{Total length of craft sticks} = p + p + p$$
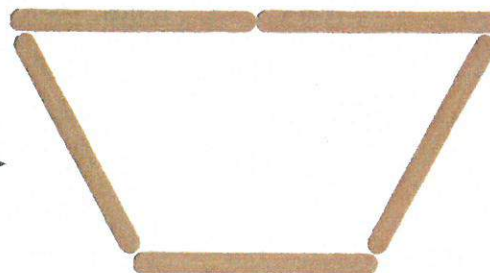$$= 3p \text{ units}$$

STEP 3 Remove, then add craft sticks to form another figure.

Example

remove 1 craft stick,
add 3 craft sticks

STEP 4 Write the total length of the craft sticks used in the new figure. Subtract the total length of the craft sticks removed and add the total length of the craft sticks added.

Example

To form a second figure, 1 craft stick was removed and 3 craft sticks were added.

$$\text{Total length of craft sticks} = 3p - p + 3p$$
$$= 5p \text{ units}$$

5.3 Inequalities and Equations

Lesson Objectives

- Write and evaluate inequalities.
- Solve simple equations.

Learn **Algebraic expressions can be used in inequalities and equations.**

Serena buys 2 bags of apples and 1 bag of 8 oranges. There is the same number of apples in each bag. Are there more oranges or apples?

Let each bag of apples contain x apples.

$x + x = 2x$

There are $2x$ apples.

To compare $2x$ and 8, you need to know the value of x.

When $x = 3$, $2x = 2 \times 3 = 6$

                  $6 < 8$, so $2x < 8$.

When $x = 3$, there are more oranges than apples.

When $x = 4$, $2x = 2 \times 4 = 8$

                  $8 = 8$, so $2x = 8$.

When $x = 4$, there is the same number of oranges and apples.

When $x = 5$, $2x = 2 \times 5 = 10$

                  $10 > 8$, so $2x > 8$.

When $x = 5$, there are more apples than oranges.

The statement $2x = 8$ is an equation.
The statements $2x < 8$ and $2x > 8$ are inequalities.

Guided Practice

Complete with $>$, $<$, or $=$.

1. When $y = 6$, $3y$ ⬤ 18.

2. When $y = 10$, $3y$ ⬤ 18.

3. When $y = 5$, $3y$ ⬤ 18.

4. When $y = 9$, $3y$ ⬤ 18.

Learn

Algebraic expressions can be compared by evaluating them for a given value of the variable.

When $b = 8$, is $4b - 6$ greater than, less than, or equal to 26?

Evaluate the expression to compare:

When $b = 8$,

$$4b - 6 = (4 \times 8) - 6$$
$$= 32 - 6$$
$$= 26$$

$26 = 26$

So, when $b = 8$, $4b - 6 = 26$.

> Two expressions that have the same value are said to be equal.
> When two equal expressions are related by an '$=$' sign, they form an equation.

When $c = 15$, is $3c \div 5$ greater than, less than, or equal to $c - 8$?

Evaluate both expressions to compare:

When $c = 15$,

$$3c \div 5 = (3 \times 15) \div 5 \qquad c - 8 = 15 - 8$$
$$= 45 \div 5 \qquad\qquad\qquad\quad = 7$$
$$= 9$$

$9 > 7$

So, when $c = 15$, $3c \div 5 > c - 8$.

> When two expressions with different values are related by an '$>$' or '$<$' sign, they form an inequality.

Guided Practice

Complete.

5 When $d = 6$, is $2d + 10$ greater than, less than or equal to $4d$?

When $d = 6$, $2d + 10 = (2 \times \boxed{}) + 10$ $\qquad$ $4d = 4 \times \boxed{}$

$\qquad\qquad\qquad = \boxed{} + 10$ $\qquad\qquad\qquad\qquad = \boxed{}$

$\qquad\qquad\qquad = \boxed{}$

So, $2d + 10$ is $\boxed{}$ $4d$, when $d = 6$.

Complete with $>$, $<$, or $=$.

6 When $e = 4$, $3e \div 6$ $\bigcirc$ $e - 2$. $\qquad$ **7** When $f = 9$, $8f - 4$ $\boxed{}$ $6f + 10$.

Learn **Equality Properties**

You can add the same number to or subtract the same number from both sides of an equation. The new equation will still be **true** for the same value of variable.

Look at the balance.
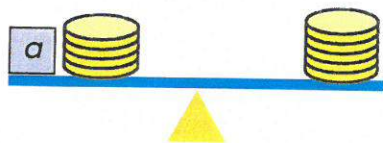
🟡 represents 1.

$\boxed{a}$ represents a counters.

a counters together with 4 counters on the left side balance 5 counters on the right side.

$a + 4 \qquad = \qquad 5$
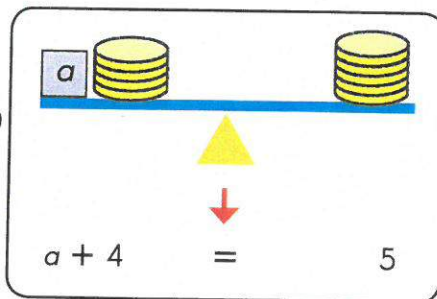
You have the equation $a + 4 = 5$.
Compare $a + 4 = 5$ with $1 + 4 = 5$, it can be seen that $a = 1$.
This equation is true for $a = 1$.

a Add 2 counters to both sides of the equation.
The two sides still balance.

You have a new equation:
$a + 4 + 2 = 5 + 2$, that is, $a + 6 = 7$.

Substitute 1 for a:
$a + 6 = 1 + 6 = 7$

The new equation $a + 6 = 7$ is still true for $a = 1$.

b Take away 2 counters from both sides of the equation.
The two sides still balance.
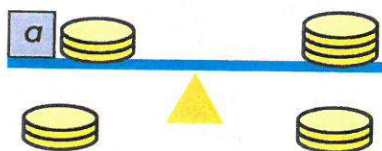
You have a new equation:
$a + 4 - 2 = 5 - 2$, that is, $a + 2 = 3$.

Substitute 1 for a:
$a + 2 = 1 + 2 = 3$

The new equation $a + 2 = 3$ is still true for $a = 1$.
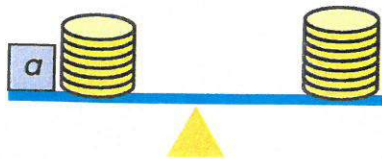
You can multiply or divide both sides of an equation by the same number. The new equation will still be true for the same value of the variable.

Look at the balance.
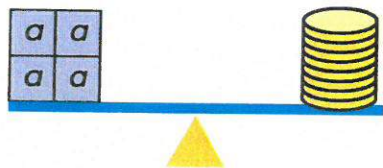
$4a$ counters on the left side balance 8 counters on the right side.
You have the equation, $4a = 8$.
Compare $4a = 8$ with $4 \times 2 = 8$, it can be seen that $a = 2$.
This equation is true for $a = 2$.

a Multiply the number of counters on both sides by 2.
The two sides still balance.
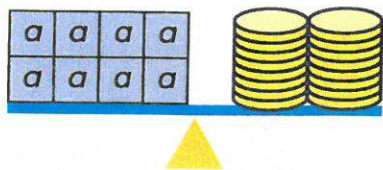
You have a new equation:
$4a \times 2 = 8 \times 2$, that is, $8a = 16$.

Substitute 2 for a:
$8a = 8 \times 2 = 16$

The new equation $8a = 16$ is still true for $a = 2$.

b Divide the number of counters on both sides by 2.
The two sides still balance.

a a

You have a new equation:
$4a \div 2 = 8 \div 2$, that is, $2a = 4$.

Substitute 2 for a:
$2a = 2 \times 2 = 4$

The new equation $2a = 4$ is still true for $a = 2$.

Learn **Solve** equations with variables on one side of the equal sign.

For what value of y will $5y - 2 = 13$ be true?

> To find the value of y that makes $5y - 2 = 13$ true, you simply need to find the value of y that makes $5y - 2$ equal to 13.

> In finding the value of y that makes $5y - 2 = 13$ true, you are also said to be solving $5y - 2 = 13$.

Method 1

If $y = 2$,
$$5y - 2 = (5 \times 2) - 2$$
$$= 10 - 2$$
$$= 8$$
$$\neq 13$$

'$\neq$' means 'is not equal to'.

The value of $5y - 2$ is too small when $y = 2$.

Try $y = 3$.

If $y = 3$,
$$5y - 2 = (5 \times 3) - 2$$
$$= 15 - 2$$
$$= 13$$

$5y - 2 = 13$ is true when $y = 3$.

Method 2

'Building up': $y \xrightarrow{\times 5} 5y \xrightarrow{-2} 5y - 2$

'Breaking down': $y \xleftarrow{\div 5} 5y \xleftarrow{+2} 5y - 2$

$$5y - 2 = 13$$
$$5y - 2 + 2 = 13 + 2 \longleftarrow \text{Add 2 to both sides of the equation.}$$
$$5y = 15$$
$$5y \div 5 = 15 \div 5 \longleftarrow \text{Divide both sides of the equation by 5.}$$
$$y = 3$$

$5y - 2 = 13$ is true when $y = 3$.

Check!

Evaluate the expression $5y - 2$ for the value of y you have found.

$$5y - 2 = (5 \times 3) - 2$$
$$= 15 - 2$$
$$= 13$$

The answer is correct.

Guided Practice

Fill in ⬭ **with +, −, ×, or ÷ and** ▭ **with the correct number.**

8 For what value of p will $6p + 7 = 37$ be true?

$$6p + 7 = 37$$
$$6p + 7 \;⬭\; ▭ = 37 \;⬭\; ▭$$
$$6p = ▭$$
$$6p \;⬭\; ▭ = ▭ \;⬭\; ▭$$
$$p = ▭$$

$6p + 7 = 37$ is true when $p = ▭$.

Solve each equation.

9 $5r + 5 = 60$

10 $3q - 12 = 15$

Learn **Solve equations with variables on both sides of the equal sign.**

For what value of y will $6y - 7 = 2y + 9$ be true?

Guess and check.

Method 1

y	$6y - 7$	$2y + 9$	Both sides equal?
2	$6 \times 2 - 7 = 12 - 7$ $= 5$	$2 \times 2 + 9 = 4 + 9$ $= 13$	No
3	$6 \times 3 - 7 = 18 - 7$ $= 11$	$2 \times 3 + 9 = 6 + 9$ $= 15$	No
4	$6 \times 4 - 7 = 24 - 7$ $= 17$	$2 \times 4 + 9 = 8 + 9$ $= 17$	Yes

$6y - 7 = 2y + 9$ is true when $y = 4$.

Method 2

$6y - 7 = 2y + 9$

$6y - 7 + 7 = 2y + 9 + 7$ ← Add 7 to both sides of the equation.

$6y = 2y + 16$

$6y - 2y = 2y - 2y + 16$ ← Subtract 2y from both sides of the equation.

$4y = 16$

$4y \div 4 = 16 \div 4$ ← Divide both sides of the equation by 4.

$y = 4$

$6y - 7 = 2y + 9$ is true when $y = 4$.

Check!

Substitute the value of y into both sides of the equation.

Left side:

$6y - 7 = 6 \times 4 - 7$
$= 24 - 7$
$= 17$

Right side:

$2y + 9 = 2 \times 4 + 9$
$= 8 + 9$
$= 17$

$y = 4$ is the correct answer.

Guided Practice

Fill in ⬤ **with** $+$, $-$, $\times$, **or** $\div$ **and** ▭ **with the correct number.**

11 For what value of q will $8q - 7 = 5q + 11$ be true?

$$8q - 7 = 5q + 11$$

$$8q - 7 \;⬤\; \boxed{} = 5q + 11 \;⬤\; \boxed{}$$

$$8q = 5q \;⬤\; \boxed{}$$

$$8q \;⬤\; 5q = 5q \;⬤\; 5q \;⬤\; \boxed{}$$

$$3q = \boxed{}$$

$$3q \;⬤\; \boxed{} = \boxed{} \;⬤\; \boxed{}$$

$$q = \boxed{}$$

$8q - 7 = 5q + 11$ is true when $q = \boxed{}$.

12 For what value of m will $3m + 9 = 5m - 11$ be true?

$$3m + 9 = 5m - 11$$

$$3m + 9 \;⬤\; \boxed{} = 5m - 11 \;⬤\; \boxed{}$$

$$3m \;⬤\; \boxed{} = 5m$$

$$3m \;⬤\; 3m + \boxed{} = 5m \;⬤\; 3m$$

$$\boxed{} = 2m$$

$$2m = \boxed{}$$

$$2m \;⬤\; \boxed{} = \boxed{} \;⬤\; \boxed{}$$

$$m = \boxed{}$$

$3m + 9 = 5m - 11$ is true when $m = \boxed{}$.

> I can either subtract $\boxed{}$ from both sides of the equation or add $\boxed{}$ to both sides. Which do I know how to do?
>
> Subtract $\boxed{}$:
>
> $3m + 9 - \boxed{} = 5m - 11 - \boxed{}$
>
> $\underbrace{}_{?}$
>
> Add $\boxed{}$:
>
> $3m + 9 + \boxed{} = 5m - 11 + \boxed{}$
>
> I do not know how to simplify
>
> '$- \boxed{} \;⬤\; \boxed{}$'. I will add
>
> $\boxed{}$ to both sides instead.

Learn **Use algebraic expressions to compare quantities and solve equations.**

Andy and Cathy each have some pencils. Andy has his pencils in 4 boxes. 3 of the boxes have an equal number of pencils. There are p pencils in each of the 3 boxes. The remaining box has 3 pencils fewer. Cathy has 2 boxes of pencils each with p pencils and 13 extra pencils.

(a) Write the number of pencils Andy and Cathy each have, in terms of p.

Andy has $3p + (p - 3)$ pencils. So, Andy has $(4p - 3)$ pencils.
Cathy has $(2p + 13)$ pencils.

(b) Write an inequality to show who has more pencils if $p = 9$.

If $p = 9$,

$$
\begin{aligned}
4p - 3 &= (4 \times 9) - 3 \\
&= 36 - 3 \\
&= 33
\end{aligned}
\qquad
\begin{aligned}
2p + 13 &= (2 \times 9) + 13 \\
&= 18 + 13 \\
&= 31
\end{aligned}
$$

$4p - 3 > 2p + 13$.

Andy has more pencils if $p = 9$.

(c) For what value of p will Andy and Cathy have the same number of pencils?

$$
\begin{aligned}
4p - 3 &= 2p + 13 \\
4p - 3 + 3 &= 2p + 13 + 3 \\
4p &= 2p + 16 \\
4p - 2p &= 2p + 16 - 2p \\
2p &= 16 \\
2p \div 2 &= 16 \div 2 \\
p &= 8
\end{aligned}
$$

Andy and Cathy will have the same number of pencils, if $p = 8$.

2 Aida bought a belt for x dollars and a handbag that cost twice as much as the belt. She gave the cashier $100.

   a Find the amount that Aida spent in terms of x.

   b Find the amount of change Aida received in terms of x.

   c If $x = 15$, how much change did Aida receive?

3 Paul scored z points playing a math game. Meghan scored 4 times as many points as Paul. Kieran scored 5 more points than Meghan.

   a Find the number of points Meghan scored in terms of z.

   b Find the number of points Kieran scored in terms of z.

   c Find the total number of points the three players scored in terms of z.

4 A plumber has a copper pipe and a steel pipe. The copper pipe is $(3p + 2)$ feet long and the steel pipe is $(4p - 3)$ feet long.

   a If $p = 8$, which pipe is longer?

   b For what value of p will the two pipes be of the same length?

5 A group of 3 friends made m bracelets. They sold the bracelets for $14 each and shared the money equally.

   a How much did each person get? Give your answer in terms of m.

   b If there were 18 bracelets, how much did each person get?

6 A pail and a pitcher contain q quarts of water altogether. The pail contains 9 times as much water as the pitcher.

   a Find the amount of water in the pitcher in terms of q.

   b If the pail and the pitcher contain 25 quarts of water altogether, find the amount of water in the pail in quarts. Express your answer as a decimal.

ON YOUR OWN

Go to Workbook A:
Practice 4, pages 189–194