Lesson 16: Write Expressions in Which Letters Stand for Numbers

Student Outcomes

- Students write algebraic expressions that record all operations with numbers and letters standing for the numbers.

Lesson Notes

In general, key word readings should be avoided. However, at this initial phase it is important for students to understand the direct relationship between words in a written phrase and their appearance in an algebraic expression.

Classwork

Opening Exercise (5 minutes)

Students underline the key math vocabulary words in each statement.

Opening Exercise

Underline the key words in each statement.

a. **The sum of twice b and 5.**

The sum of twice b and 5.

b. **The quotient of c and d.**

The quotient of c and d.

c. **a raised to the fifth power then increased by the product of 5 and c.**

a raised to the fifth power then increased by the product of 5 and c.

d. **The quantity of a plus b divided by 4.**

The quantity of a plus b divided by 4.

e. **10 less than the product of 15 and c.**

10 less than the product of 15 and c.

f. **5 times d then increased by 8.**

5 times d then increased by 8.

Mathematical Modeling Exercise 1 (10 minutes)

Model how to change the expressions given in the opening exercise from words to variables and numbers.

Mathematical Modeling Exercise 1

a. The sum of twice b and 5.

- Underline key words: The sum of twice b and 5.
- Identify the operations each key word implies.
  - *"Sum" indicates addition and "twice" indicates multiplication by 2.*
- Write an expression.

$2b + 5$

b. The quotient of c and d.

- Underline key words: The quotient of c and d.
- Identify the operation the key word implies.
  - *"Quotient" implies division.*
- Write an expression.

$\frac{c}{d}$

MP.6

c. a raised to the fifth power then increased by the product of 5 and c.

- Underline key words: a raised to the fifth power, increased by the product of 5 and c.
- Identify the operations each key word implies.
  - *"Power" indicates exponents, "increased" implies addition, and "product" implies multiplication.*
- Write an expression.

$a^5 + 5c$

d. The quantity of a plus b divided by 4.

- Underline key words: The quantity of a plus b divided by 4.
- Identify the operations each key word implies.
  - *"Quantity" indicates parentheses, "plus" indicates addition, and "divided by" implies division.*
- Write an expression.

$\frac{a+b}{4}$

e. 10 less than the product of 15 and c.

- Underline key words: 10 less than the product of 15 and c.

- Identify the operations each key word implies.
  - *"Less than" indicates subtraction and "product" implies multiplication.*
- Write an expression.

$15c - 10$

- Would $10 - 15c$ also be correct? Why or why not?
  - *This expression would not be correct. If the amount of money I have is 10 less than someone else, I would take the money the other person has and subtract the 10.*

MP.6

f. 5 times d then increased by 8.

- Underline key words: 5 times d then increased by 8.
- Identify the operations each key word implies.
  - *"Times" indicates multiplication and "increased" implies addition.*
- Write an expression.

$5d + 8$

Mathematical Modeling Exercise 2 (10 minutes)

Mathematical Modeling Exercise 2

Model how to change each real-world scenario to an expression using variables and numbers. Underline the text to show the key words before writing the expression.

Marcus has 4 more dollars than Yaseen. If y is the amount of money Yaseen has, write an expression to show how much money Marcus has.

- Underline key words.
  - *Marcus has 4 more dollars than Yaseen.*
- If Yaseen had $7, how much money would Marcus have?

MP.6

  - $11
- How did you get that?
  - *Added $7 + 4$*
- Write an expression using y for the amount of money Yaseen has.
  - $y + 4$

Mario is missing half of his assignments. If a represents the number of assignments, write an expression to show how many assignments Mario is missing.

- Underline key words.

- *Mario is missing <u>half</u> of his assignments.*

- If Mario was assigned 10 assignments, how many is he missing?
  - 5
- How did you get that?
  - $10 \div 2$
- Write an expression using a for the number of assignments Mario was assigned.
  - $\frac{a}{2}$ or $a \div 2$

Kamilah's weight has tripled since her first birthday. If w represents the amount Kamilah weighed on her first birthday, write an expression to show how much Kamilah weighs now.

- Underline key words.
  - *Kamilah's weight has <u>tripled</u> since her first birthday.*
- If Kamilah weighed 20 pounds on her first birthday, how much does she weigh now?
  - 60 pounds
- How did you get that?
  - *Multiply* 3 *by* 20.
- Write an expression using w for Kamilah's weight on her first birthday.
  - $3w$

MP.6

Nathan brings cupcakes to school and gives them to his five best friends who share them equally. If c represents the number of cupcakes Nathan brings to school, write an expression to show how many cupcakes each of his friends receive.

- Underline key words.
  - *Nathan brings cupcakes to school and gives them to his five best friends who <u>share</u> them <u>equally</u>.*
- If Nathan brings 15 cupcakes to school, how many will each friend receive?
  - 3
- How did you determine that?
  - $15 \div 5$
- Write an expression using c to represent the number of cupcakes Nathan brings to school.
  - $\frac{c}{5}$ or $c \div 5$

Mrs. Marcus combines her atlases and dictionaries and then divides them among 10 different tables. If a represents the number of atlases and d represents the number of dictionaries Mrs. Marcus has, write an expression to show how many books would be on each table.

- Underline key words.
  - *Mrs. Marcus <u>combines</u> her atlases and dictionaries and then <u>divides</u> them among 10 different tables.*

- If Mrs. Marcus had 8 atlases and 12 dictionaries, how many books would be at each table?

- 2
- How did you determine that?
  - *Added the atlases and dictionaries together and then divided by* 10.
- Write an expression using a for atlases and d for dictionaries to represent how many books each table would receive.
  - $\frac{a+d}{10}$ or $(a + d) \div 10$

MP.6

To improve in basketball, Ivan's coach told him that he needs to take four times as many free throws and four times as fmany jump shots every day. If f represents the number of free throws and j represents the number of jump shots Ivan shoots daily, write an expression to show how many shots he will need to take in order to improve in basketball.

- Underline key words.
  - *To improve in basketball, Ivan needs to shoot* 4 *times more free throws and jump shots daily.*
- If Ivan shoots 5 free throws and 10 jump shots, how many will he need to shoot in order to improve in basketball?
  - 60
- How did you determine that?
  - *Added the free throws and jump shots together and then multiplied by* 4.
- Write an expression using f for free throws and j for jump shots to represent how many shots Ivan will have to take in order to improve in basketball.
  - $4(f + j)$ or $4f + 4j$

Exercises (10 minutes)

Have students work individually on the following exercises.

Exercises

Mark the text by underlining key words, and then write an expression using variables and/or numbers for each statement.

1. **b decreased by c squared.**

   b decreased by c squared.

   $b - c^2$

2. **24 divided by the product of 2 and a.**

   24 divided by the product of 2 and a.

   $\frac{24}{2a}$ or $24 \div (2a)$

3. **150 decreased by the quantity of 6 plus b.**

150 decreased by the quantity of 6 plus b.

$150 - (6 + b)$

4. The sum of twice c and 10.

The sum of twice c and 10.

$2c + 10$

5. Marlo had $\$35$ but then spent $\$m$.

Mario had $\$35$ but then spent $\$m$.

$35 - m$

6. Samantha saved her money and was able to quadruple the original amount, m.

Samantha saved her money and was able to quadruple the original amount, m.

$4m$

7. Veronica increased her grade, g, by 4 points, and then doubled it.

Veronica increased her grade, g, by 4 points, and then doubled it.

$2(g + 4)$

8. Adbell had m pieces of candy and ate 5 of them. Then, he split the remaining candy equally among 4 friends.

Adbell had m pieces of candy and ate 5 of them. Then, he split the remaining candy equally among 4 friends.

$\frac{m-5}{4}$ *or* $(m - 5) \div 4$

9. To find out how much paint is needed, Mr. Jones must square the side length, s, of the gate, and then subtract 15.

To find out how much paint is needed, Mr. Jones must square the side length, s, of the gate, and then subtract 15.

$s^2 - 15$

10. Luis brought x cans of cola to the party, Faith brought d cans of cola, and De'Shawn brought h cans of cola. How many cans of cola did they bring altogether?

Luis brought x cans of cola to the party, Faith brought d cans of cola, and De'Shawn brought h cans of cola. How many cans of cola did they bring altogether?

$x + d + h$

Closing (5 minutes)

- How is writing expressions with variables and numbers similar to writing expressions using words?
  - *Possible answers: The same vocabulary words can be used; identifying parts of the expression before writing the expression is helpful.*
- How is writing expressions with variables and numbers different than writing expressions using words?
  - *Possible answers: When an expression with words is provided, it is possible that it might be represented mathematically in more than one way. However, when an algebraic expression is written, there can only be one correct answer.*

Exit Ticket (5 minutes)

Name _____ Date _____

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Exit Ticket

Mark the text by underlining key words, and then write an expression using variables and/or numbers for each of the statements below.

1. Omaya picked x amount of apples, took a break, and then picked v more. Write the expression that models the total number of apples Omaya picked.

2. A number h is tripled and then decreased by 8.

3. Sidney brings s carrots to school and combines them with Jenan's j carrots. She then splits them equally among 8 friends.

4. 15 less than the quotient of e and d.

5. Marissa's hair was 10 inches long, and then she cut h inches.

Exit Ticket Sample Solutions

Mark the text by underlining key words, and then write an expression using variables and/or numbers for each of the statements below.

1. **Omaya picked x amount of apples, took a break, and then picked v more. Write the expression that models the total number of apples Omaya picked.**

   Omaya picked x amount of apples, took a break, and then picked v more.

   $x + v$

2. **A number h is tripled, and then decreased by 8.**

   A number h is tripled, and then decreased by 8.

   $3h - 8$

3. **Sidney brought s carrots to school and combined them with Jenan's j carrots. She then split them equally among 8 friends.**

   Sidney brought s carrots to school and combined them with Jenan's j carrots. She then split them equally between 8 friends.

   $\frac{s+j}{8}$ *or* $(s + j) \div 8$

4. **15 less than the quotient of e and d.**

   15 less than the quotient of e and d.

   $\frac{e}{d} - 15$ *or* $e \div d - 15$

5. **Marissa's hair was 10 inches long, and then she cut h inches.**

   Marissa's hair was 10 inches long, and then she cut h inches.

   $10 - h$

Problem Set Sample Solutions

Mark the text by underlining key words, and then write an expression using variables and numbers for each of the statements below.

1. **Justin can type w words per minute. Melvin can type 4 times as many words as Justin. Write an expression that represents the rate at which Melvin can type.**

   Justin can type w words per minute. Melvin can type 4 times as many words as Justin. Write an expression that represents the rate at which Melvin can type.

   $4w$

2. Yohanna swam y yards yesterday. Sheylin swam 5 yards less than half the amount of yards as Yohanna. Write an expression that represents the number of yards Sheylin swam yesterday.

   Yohanna swam y yards yesterday. Sheylin swam 5 yards less than half the amount of yards as Yohanna. Write an expression that represents the number of yards Sheylin swam yesterday.

   $\frac{y}{2} - 5$ *or* $y \div 2 - 5$ *or* $\frac{1}{2}y - 5$

3. A number d is decreased by 5 and then doubled.

   A number is d decreased by 5 and then doubled.

   $2(d - 5)$

4. Nahom had n baseball cards and Semir had s baseball cards. They combined their baseball cards and then sold 10 of them.

   Nahom had n baseball cards and Semir had s baseball cards. They combined their baseball cards and then sold 10 of them.

   $n + s - 10$

5. The sum of 25 and h is divided by f cubed.

   The sum of 25 and h is divided by f cubed.

   $\frac{25+h}{f^3}$ *or* $(25 + h) \div f^3$