Lesson 18: Writing and Evaluating Expressions—Addition and Subtraction

Student Outcomes

- Students use variables to write expressions involving addition and subtraction from real-world problems.
- Students evaluate these expressions when given the value of the variable.

Lesson Notes

When students write expressions, make sure they are as specific as possible. Students should understand the importance of specifying units when defining letters. For example, students should say, "Let K = Karolyn's weight in pounds" instead of "Let K = Karolyn's weight" because weight is not a number until it is specified by pounds, ounces, grams, etc. They also must be taught that it is inaccurate to define K as Karolyn because Karolyn is not a number. Students conclude that in word problems each letter represents a number, and its meaning must be clearly stated.

Classwork

Opening Exercise (4 minutes)

Opening Exercise

How can we show a number increased by 2?

$a + 2$ or $2 + a$

Can you prove this using a model?

Yes, I can use a tape diagram.

Discussion (5 minutes)

- In this lesson, you will connect real-world problems to addition and subtraction expressions. What story problem could you make up to go along with the expression $a + 2$?

Allow a few moments for students to form realistic scenarios. As students share these, critique them.

- *Answers will vary. Ronnie has some apples, but Gayle has two more apples than Ronnie. How many apples does Gayle have?*

> **Example 1: The Importance of Being Specific in Naming Variables**
>
> When naming variables in expressions, it is important to be very clear about what they represent. The units of measure must be included if something is measured.

Exercises (5 minutes)

Ask students to read the variables listed in the table and correct them for specificity.

> **Exercises**
>
> 1. Read the variable in the table and improve the description given, making it more specific.
>
> *Answers may vary because students may choose a different unit.*
>
> | Variable | Incomplete Description | Complete Description with Units |
> |---|---|---|
> | Joshua's speed (J) | Let J = Joshua's speed | *Let J = Joshua's speed in meters per second* |
> | Rufus's height (R) | Let R = Rufus's height | *Let R = Rufus's height in centimeters* |
> | Milk sold (M) | Let M = the amount of milk sold | *Let M = the amount of milk sold in gallons* |
> | Colleen's time in the 40 meter hurdles (C) | Let C = Colleen's time | *Let C = Colleen's time in seconds* |
> | Sean's age (S) | Let S = Sean's age | *Let S = Sean's age in years* |

- Again, when naming variables in expressions, it is important to be very clear about what they represent. When a variable represents a quantity of items, this too must be specified.

Review the concept of speed from the above table. Recall from Module 1 that speed is a rate. Emphasize that there are two different units needed to express speed (meters per second in the above example).

> 2. Read each variable in the table and improve the description given, making it more specific.
>
> | Variable | Incomplete Description | Complete Description with Units |
> |---|---|---|
> | Karolyn's CDs (K) | Let K = Karolyn's CDs | Let K = the number of CDs Karolyn has |
> | Joshua's merit badges (J) | Let J = Joshua's merit badges | *Let J = the number of merit badges Joshua has earned* |
> | Rufus's trading cards (R) | Let R = Rufus's trading cards | *Let R = the number of trading cards in Rufus's collection* |
> | Milk money (M) | Let M = the amount of milk money | *Let M = the amount of milk money collected in dollars* |

Example 2 (17 minutes): Writing and Evaluating Addition and Subtraction Expressions

- Read the following story descriptions, and write an addition or subtraction expression for each one in the table.

Example 2: Writing and Evaluating Addition and Subtraction Expressions

Read each story problem. Identify the unknown quantity, and write the addition or subtraction expression that is described. Finally, evaluate your expression using the information given in column four.

Story Problem	Description with Units	Expression	Evaluate the Expression If:	Show Your Work and Evaluate
Gregg has two more dollars than his brother Jeff. Write an expression for the amount of money Gregg has.	Let j = Jeff's money in dollars	$j + 2$	Jeff has $12.	$j + 2$ $12 + 2$ 14 Gregg has $14.
Gregg has two more dollars than his brother Jeff. Write an expression for the amount of money Jeff has.	Let g = Gregg's money in dollars	$g - 2$	Gregg has $14.	$g - 2$ $14 - 2$ 12 Jeff has $12.
Abby read 8 more books than Kristen in the first marking period. Write an expression for the number of books Abby read.	Let k = the number of books Kristen read in the first marking period	$k + 8$	Kristen read 9 books in the first marking period.	$k + 8$ $9 + 8$ 17 Abby read 17 books in the first marking period.
Abby read 6 more books than Kristen in the second marking period. Write an expression for the number of books Kristen read.	Let a = the number of books Abby read in the second marking period	$a - 6$	Abby read 20 books in the second marking period.	$a - 6$ $20 - 6$ 14 Kristen read 14 books in the second marking period.
Daryl has been teaching for one year longer than Julie. Write an expression for the number of years that Daryl has been teaching.	Let j = the number of years Julie has been teaching	$j + 1$	Julie has been teaching for 28 years.	$j + 1$ $28 + 1$ 29 Daryl has been teaching for 29 years.
Ian scored 4 fewer goals than Julia in the first half of the season. Write an expression for the number of goals Ian scored.	Let j = the number of goals scored by Julia	$j - 4$	Julia scored 13 goals.	$j - 4$ $13 - 4$ 9 Ian scored 9 goals in the first half of the season.
Ian scored 3 fewer goals than Julia in the second half of the season. Write an expression for the number of goals Julia scored.	Let i = the number of goals scored by Ian	$i + 3$	Ian scored 8 goals.	$i + 3$ $8 + 3$ 11 Julia scored 11 goals in the second half of the season.
Johann visited Niagara Falls 3 times fewer than Arthur. Write an expression for the number of times Johann visited Niagara Falls.	Let f = the number of times Arthur visited Niagara Falls	$f - 3$	Arthur visited Niagara Falls 5 times.	$f - 3$ $5 - 3$ 2 Johann visited Niagara Falls twice.

Closing (5 minutes)

- ▪ Why is it important to describe the variable in an expression?
  - □ *The biggest reason to define the variable is to know what the expression represents.*
  - □ *If something is measured, include units. If something is counted, include that it is a number of items.*
- ▪ How do you determine if an expression will be an addition expression or a subtraction expression?
  - □ *In the first problem above, if we define x as the amount of money that Jeff has, then we would write an expression for the amount of money that Gregg has as $x + 2$. However, if we define the variable to be the amount of money that Gregg has, then we would write an expression to represent the amount of money that Jeff has as $x - 2$. Since the story problem represents a relationship between two quantities, both expressions are equally relevant.*

Exit Ticket (5 minutes)

Name _____   Date _____

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Exit Ticket

Kathleen lost a tooth today. Now she has lost 4 more than her sister Cara lost.

1. Write an expression to represent the number of teeth Cara has lost. Let $K=$ the number of teeth Kathleen lost.

    Expression:

2. Write an expression to represent the number of teeth Kathleen has lost. Let $C=$ the number of teeth Cara lost.

    Expression:

3. If Cara lost 3 teeth, how many teeth has Kathleen lost?

Exit Ticket Sample Solutions

Kathleen lost a tooth today. Now she has lost 4 more than her sister Cara lost.

1.   Write an expression to represent the number of teeth Cara has lost. Let $K =$ the number of teeth Kathleen lost.

     Expression: $K - 4$

2.   Write an expression to represent the number of teeth Kathleen lost. Let $C =$ the number of teeth Cara lost.

     Expression: $C + 4$

3.   If Cara lost 3 teeth, how many teeth has Kathleen lost?

     $C + 4$; $3 + 4$; Kathleen has lost 7 teeth.

Problem Set Sample Solutions

1.   Read each story problem. Identify the unknown quantity, and write an addition or subtraction expression that is described. Finally, evaluate your expression using the information given in column four.

     Sample answers are shown. An additional expression can be written for each.

Story Problem	Description with Units	Expression	Evaluate the Expression If:	Show Your Work and Evaluate
Sammy has two more baseballs than his brother Ethan.	Let $e =$ the number of balls Ethan has	$e + 2$	Ethan has 7 baseballs.	$e + 2$ $7 + 2$ 9 **Sammy has 9 baseballs.**
Ella wrote 8 more stories than Anna in the fifth grade.	*Let $s =$ the number of stories Anna wrote in fifth grade*	$s + 8$	Anna wrote 10 stories in the fifth grade.	*$s + 8$ $10 + 8$ 18 Ella wrote 18 stories in fifth grade.*
Lisa has been dancing for 3 more years than Danika.	*Let $y =$ the number of years Danika has been dancing*	$y + 3$	Danika has been dancing for 6 years.	*$y + 3$ $6 + 3$ 9 Lisa has been dancing for 9 years.*
The New York Rangers scored 2 fewer goals than the Buffalo Sabres last night.	*Let $g =$ the number of goals scored by the Rangers*	$g + 2$	The Rangers scored 3 goals last night.	*$g + 2$ $3 + 2$ 5 The Buffalo Sabres scored 5 goals last night.*
George has gone camping 3 times fewer than Dave.	*Let $c =$ the number of times George has gone camping*	$c + 3$	George has gone camping 8 times.	*$c + 3$ $8 + 3$ 11 Dave has gone camping 11 times.*

2.   If George went camping 15 times, how could you figure out how many times Dave went camping?

     Adding 3 to George's camping trip total (15) would yield an answer of 18 trips for Dave.