Lesson 16 Introduction
Algebraic Expressions

6.EE.A.2a
6.EE.A.2b
6.EE.A.2c

Use What You Know

In Lesson 15, you learned to write and evaluate expressions with numbers and operations. Now, take a look at this problem.

Describe the expression $2x + 5$ in words.

Use the math you know to solve the problem.

a. What does the letter x stand for?

b. Which operation is represented by $2x$?

c. What do you call the result of this operation?

d. What operation does the $+$ sign show?

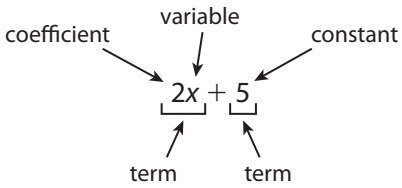
e. What do you call the result of this operation?

f. Explain what the whole expression represents.

Find Out More

You have evaluated expressions with known numbers and operation signs. An example of this would be $6 - 7 \times 4$. Now you will evaluate expressions that include variables. Remember, a **variable** is a letter that stands for an unknown number.

Look at this expression.



Every expression is made up of terms. A **term** is a known number, a variable, or the product of a known number and variable(s). The expression $2x + 5$ has two terms: $2x$ and 5.

A term that is a known number without variables is called a **constant**. The expression $2x + 5$ has one constant: 5.

A term that includes variables is called a **variable term**. The expression $2x + 5$ has one variable term: $2x$.

If one factor of a variable term is a known number, that number is called the **coefficient**. The coefficient of the term $2x$ is 2.

Look again at the term $2x$. It means "multiply a number by 2." You have used the symbol $\times$ for multiplication. However, now that you are using the variable x, you will need other ways to show multiplication. The expression $2 \times x$ would look confusing. Instead, you can write $2 \cdot x$ or $2x$.

Reflect

1 Claire says the expression $8x^3$ has three terms: 8, x, and 3. Is she correct? Explain.

Learn About

Writing Expressions with Variables

Read the problem below. Then explore ways to write expressions from words.

Write an expression with the same meaning as "subtract a number times 4 from 10."

Model It

You can look for operation words to help you write the expression.

"Subtract a number times 4 from 10."
The expression will be a difference between terms.

First term	−	Second term

This is the overall "shape" of the expression.

Model It

You can think of similar expressions to help you write this expression.

Write an expression for "subtract 6 from 10."	$10 - 6$
Write an expression for "subtract a number from 10."	$10 - x$
Write an expression for "a number times 4."	$4x$

Connect It Now, you will solve the problem from the previous page using the models.

2 Look at the first *Model It* on the previous page. When you subtract a number "from 10," will 10 be the first term or the second term? Explain.

3 Erica says that the expression $4x$ has one term. Is she correct? Explain.

4 Look at the second *Model It*. Write an expression for "subtract a number times 4 from 10."

5 List each term in your answer to problem 4.

6 Does your answer to problem 4 have any constants? Explain.

7 What are the coefficients, if any, in your answer to problem 4? Explain.

8 Explain the difference between a constant and a coefficient.

Try It Use what you just learned about writing expressions to solve these problems. Show your work on a separate sheet of paper.

9 Write an expression with the same meaning as "the result of multiplying $\frac{1}{2}$ by a number, then subtracting 9."

10 Write an expression with the same meaning as "7 less than the square of a number."

11 Write an expression to represent "the sum of 3 and the quotient of a number divided by 6."

Learn About Writing and Evaluating Expressions

Read the problem below. Then explore ways to write and evaluate expressions with variables.

Jennifer buys 1 pack of orange sugarless gum and 3 packs of mint sugarless gum. The pack of orange gum has 8 pieces. The packs of mint gum each have the same number of pieces.

- Write an expression to show the total number of pieces of gum that Jennifer buys.
- If 1 pack of mint gum has 6 pieces, what is the total number of pieces of gum that Jennifer buys?

Picture It You can draw a picture to help you understand this problem.

You can draw the packs of gum and label the number of pieces in each pack.

8 pieces

p pieces

p pieces

p pieces

Model It You can use words to help you solve this problem.

You can write a sentence describing the total number of gum pieces.

The total number of pieces of gum is the sum of the number of pieces in one pack of orange gum and the number of pieces in three packs of mint gum.

The word *sum* in the sentence above tells you that the expression will have this overall "shape."

First amount	+	Second amount

Connect It

Now you will solve the problem from the previous page using the picture and model.

12 Write an expression for "the number of pieces in one pack of orange gum."

13 Write an expression for "the number of pieces in three packs of mint gum."

14 Write an expression for "the sum of the number of pieces in one pack of orange gum and the number of pieces in three packs of mint gum."

15 Explain how you could use the expression from problem 14 to find the total number of pieces Jennifer buys if each pack of mint gum has 6 pieces.

Try It

Use what you just learned about solving expressions with variables to solve these problems. Show your work on a separate sheet of paper.

16 Martina is 3 inches less than twice as tall as her little brother. Write an expression for Martina's height. How tall is Martina if her little brother is 28 inches tall?

17 Tracy has 5 cans of vegetable juice in her refrigerator. Four of the cans each have 6 ounces of juice. Write an expression for the total ounces of juice Tracy has in her refrigerator. If the fifth can has 12 ounces, what is the total ounces of juice Tracy has?

18 Brian says that the expression $8n + 2$ is equal to 83 when $n = 1$. Explain why Brian's answer is incorrect.

Learn About

Writing and Evaluating Expressions

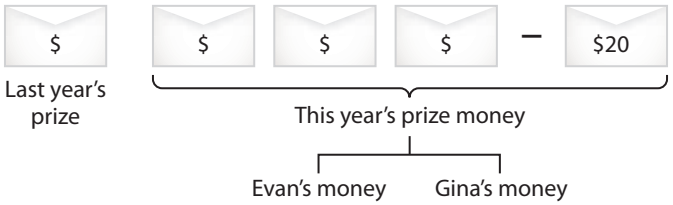
Read the problem below. Then continue exploring ways to write and evaluate expressions with variables.

Last year, the Speedster Bicycle Company held a bicycle design contest and awarded a cash prize. This year, the contest prize is $20 less than three times last year's prize. Evan and Gina win this year's contest and split the prize money evenly between them.

- Write an expression to show how much prize money Evan wins.
- If last year's prize was $50, how much prize money does Evan win?

Picture It You can draw a picture to help you understand the problem.

You can represent the prize money as envelopes and draw a line to show Evan's half.



Model It You can use words to help you solve the problem.

The contest prize is $20 less than three times last year's prize.

The phrase *less than* tells you the expression representing this year's prize money will have this overall "shape."

First amount	–	Second amount

Evan gets half of this year's prize.

The phrase *half of* tells you this year's prize money is divided by 2. The expression representing Evan's share of this year's prize money will have this overall "shape."

$$\frac{\text{First amount} - \text{Second amount}}{2}$$

Connect It **Now you will solve the problem from the previous page using the picture and model.**

19 Look at *Model It* on the previous page. This year's prize is "$20 less than" another amount. Will 20 be the first amount or the second amount? Explain.

20 Explain how to write an expression for "three times last year's prize."

21 Write an expression for "$20 less than three times last year's prize."

22 Chandler writes the expression $\frac{1}{2}(3x - 20)$ to represent Evan's winnings. Is she correct? Explain.

23 Explain how you can find how much money Evan wins if last year's prize was $50.

Try It **Use what you just learned to solve this problem. Show your work on a separate sheet of paper.**

24 The price of one share of XYZ Inc.'s stock drops by $0.02 on Monday. On Tuesday, the price goes back up by $0.05.

Write an expression with three terms to show the change in price of XYZ stock.

If one share of XYZ stock cost $34.18 at the start of business on Monday morning, what is the price of one share of XYZ stock at the close of business on Tuesday evening?

Practice Writing and Evaluating Expressions

Study the example below. Then solve problems 25–27.

Example

During a car trip, LaTasha drives 65 miles per hour for several hours. She stops for gasoline, and then drives 40 miles more.

Write an expression to show how many miles LaTasha drives in all. Use your expression to find how many miles she drives in all if she drives for 3 hours before stopping for gasoline.

Look at how you could show your work using a model.

Miles before stop	+	Miles after stop

Miles before stop is "65 miles per hour for several hours": $65h$

Miles after stop is "40 miles more": 40

Total miles is $65h + 40$; evaluate for $h = 3$.

$65(3) + 40 = 195 + 40 = 235$

Solution $65h + 40$; LaTasha drives a total of 235 miles.

This student used a model to think about the terms and operations Then, the student wrote an expression and evaluated it for $h = 3$.

Pair/Share
Are there any other expressions that would also be correct?

25 Georgia is 2 years younger than $\frac{1}{3}$ of her Aunt Mika's age. Write an expression that describes Georgia's age. How old is Georgia if her Aunt Mika is 27?

Show your work.

Solution _____

Finding $\frac{1}{3}$ of an amount is the same as dividing that amount by 3.

Pair/Share
Would the expression $m - 20$ always give Georgia's age correctly?

26 Shane buys 3 books. Each book is the same price. He also must pay $0.35 tax on each book. Write an expression to show the total cost of the books. If the price of each book is $5.15, how much does Shane spend in all?

Show your work.

The total cost of each book is its price plus tax.

Solution _____

_____

Pair/Share

How many terms are in the expression you wrote? Explain how you know.

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27 Christi alters a skirt. She cuts 7 inches off the bottom of the skirt and then adds a 5-inch ruffle to the skirt's remaining bottom edge. Which expression best represents the final length of the skirt?

A $2 - s$

B $2 + s$

C $s - 2$

D $s - 12$

Evan chose **D** as the correct answer. How did he get that answer?

_____

_____

_____

_____

_____

I can draw a picture to help myself understand this problem.

Pair/Share

Talk about the problem and then write your answer together.

Practice Writing and Evaluating Expressions

Solve the problems.

1 How many coefficients are in the expression $5x^3 - 2x^2 + 6x - 4$?

A 1

B 2

C 3

D 4

2 Mila's dog weighs 4 pounds more than 8 times the weight of Keiko's dog. Which expression could be used to find the weight of Mila's dog?

A $8k + 4$

B $4k + 8$

C $4(8k)$

D $4 + 8 + k$

3 Match the algebraic expression with its English meaning by writing the expression in the appropriate box. *Not all expressions will have a match.*

$5 - 2x$	$5x + y$	$x^2 - 5$	$5x - 2$	$(25x)^2$	$(5 - x)^2$	$2x - 5$	$5(x + y)$

"Five less than twice a number"	"Five times the sum of two numbers"	"The difference of 5 and a number, squared"

4 Which of these expressions equal 15 when $x = \frac{1}{2}$ and $y = 3$? Circle all that apply.

A $4(2y - 4x) - 1$

B $4x^2 + 2y^3 - 10$

C $4(x^2 + 1) + 2x + 3y$

D $xy + 3\frac{1}{2} + 20x$

E $\frac{9}{y} + 14x^2$

5 Keenan gives Tisha half of his strawberries. Tisha keeps 4 of the strawberries she got from Keenan and gives the rest to Suvi.

Part A Write an expression for the number of strawberries Tisha gives to Suvi. Use *k* for the number of strawberries Keenan started with.

Answer _____

Part B Could Keenan have started with 6 strawberries? Use your expression to explain why or why not.

Show your work.

Answer _____

_____

6 Jason paints $\frac{1}{4}$ of the area of his living room walls, *w*, on Monday. On Tuesday, he paints twice as much as he painted on Monday.

Part A Write an expression to find the remaining unpainted area.

Show your work.

Answer _____

Part B Jason's living room has 210 square feet of wall. How much wall is left to paint?

Show your work.

Answer _____

Self Check **Go back and see what you can check off on the Self Check on page 143.**