DVDs and Songs

5

Using Algebraic Expressions to Analyze and Solve Problems

WARM UP

Blake is twice as old as Alec.
Celia is 3 years older than Blake.

1. If Alec is 9 years old, how old is Blake?
2. If Alec is 9 years old, how old is Celia?
3. If Celia is 13 years old, how old is Blake?
4. If Celia is 13 years old, how old is Alec?
5. If Blake is 30 years old, how old is Alec?
6. If Blake is 30 years old, how old is Celia?

LEARNING GOALS

- Represent real-world problems with algebraic expressions.
- Use variables and write algebraic expressions to solve real-world and mathematical problems.

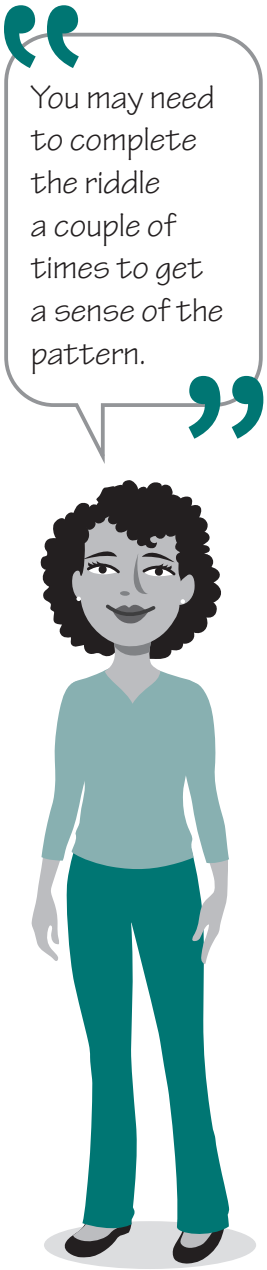
You have written numeric and algebraic expressions. How can algebraic expressions help you solve real-world problems?

Getting Started

Number Magic

Complete the number riddle by following each step.

Step 1: Pick a number between 1 and 30.
Step 2: Add 9 to your number.
Step 3: Multiply the sum by 3.
Step 4: Subtract 6 from the product.
Step 5: Divide the difference by 3.
Step 6: Subtract your original number.



1. Record your answer.

2. Compare your original number and your result with a classmate's number and result.

3. Use properties of numbers to demonstrate why the riddle works.

ACTIVITY 5.1

Writing Expressions to Solve Problems

NOTES

Jaret, Haley, Dillan, and Kierstin each collect DVDs. Jaret likes western movies, Haley likes comedies, Dillan likes action movies, and Kierstin likes science fiction movies.

Haley says: "I have twice as many DVDs as Jaret."

Dillan says: "I have four more DVDs than Haley."

Kierstin says: "I have three times as many as Dillan."

1. **If Jaret has 10 DVDs, determine the number of DVDs for each friend. Explain your reasoning.**

Haley **Dillan**

Kierstin **All four friends together**

2. **If Kierstin has 24 DVDs, determine the number of DVDs for each friend. Explain your reasoning.**

Haley **Dillan**

Jaret **All four friends together**

3. Let j represent the number of DVDs that Jaret has.

   a. Write an algebraic expression that represents the number of DVDs for each friend.

      Haley

      Dillan

      Kierstin

      All four friends together

   b. Use your expression from Question 3 to determine the number of DVDs they have altogether if Jaret has:

      10 DVDs.

      2 DVDs.

      25 DVDs.

      101 DVDs.

   c. Write an algebraic expression to represent the number of DVDs for:

      Jaret and Dillan

      Haley and Kierstin

4. Let k represent the number of DVDs Kierstin has.

   a. Write an algebraic expression that represents the number of DVDs for each friend.

      Haley

      Dillan

      Jaret

      All four friends together

b. Use your expression from Question 6 to determine the number of DVDs they have altogether if Kierstin has:

72 DVDs.

24 DVDs.

36 DVDs.

660 DVDs.

c. Write an algebraic expression to represent the number of DVDs for:

Jaret and Dillan

Haley and Kierstin

5. Let *h* represent the number of DVDs Haley has.

a. Write an algebraic expression that represents the number of DVDs for each friend.

Jaret

Dillan

Kierstin

All four friends together

b. Use your expression from Question 9 to determine the number of DVDs they have altogether if Haley has:

20 DVDs.

24 DVDs.

50 DVDs.

34 DVDs.

c. Write an algebraic expression to represent the number of DVDs for:

Jaret and Dillan

Haley and Kierstin

6. Let *d* represent the number of DVDs Dillan has.

a. Write an algebraic expression that represents the number of DVDs for each friend.

Jaret

Haley

Kierstin

All four friends together

b. Use your expression from Question 11 to determine the number of DVDs they have altogether if Dillan has:

24 DVDs.

8 DVDs.

20 DVDs.

60 DVDs.

c. Write an algebraic expression to represent the number of DVDs for:

Jaret and Dillan

Haley and Kierstin

ACTIVITY 5.2

More Solving Problems with Expressions

Five friends have their own MP3 players.

Jake has 5 more songs on his MP3 than Rick has on his.

Marilyn has half as many songs on her MP3 as Jake has on his.

Lori has 3 more than twice the number of songs on her MP3 as Rick has on his.

Cody has 3 times as many songs on his MP3 as Marilyn has on hers.

1. **Let *r* represent the number of songs on Rick's MP3 player. Write an algebraic expression that represents the number of songs on each friend's MP3 player.**

   Jake **Marilyn**

   Lori **Cody** **All five friends together**

2. **Use your expression from Question 1 to calculate the number of songs they have altogether if Rick has:**

   a. 15 songs. **b. 47 songs.**

3. **Write an algebraic expression to represent the number of songs for:**

   a. Jake, Cody, and Rick **b. Marilyn and Lori**

NOTES

TALK the TALK

Be a Magician!

You started this lesson by looking at a number riddle. Now that you have explored algebraic expressions, you can think about how they work.

1. **Write the corresponding algebraic expressions for each step to show why this number trick works.**

   - **Choose a number.**
   - **Add 5.**
   - **Double the result.**
   - **Subtract 4.**
   - **Divide the result by 2.**
   - **Subtract the number you started with.**
   - **The result is 3.**

2. **Create your own number trick. Then write the corresponding algebraic expressions to show why it works.**

Assignment

Write

How can algebraic expressions help you to solve real-world problems?

Remember

An algebraic expression is a mathematical phrase involving at least one variable and sometimes numbers and operation symbols.

Practice

At the end of each school year, Evan cleans out all of the school supplies that have collected in his desk. He can't believe how much stuff is in there this year! He has 4 times as many markers as he has pencils. He has 3 more highlighters than he has markers. He has twice as many pens as he has highlighters.

1. Suppose Evan found 5 pencils in his desk.
   a. Determine the number of markers that are in his desk. Explain your reasoning.
   b. Determine the number of highlighters that are in his desk. Explain your reasoning.
   c. Determine the number of pens that are in his desk. Explain your reasoning.
   d. Determine the total number of writing utensils that are in his desk. Explain your reasoning.
2. Suppose Evan found 78 pens in his desk.
   a. Determine the number of highlighters that are in his desk. Explain your reasoning.
   b. Determine the number of markers that are in his desk. Explain your reasoning.
   c. Determine the number of pencils that are in his desk. Explain your reasoning.
   d. Determine the total number of writing utensils that are in his desk. Explain your reasoning.
3. Let p represent the number of pencils that Evan has in his desk.
   a. Write an algebraic expression that represents the number of markers in Evan's desk.
   b. Write an algebraic expression that represents the number of highlighters in Evan's desk.
   c. Write an algebraic expression that represents the number of pens in Evan's desk.
   d. Write an algebraic expression that represents the total number of writing utensils in Evan's desk.
   e. Use your expression from part (d) to determine the total number of writing utensils in Evan's desk if there are 8 pencils.
   f. Use your expression to determine the total number of writing utensils in Evan's desk if there are 12 pencils.

Stretch

1. A three-digit number with all the same digits can be represented with an algebraic expression: $100 \times a + 10 \times a + a$. Use this fact to explain why any three-digit number with all repeated digits can be divided evenly by 37.

Review

Write an algebraic expression to represent each verbal expression.

1. One-third the sum of a number and two and one hundredths.
2. Sixteen and two-tenths subtracted from two times a number.

Calculate each percent.

3. In Ms. Romano's math class of 25 students, 8 of the students play a musical instrument. What percent of the class plays a musical instrument?
4. In Ms. Sobato's science class of 20 students, 3 of the students are in the school play. What percent of the class is in the school play?

Determine each whole for the percent and part given.

5. 68 is 32% of what number?
6. 16 is 80% of what number?