

Write Algebraic Equations



Getting the Idea

An **equation** is a mathematical sentence that contains an equal sign (=).

An **algebraic equation** contains at least one variable.

You may need to write an algebraic equation to solve some word problems.

Example 1

Nicholas has 28 coins in his coin collection. That is 5 more than his brother Sam has in his collection. Write an equation that represents s , the number of coins Sam has.

Strategy Use key words to translate the words into an equation.

Step 1

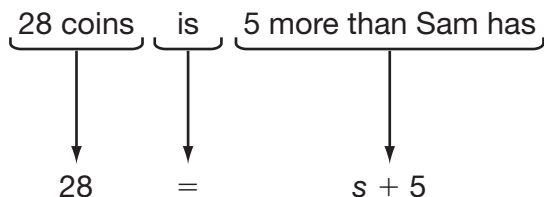
Identify the key words.

The words “more than” indicate addition.

The word “is” indicates where to place the equal sign.

Step 2

Translate the words into a number sentence.



Solution The equation $28 = s + 5$ represents the number of coins Sam has.

Example 2

Mr. Edwards purchased 3 bags of potatoes. He bought 36 potatoes in all. Each bag contains the same number of potatoes. Write an equation that represents this situation.

Strategy Use key words to translate the words into an equation.

Step 1

Identify the key words.

The words “in all” suggest either addition or multiplication.

Since each of the 3 bags contains the same number of potatoes, multiply 3 by the number of potatoes in each bag.

Step 2

Translate the words into an equation.

Let p = the number of potatoes in each bag.

$$3p = 36$$

Solution The equation $3p = 36$ represents this situation.

Example 3

Phoebe is 3 years less than half her brother’s age. Phoebe is 13 years old. Her brother is b years old. Write an equation that could be used to find her brother’s age.

Strategy Use key words to translate the words into an equation.

Step 1

Identify the key words.

The word “half” means to multiply by $\frac{1}{2}$ or to divide by 2.

The words “less than” indicate subtraction.

The word “is” suggests where to place the equal sign.

Step 2

Translate the words into a number sentence.

$$\frac{b}{2} - 3 = 13$$

Solution The equation $\frac{b}{2} - 3 = 13$ could be used to find her brother’s age.

Example 4

Rafael’s tennis racket cost 5% more than Carl’s tennis racket. Rafael’s racket cost \$126. Write an equation that could be used to find the cost of Carl’s tennis racket.

Strategy Use mathematical sense to translate the words into an equation.

Step 1

Understand how the quantities are related.

Rafael’s racket cost 5% more than 100% of the cost of Carl’s racket.

Step 2

Write an expression for the cost of Rafael's racket.

Let c = the cost of Carl's tennis racket.

$$5\%c + 100\%c \text{ or } 105\%c$$

The cost of Rafael's racket is 105% of the cost of Carl's racket.

Step 3

Simplify the expression for the cost of Rafael's racket.

$$5\%c + 100\%c =$$

$$0.05c + 1c = \quad \text{Change percents to decimals.}$$

$$1.05c \quad \text{Add.}$$

Step 4

Write the equation for the cost of Rafael's racket.

An expression for the cost, in terms of Carl's racket, is $1.05c$.

You also know that Rafael's racket cost \$126.

$$1.05c = 126$$

Solution The equation $1.05c = 126$ could be used to find the cost of Carl's tennis racket.



Coached Example

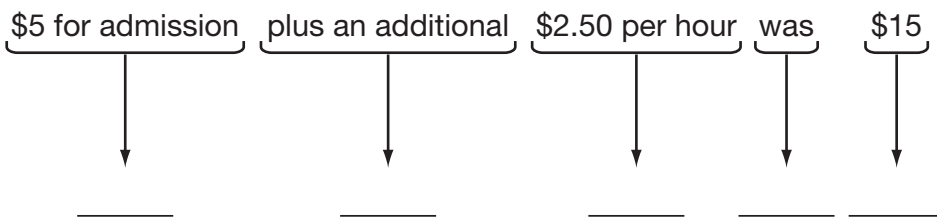
Nigel went to an ice rink and paid \$5 for admission plus an additional \$2.50 per hour to rent skates. The total cost was \$15. Write an equation that represents h , the number of hours for which Nigel rented skates.

The word “_____” indicates addition.

The words “per hour” suggest _____.

The word “_____” indicates where to place the equal sign.

Translate the words into a mathematical sentence.



The equation _____ represents the situation.



Lesson Practice

Choose the correct answer.

- Lou had r rocks in his collection. He separated his rocks into 3 equal piles. He now has 12 rocks in each pile. Which equation represents this situation?
 - $r - 3 = 12$
 - $r \div 3 = 12$
 - $r + 3 = 12$
 - $r \times 3 = 12$
- Magdalena bought a sweater that cost d dollars. She paid the clerk \$40.00. She received \$5.19 in change. Which equation represents this situation?
 - $40.00 - d = 5.19$
 - $40.00 + d = 5.19$
 - $d - 40.00 = 5.19$
 - $d - 5.19 = 40.00$
- Kevin sold 5 times as many raffle tickets as Alice. If Kevin sold 45 raffle tickets in all, which equation can be used to find a , the number of tickets Alice sold?
 - $5 + a = 45$
 - $45 + a = 5$
 - $5a = 45$
 - $45a = 5$
- Clarissa had a strip of leather that was n yards long. She cut the strip into pieces that were each $\frac{1}{4}$ yard long, with no leather left over. She used all of the pieces and made 9 bracelets. Which equation represents this situation?
 - $n + \frac{1}{4} = 9$
 - $n - \frac{1}{4} = 9$
 - $n \times \frac{1}{4} = 9$
 - $n \div \frac{1}{4} = 9$
- This season, the number of points Reggie scored was 36 less than 4 times the number of points Larry scored. Reggie scored 64 points this season. The equation below represents this situation.
$$4n - 36 = 64$$
What does n represent in this equation?
 - the number of points Reggie scored
 - the number of points Larry scored
 - how many more points Reggie scored than Larry
 - how many points Reggie and Larry scored in all

6. Jonas bought 3 books. Each book was the same price. After using a \$10-off coupon, the total charge was \$20. Which equation can be used to find b , the cost of each book?
- A. $3b + 10 = 20$
 B. $3b - 10 = 20$
 C. $10b + 3 = 20$
 D. $10b - 3 = 20$
7. A rectangle has a length of x centimeters and a width that is equal to half of its length. The perimeter of the rectangle is 22.5 centimeters. Which equation represents this situation?
- A. $(x)\left(\frac{x}{2}\right) = 22.5$
 B. $\frac{1}{2}\left(x + \frac{x}{2}\right) = 22.5$
 C. $x + \frac{x}{2} = 22.5$
 D. $x + 2x = 22.5$

8. Irina bought 2 songbooks and a new guitar. Each songbook cost the same price. The guitar cost \$250.10. Before tax, she spent a total of \$301.80. Which equation can be used to find c , the cost in dollars, of each songbook?

- A. $\frac{c}{2} + 250.10 = 301.80$
 B. $2c - 250.10 = 301.80$
 C. $2c + 250.10 = 301.80$
 D. $2 + c + 250.10 = 301.80$

9. Madison's skateboard cost 10% more than Tony's skateboard. Madison's skateboard cost \$83.

- A. Choose a variable to represent the unknown value in the situation. Explain what the variable represents.

- B. Write an equation that could be used to find the cost of Tony's skateboard. Explain your thinking.

10. David practiced his saxophone for m minutes on Monday. On Tuesday, he practiced for 30 minutes more than twice as long as Monday. He practiced for 80 minutes on Tuesday. Use values from the box to write an equation to represent how long David practiced on Tuesday.

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

m
2
30
80

11. Which situation could be represented by the equation below? Circle all that apply.

$$8x - 17 = 30$$

- A. Steve had 8 times as many dollars as Juan, x , and spent \$17. Steve has \$30 left.
 - B. Jennifer had 30 dollars. She spent 8 times as many dollars as Tia, x , and has \$17 left.
 - C. Bella is 17 years younger than 8 times Jonah's age, x . Jonah is 30.
 - D. KeShawn is 17 years younger than 8 times Billy's age, x . KeShawn is 30.
 - E. Heath scored 30 points, which is 17 less than 8 times the number of points that Tyrese scored, x .
 - F. Lena scored 17 less than 8 times the number of points Kevin scored, x . Lena scored 30 points.
 - G. Nadia has two trees. The shorter tree is 17 inches less than 8 times the height of the other. The taller tree is 30 inches tall.
12. Pedro had 6 packs of gum with p pieces in each pack. He had a total of 72 pieces of gum. Decide whether each equation represents the situation. Select True or False for each equation.
- A. $p + 6 = 72$ True False
 - B. $6p = 72$ True False
 - C. $72 \div p = 6$ True False
 - D. $p \times 6 = 72$ True False

13. Kyra read 45 pages of her book on Saturday. On Sunday, she read 100 more pages than she read on Saturday. Use values from the box to write an equation to represent how many pages Kyra read on Sunday, s .

$$\underline{\hspace{2cm}} + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

s
45
100

14. Patty has \$75. Latisha has L dollars. Patty has \$20 more than 3 times the amount of money that Latisha has. Which equation represents the situation? Circle all that apply.

- A. $75 = 20 + 3L$
 B. $3L + 20 = 75$
 C. $3 \times 75 + 20 = L$
 D. $L = 3 \times 20 + 75$
 E. $20L + 3 = 75$
 F. $3L - 20 = 75$
 G. $75 - 20 = 3L$

15. Nina is 5 years older than half of Robin's age, r . Nina is 8 years old. Does each equation show how to find Robin's age? Select Yes or No.

- A. $2r + 5 = 8$ Yes No
 B. $5 + \frac{r}{2} = 8$ Yes No
 C. $5 - \frac{r}{2} = 8$ Yes No
 D. $\frac{r}{2} + 5 = 8$ Yes No