

1.7

Reading and Writing Equations

Focus Translate statements into equations.

Explore



Part 1

- Write an algebraic expression for these statements:
Think of a number.
Multiply it by 3.
Add 4.
- The answer is 13. What is the original number?

Part 2

- Each of you writes your own number riddle.
Trade riddles with your partner.
- Write an algebraic expression for your partner's statements.
Find your partner's original number.

Reflect & Share

Compare your answer to *Part 1* with that of another pair of classmates.
If you found different values for the original number, who is correct?
Can both of you be correct? How can you check?

Connect

Zena bought 3 CDs.
Each CD costs the same amount.
The total cost was \$36.
What was the cost of 1 CD?

$$\text{\$?} + \text{\$?} + \text{\$?} = \$36$$

We can write an equation for this situation.
Let p dollars represent the cost of 1 CD.
Then, the cost of 3 CDs is $3p$. This is equal to \$36.
We can write an equation to represent this situation:
 $3p = 36$



When we write one quantity equal to another quantity, we have an *equation*.

Each quantity may be a number or an algebraic expression.

For example, $3x + 2$ is an algebraic expression; 11 is a number.

When we write $3x + 2 = 11$, we have an equation.

An equation is a statement that two quantities are equal.

Each side of the equation has the same value.

In an equation, the variable represents a specific unknown number.

When we find the value of the unknown number, we *solve* the equation.

Example

Write an equation for each sentence.

- a) Three more than a number is 15. b) Five less than a number is 7.
c) A number subtracted from 5 is 1. d) A number divided by 3 is 10.
e) Eight added to 3 times a number is 26.

A Solution

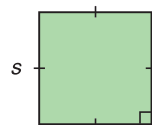
- a) Three more than a number is 15.
Let x represent the number.
Three more than x : $x + 3$
The equation is: $x + 3 = 15$
- b) Five less than a number is 7.
Let z represent the number.
Five less than z : $z - 5$
The equation is: $z - 5 = 7$
- c) A number subtracted from 5 is 1.
Let g represent the number.
 g subtracted from 5: $5 - g$
The equation is: $5 - g = 1$
- d) A number divided by 3 is 10.
Let j represent the number.
 j divided by 3: $\frac{j}{3}$
The equation is: $\frac{j}{3} = 10$
- e) Eight added to 3 times a number is 26.
Let h represent the number.
3 times h : $3h$
8 added to $3h$: $3h + 8$
The equation is: $3h + 8 = 26$

Practice

1. Write an equation for each sentence.
- a) Eight more than a number is 12. b) Eight less than a number is 12.
2. Write a sentence for each equation.
- a) $12 + n = 19$ b) $3n = 18$ c) $12 - n = 5$ d) $\frac{n}{2} = 6$

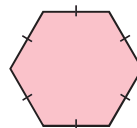
3. Write an equation for each sentence.
- Six times the number of people in the room is 258.
 - One-half the number of students in the band is 21.
 - The area of a rectangle with base 6 cm and height h centimetres is 36 cm^2 .

4. The perimeter of a square is 156 cm.
Write an equation you could use to find the side length of the square.



Recall that perimeter is the distance around a shape.

5. The side length of a regular hexagon is 9 cm.
Write an equation you could use to find the perimeter of the hexagon.



6. Match each equation with the correct sentence.
- | | |
|-----------------|---|
| a) $n + 4 = 8$ | A. Four less than a number is 8. |
| b) $4n = 8$ | B. Four more than four times a number is 8. |
| c) $n - 4 = 8$ | C. The sum of four and a number is 8. |
| d) $4 + 4n = 8$ | D. The product of four and a number is 8. |

7. Alonso thinks of a number.
He divides the number by 4, then adds 10.
The answer is 14.
Write an equation for the problem.

8. Assessment Focus

- Write an equation for each sentence.
 - Five times the number of students is 295.
 - The area of a rectangle with base 7 cm and height h centimetres is 28 cm^2 .
 - The cost of 2 tickets at x dollars each and 5 tickets at \$4 each is \$44.
 - Bhavin's age 7 years from now will be 20 years old.
- Which equation was the most difficult to write? Why?
- Write your own sentence, then write it as an equation.



Reflect

Give an example of an algebraic expression and of an equation.
How are they similar? How are they different?

1.8

Solving Equations Using Algebra Tiles

Focus Use algebra tiles and symbols to solve simple equations.

We can use tiles to represent an expression.

One yellow tile  can represent $+1$.

We call it a **unit tile**.

We also use tiles to represent variables.

This tile represents x . 

We call it an x -tile, or a **variable tile**.

A unit tile and a variable tile are collectively **algebra tiles**.

What algebraic expression do these tiles represent?



In this lesson, you will learn how to use tiles to solve equations.

In Unit 6, you will learn other ways to solve equations.

Explore

Alison had \$13.

She bought 5 gift bags.

Each bag costs the same amount.

Alison then had \$3 left.

How much was each gift bag?

- Let d dollars represent the cost of 1 gift bag. Write an equation to represent the problem.
- Use tiles. Solve the equation to find the value of d . How much was each gift bag?



Reflect & Share

Compare your equation with that of another pair of classmates.

If the equations are different, try to find out why.

Discuss your strategies for using tiles to solve the equation.

Connect

Owen collects model cars.
His friend gives him 2 cars.
Owen then has 7 cars.
How many cars did he have at the start?



We can write an equation that we can solve to find out. Let x represent the number of cars Owen had at the start.

2 more than x is: $x + 2$

The equation is: $x + 2 = 7$

We can use tiles to solve this equation.
We draw a vertical line in the centre of the page.
It represents the equals sign in the equation.

We arrange tiles on each side of the line to represent the expression or number on each side of the equation.

We want to get the x -tile on its own.

This is called *isolating the variable*.

When we solve an equation, we must *preserve* the equality.

That is, whatever we do to one side of the equation, we must also do to the other side.

To solve the equation $x + 2 = 7$:

On the left side, put tiles to represent $x + 2$.

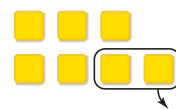
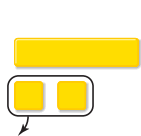


On the right side, put tiles to represent 7.



To isolate the x -tile, remove the 2 unit tiles from the left side.

To preserve the equality, remove 2 unit tiles from the right side, too.



The tiles show the solution is $x = 5$.



To *verify* the solution, replace x with 5 yellow tiles.

Left side:  \longrightarrow 7 yellow tiles

Right side:  \longrightarrow 7 yellow tiles

Since the left side and right side have equal numbers of tiles, the solution $x = 5$ is correct.

Owen had 5 cars at the start.

Example

Two more than three times a number is 14.

- Write an equation you can solve to find the number.
- Use tiles to solve the equation.
- Verify the solution.

A Solution

- Two more than three times a number is 14.

Let x represent the number.

Three times x : $3x$

Two more than $3x$: $3x + 2$

The equation is: $3x + 2 = 14$

- $3x + 2 = 14$



Remove 2 unit tiles from each side to isolate the x -tiles.



There are 3 x -tiles.

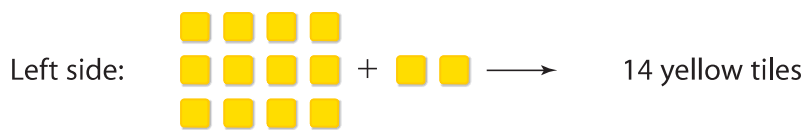
Arrange the tiles remaining on each side into 3 equal groups.



One x -tile equals 4 unit tiles.

So, $x = 4$

c) To verify the solution, replace x with 4 yellow tiles.



Since the left side and right side have equal numbers of tiles, the solution $x = 4$ is correct.

Practice

Use tiles to solve each equation.

1. Draw pictures to represent the steps you took to solve each equation.

a) $x + 6 = 13$

b) $4 + x = 12$

c) $11 = x + 7$

d) $2x = 16$

e) $18 = 3x$

f) $4x = 12$

2. Seven more than a number is 12.

a) Write an equation for this sentence.

b) Solve the equation. Verify the solution.

3. For each equation in question 1, identify a constant term, the numerical coefficient, and the variable.

4. At the used bookstore, one paperback book costs \$3.
How many books can be bought for \$12?
a) Write an equation you can solve to find how many books can be bought.
b) Solve the equation. Verify the solution.
5. Kiera shared 20 hockey cards equally among her friends.
Each friend had 4 cards.
a) Write an equation that describes this situation.
b) Solve the equation to find how many friends shared the cards.
6. In Nirmala's Grade 7 class, 13 students walk to school. There are 20 students in the class.
a) Write an equation you can solve to find how many students do not walk to school.
b) Solve the equation. Verify the solution.
7. Jacob is thinking of a number. He multiplies it by 3 and then adds 4. The result is 16.
a) Write an equation to represent this situation.
b) Solve the equation to find Jacob's number.
8. **Assessment Focus** Tarana had 2 paper plates. She bought 4 packages of paper plates.
Each package had the same number of plates. Tarana now has a total of 18 plates.
How many paper plates were in each package?
a) Write an equation you can solve to find how many plates were in each package.
b) Solve the equation. Verify the solution.
9. **Take It Further** Dominique has 20 comic books. She gives 5 to her sister,
then gives 3 to each of her friends. Dominique has no comic books left.
a) Write an equation you can solve to find how many friends were given comic books.
b) Solve the equation. Verify the solution.
10. **Take It Further**
a) Write an equation whose solution is $x = 4$.
b) Write a sentence for your equation.
c) Solve the equation.
d) Describe a situation that can be represented by your equation.

Reflect

When you solve an equation, how can you be sure that your solution is correct?