

# Lesson 2-1

## Translating Words into Equations

### Algebraic Thinking

Name \_\_\_\_\_

Date \_\_\_\_\_

### Goal of the Lesson

Translate a verbal sentence into an algebraic expression or equation before solving it.

**Main idea:** Algebra is a language. First understand the words. Then write the equation. Then solve.

### A. Translation Checklist

Use this order every time.

1. **What quantity is unknown?** Define a variable.
2. **What operations are described?** Add, subtract, multiply, divide, square, or compare.
3. **What happens first?** Look for grouped phrases.
4. **Are parentheses needed?** Parentheses show that a whole group is changed.
5. **What equation matches the sentence?** Solve only after the translation is clear.

### B. Important Translation Words

Words	Meaning	Example
sum of	add quantities	the sum of a number and 5: $x + 5$
difference of	subtract quantities	the difference of a number and 5: $x - 5$
product of	multiply quantities	the product of 3 and a number: $3x$
quotient of	divide quantities	the quotient of a number and 4: $\frac{x}{4}$
less than	reverse the order carefully	5 less than a number: $x - 5$
the quantity of	group first	3 times the quantity of a number and 2: $3(x + 2)$

**Student note:** Which phrase above is easiest to translate? Which one is most likely to cause mistakes?

## C. Model Example: Build the Equation First

**Problem.** Three times the sum of a number and 5 is 27. Find the number.

Question	Answer
What quantity is unknown?	The number is unknown. Let the number be $x$ .
What operation happens first?	The phrase “the sum of a number and 5” means $x + 5$ happens first.
Are parentheses needed?	Yes. The entire sum is multiplied by 3.
What expression is described?	$3(x + 5)$
What equation matches the sentence?	$3(x + 5) = 27$

**Now solve the equation.**

$$3(x + 5) = 27$$

$$x + 5 = 9$$

$$x = 4$$

**Check:** Three times the sum of 4 and 5 is  $3(4 + 5) = 3(9) = 27$ .

**Your explanation:** Why is  $3x + 5 = 27$  not the correct equation for this sentence?

## D. Compare Similar Phrases

Small wording changes can completely change the equation.

Phrase	What Happens First?	Expression
3 less than twice a number	multiply by 2, then subtract 3	$2x - 3$
Twice the quantity of 3 less than a number	subtract 3 first, then multiply by 2	$2(x - 3)$

**Your turn:** Explain why  $2x - 3$  and  $2(x - 3)$  are not the same expression.

## E. Guided Practice: Translate Before Solving

Complete the table. Do not solve until the equation is correct.

Verbal Sentence	Unknown	What Happens First?	Parentheses?	Equation
A number increased by 9 is 25.				
Three times a number decreased by 4 is 20.				
Three times the quantity of a number decreased by 4 is 20.				
Half of a number increased by 7 is 19.				
Four less than the product of 6 and a number is 38.				

## F. Step-by-Step Application

**Problem.** A number is multiplied by 4. Then 6 is added. The result is 34. Find the number.

**Step 1. Define the unknown.** Let the number be \_\_\_\_\_.

**Step 2. Build the expression one action at a time.**

Multiply the number by 4: \_\_\_\_\_

Then add 6: \_\_\_\_\_

**Step 3. Write the equation.**

\_\_\_\_\_ = 34

**Step 4. Solve.**

**Step 5. Check in the original sentence.**

## G. Word Problems

Translate first. Then solve.

### Problem 1

A math club has 8 more students than last year. This year there are 31 students. How many students were in the club last year?

Question	Student Work
What quantity is unknown?	
What expression represents this year?	
What equation should be solved?	
Solve and check.	

### Problem 2

A science kit costs \$12 less than twice the cost of a notebook. The science kit costs \$46. What is the cost of the notebook?

Question	Student Work
What quantity is unknown?	
What happens first?	
Are parentheses needed? Why?	
What equation should be solved?	
Solve and check.	

## H. Exit Ticket: Challenge Problems

These problems are more difficult. Translate carefully before solving. You do not need to use a table, but your work should show the same thinking process used in the examples.

For each problem, write:

- what quantity is unknown,
- what operation or grouped phrase happens first,
- the equation,
- the solution,
- a short check in the original sentence.

**Problem 1**

Five more than three times the quantity of a number decreased by 4 is 26. Find the number.

**Unknown:** \_\_\_\_\_

**What happens first?** \_\_\_\_\_

**Equation:** \_\_\_\_\_

**Solve:**

**Check:** \_\_\_\_\_

**Problem 2**

The product of 2 and the sum of a number and 9 is 6 less than four times the number. Find the number.

**Unknown:** \_\_\_\_\_

**Grouped phrase or first operation:** \_\_\_\_\_

**Equation:** \_\_\_\_\_

**Solve:**

**Check:** \_\_\_\_\_

## Exit Ticket Continued

### Problem 3

The science club has 7 fewer than twice as many students as the robotics club. Together, the two clubs have 47 students. How many students are in each club?

**Unknown:** \_\_\_\_\_

**Expression for the science club:** \_\_\_\_\_

**Equation:** \_\_\_\_\_

**Solve:**

**Answer in words:** \_\_\_\_\_

**Check:** \_\_\_\_\_

### Problem 4

A notebook and two identical lab manuals cost \$38 altogether. Each lab manual costs \$5 more than the notebook. What is the cost of the notebook, and what is the cost of one lab manual?

**Unknown:** \_\_\_\_\_

**Expression for one lab manual:** \_\_\_\_\_

**Equation:** \_\_\_\_\_

**Solve:**

**Answer in words:** \_\_\_\_\_

**Check:** \_\_\_\_\_

## Exit Ticket Continued

### Problem 5

Three times the sum of a number and 2 is equal to 5 less than twice the sum of the number and 10. Find the number.

**Unknown:** \_\_\_\_\_

**Left-side expression:** \_\_\_\_\_

**Right-side expression:** \_\_\_\_\_

**Equation:** \_\_\_\_\_

**Solve:**

**Check:** \_\_\_\_\_

### Reflection

Choose one problem above. Explain how you knew whether parentheses were needed.

\_\_\_\_\_