

Miyabi Math Unit 02:

Systems of Linear Equations

Free Sample

Selected pages from the Student Edition

Systems of Linear Equations — Step by Step

This is a free sample of *Systems of Linear Equations — Step by Step (Unit 2)*. It contains selected pages from the Student Edition: the key words, three worked examples (EX-01, EX-03, EX-06) and three practice questions (PR-01, PR-06, PR-16) with their answers. The full product includes 68 questions and a Solutions Edition with worked solutions for every question.

Part 1 · What is a solution of a system?

Key words

- A **system of linear equations** is two equations that we solve together. In this unit, each system has two variables, x and y .
- We name the equations **Eq. 1** and **Eq. 2**. A new equation that we make is called Eq. 3, Eq. 4, and so on.
- The **coefficient** of a variable is the number in front of it. In $3x$, the coefficient of x is 3. In $-y$, the coefficient of y is -1 .
- A **solution of a system** is a pair of numbers that makes **both** equations true.
- We write a solution as an **ordered pair** (x, y) . The x -value comes first. The y -value comes second. $(x, y) = (4, 1)$ means $x = 4$ and $y = 1$.
- To **check** a solution, put the numbers in place of x and y in **both** equations.

Worked examples

EX-01 Is $(x, y) = (4, 1)$ a solution of the system? Eq. 1: $x + y = 5$, Eq. 2: $2x - y = 7$

Eq. 1: Left side:	$x + y = 4 + 1$	Put 4 in place of x and 1 in place of y .
	$= 5$	
Right side:	5	$5 = 5 \checkmark$
Eq. 2: Left side:	$2x - y = 2 \times 4 - 1$	
	$= 8 - 1$	
	$= 7$	
Right side:	7	$7 = 7 \checkmark$

Both equations are true. **Yes, $(x, y) = (4, 1)$ is a solution of the system.**

Check in Eq. 1: $4 + 1 = 5 \checkmark$

Check in Eq. 2: $2 \times 4 - 1 = 8 - 1 = 7 \checkmark$

Practice A — is it a solution?

Put the numbers into **both** equations. Then answer Yes or No.

ID	Question	Hint
PR-01	Is $(x, y) = (5, 2)$ a solution of the system? Eq. 1: $4x - 3y = 14$, Eq. 2: $x + y = 7$	

Part 2 · Solving by substitution

Worked examples

EX-03 Solve the system. Eq. 1: $y = x + 2$, Eq. 2: $3x + y = 14$

Eq. 1 tells us that y is the same as $x + 2$. So we can put $(x + 2)$ in place of y in Eq. 2. Then Eq. 2 has only one variable, and we can solve it as in Unit 1.

$3x + y = 14$	Eq. 2.
$3x + (x + 2) = 14$	Put $(x + 2)$ in place of y . This is called substituting.
$4x + 2 = 14$	Combine the x -terms: $3x + x = 4x$.
$4x + 2 - 2 = 14 - 2$	Subtract 2 from both sides.
$4x = 12$	
$4x \div 4 = 12 \div 4$	Divide both sides by 4.
$x = 3$	
$y = 3 + 2$	Put 3 in place of x in Eq. 1.
$y = 5$	

Check in Eq. 1: Left: $y = 5$. Right: $3 + 2 = 5$ ✓

Check in Eq. 2: $3 \times 3 + 5 = 9 + 5 = 14$ ✓

Answer: $(x, y) = (3, 5)$

Practice B — substitution

ID	Question	Hint
PR-06	Solve the system. Eq. 1: $y = 4x - 3$, Eq. 2: $x + y = 12$	

Part 3 · Solving by elimination: adding or subtracting

Worked examples

EX-06 Solve the system. Eq. 1: $3x + y = 11$, Eq. 2: $x - y = 1$

Why we can add two equations: Eq. 1 says that $3x + y$ and 11 are the same number. Eq. 2 says that $x - y$ and 1 are the same number. So when we add $x - y$ to the left side of Eq. 1 and add 1 to the right side, we add the same amount to both sides. An equation stays true when we add the same amount to both sides. So we can add the left sides together and the right sides together.

Look at the y -terms: $+y$ in Eq. 1 and $-y$ in Eq. 2. Their sum is 0, so y disappears. This is called **eliminating** y .

Eq. 1 + Eq. 2:

$$\begin{array}{rcl}
 (3x + y) + (x - y) & = & 11 + 1 \quad \text{Add the left sides. Add the right sides.} \\
 3x + x + y - y & = & 12 \\
 4x & = & 12 \quad \text{3x + x = 4x, and y - y = 0.} \\
 4x \div 4 & = & 12 \div 4 \quad \text{Divide both sides by 4.} \\
 x & = & 3 \\
 3 \times 3 + y & = & 11 \quad \text{Put 3 in place of x in Eq. 1.} \\
 9 + y & = & 11 \\
 9 + y - 9 & = & 11 - 9 \quad \text{Subtract 9 from both sides.} \\
 y & = & 2
 \end{array}$$

Check in Eq. 1: $3 \times 3 + 2 = 9 + 2 = 11 \checkmark$

Check in Eq. 2: $3 - 2 = 1 \checkmark$

Answer: $(x, y) = (3, 2)$

Practice C — adding or subtracting the equations

ID	Question	Hint
PR-16	Solve the system. Eq. 1: $4x + y = 14$, Eq. 2: $-4x + 3y = 10$	

Answers

Answers only. The steps and checks are in the Solutions Edition. If your answer is different, check it in **both** equations first, then compare your steps with the Solutions Edition.

Practice

ID	Answer
PR-01	Yes
PR-06	$(x, y) = (3, 9)$
PR-16	$(x, y) = (2, 6)$