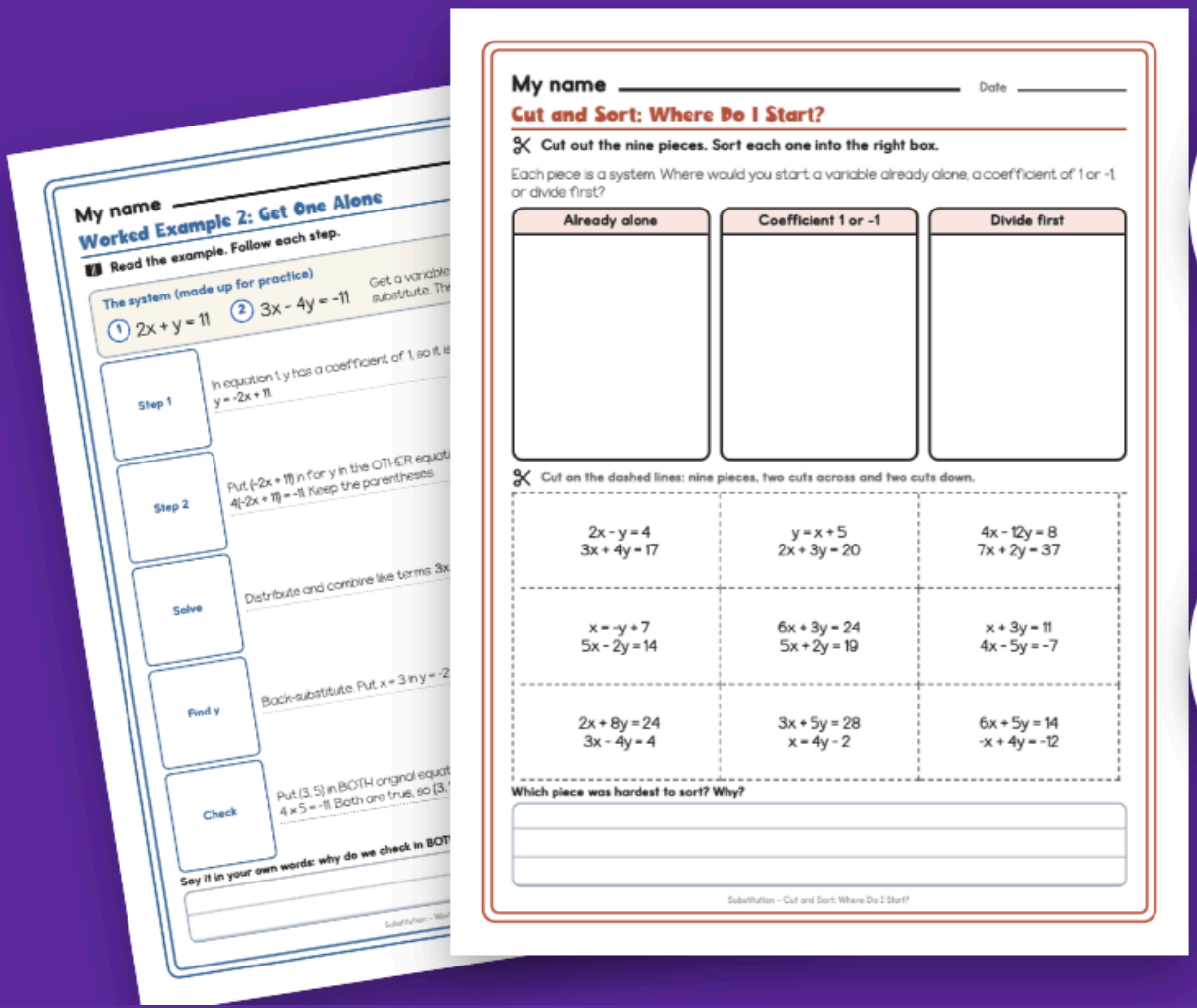
SOLVING SYSTEMS OF EQUATIONS BY SUBSTITUTION

GRADES 8-9



23 STUDENT PAGES

ANSWER KEYS

Bright Path Sped

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PREVIEW

How To Read a Page

The parts of a student page, then the kinds of sheet in the order they come.

The parts of a page

- **The answer box.** A bordered box for a number, a letter or a point. Click it to type, or print and write in it.
- **The ruled work box.** Lines 0.34 inch apart for steps. Write one step to a line: the alone line, the substitute line, the solve line.
- **The check box.** Mark it when the answer has been put back in both original equations; or pick true or false, works or does not.
- **The guided pages.** The first page of each start has fill-in boxes for the expression and for the equation you get after substituting.
- **The cut line.** Nine pieces in a short grid, edge to edge: two straight cuts across and two down.

Kind of sheet	How many	What the student does
References and words	3 sheets	The four steps, where to start, six words to match.
Worked examples	3 sheets	One for each start, every step shown, with the check in both equations.
Already alone	7 systems	A variable is alone. Substitute it into the other equation.
Coefficient 1 or -1	7 systems	Get a variable alone first, then substitute.
Divide first	7 systems	Divide every term to get a variable alone, then substitute.
Pick and mix	6 to pick, 4 to solve	Choose the start, then solve a mix.
Checks	8 points	Test a point in both equations.
Word problems	2 problems	Write the system, then substitute.
Checks and mistakes	12 items	True or false, and Devon's four mistakes to find.
Writing, quiz, sort	3 prompts, 6 items, 9 pieces	Explain-its with five ruled lines each, a quiz, exit tickets, one sort.

Untimed, unscored on the page

No student page has a timer or a score on it. The keys and the tracker are for you. The answer keys are on pages 28 to 32, and every key line shows the expression, the solved line and both numbers.

Explain-its

Their keys (page 32) say what to look for, not one right sentence. Accept any answer that uses the expression in parentheses, distributing to every term or a check in both equations correctly.

Printing and the type-in fields

The name line, every answer box, every ruled box and every check box are type-in fields in any PDF reader: click one, type, then save. You can also print and write by hand. This is a fillable PDF, not a slideshow or a word-processor file.

Room to work

Every system has its own ruled work box. The guided pages give each system a wide box beside it. If a student needs more room, hand over one page a day.

PREVIEW

Preview · Bright Path Sped

My name _____ Date _____

The Four Steps

Read the four steps. Look at the example.

Substitution means replacing a variable with something equal to it. These are the four steps.

1 Get one alone
Pick an equation and a variable. If a variable is not alone yet, get it alone. If one already is, you are ready.

2 Substitute
Put that expression in for the variable in the OTHER equation. Use parentheses around it.

3 Solve
Distribute, combine like terms, and solve for the one variable that is left.

4 Find the other, then check
Put your answer back in to find the second number (back-substitute). Check the point in BOTH equations.

Example (made up for practice)

1 $y = 2x - 1$ 2 $3x + y = 9$

Substitute: $3x + (2x - 1) = 9$. **Solve:** $5x = 10$, $x = 2$. **Find y:** $y = 3$.

Say the four steps in your own words.

PREVIEW

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My name _____ Date _____

Substitution Words

Match each word to what it means.

Write the letter of the meaning in the box. The four steps page can help.

1	**system of equations**		**A**	To get a variable alone on one side of an equation.
2	**solution**		**B**	Two or more equations that use the same variables.
3	**substitute**		**C**	To put the number you found into an equation to find the other variable.
4	**isolate**		**D**	An ordered pair (x, y) that makes both equations true.
5	**expression**		**E**	Numbers and variables with no equals sign, like 2x + 1.
6	**back-substitute**		**F**	To replace a variable with an expression that equals it.

Use two of the words in one sentence about a system.

PREVIEW

My name _____ Date _____

Worked Example 2: Get One Alone

Read the example. Follow each step.

The system (made up for practice)

① $2x + y = 11$ ② $3x - 4y = -11$

Get a variable with a 1 in front alone. Then substitute. Then check in both equations.

Step 1

In equation 1, y has a coefficient of 1, so it is easy to get alone. $2x + y = 11$ becomes $y = -2x + 11$.

Step 2

Put $(-2x + 11)$ in for y in the OTHER equation, equation 2: $3x - 4y = -11$ becomes $3x - 4(-2x + 11) = -11$. Keep the parentheses.

Solve

Distribute and combine like terms: $3x + 8x - 44 = -11$, so $11x = 33$. Divide: $x = 3$.

Find y

Back-substitute. Put $x = 3$ in $y = -2x + 11$: $y = -2 \times 3 + 11 = 5$.

Check

Put (3, 5) in BOTH original equations. Equation 1: $2 \times 3 + 1 \times 5 = 11$. Equation 2: $3 \times 3 - 4 \times 5 = -11$. Both are true, so **(3, 5)** is the solution.

Say it in your own words: why do we check in BOTH equations?

PREVIEW

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My name _____ Date _____

Already Alone 1: Guided

Substitute. Fill in the boxes.

One equation already has a variable alone. Put that expression in for the variable in the other equation.

1

1. $y = 2x - 1$
2. $3x + y = 9$

The expression: ☐

Substitute: ☐

x = ☐ y = ☐ ☐ **checked**

Show your work.

2

1. $x = 3y - 4$
2. $2x - y = 7$

The expression: ☐

Substitute: ☐

x = ☐ y = ☐ ☐ **checked**

Show your work.

3

1. $4x + 3y = 19$
2. $y = -x + 6$

The expression: ☐

Substitute: ☐

x = ☐ y = ☐ ☐ **checked**

Show your work.

PREVIEW

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My name _____ Date _____

Get One Alone 1: Guided

Get one alone. Then substitute.

Get a variable with a 1 or -1 in front alone. Then put it in the OTHER equation.

1

1) $x + 2y = 11$
2) $3x - y = 5$

Get one alone: ☐

Substitute: ☐

x = ☐ y = ☐ ☐ **checked**

Show your work.

2

1) $2x + y = 10$
2) $5x - 3y = -8$

Get one alone: ☐

Substitute: ☐

x = ☐ y = ☐ ☐ **checked**

Show your work.

3

1) $4x + 3y = 25$
2) $x - 2y = -2$

Get one alone: ☐

Substitute: ☐

x = ☐ y = ☐ ☐ **checked**

Show your work.

PREVIEW

Preview · Bright Path Sped

My name _____ Date _____

Divide First 1: Guided

Divide first. Then substitute.

Divide every term of one equation to get a variable alone. Then put it in the OTHER equation.

1

1. $2x + 4y = 14$
2. $3x - 5y = -1$

Divide, get alone: ☐

Substitute: ☐

x = ☐ y = ☐ ☐ **checked**

Show your work.

2

1. $3x - 6y = 3$
2. $4x + 3y = 26$

Divide, get alone: ☐

Substitute: ☐

x = ☐ y = ☐ ☐ **checked**

Show your work.

3

1. $7x + 3y = 27$
2. $-4x + 8y = 4$

Divide, get alone: ☐

Substitute: ☐

x = ☐ y = ☐ ☐ **checked**

Show your work.

PREVIEW

Preview · Bright Path Sped

My name _____ Date _____

Pick the Start

Look at each system. Check the best start.

Do not solve. Just pick the best place to start.

1

1. $3x + 2y = 23$
2. $x = 2y - 3$

- ☐ already alone
- ☐ coefficient 1 or -1
- ☐ divide first

2

1. $3x + y = 4$
2. $2x - 5y = 14$

- ☐ already alone
- ☐ coefficient 1 or -1
- ☐ divide first

3

1. $2x - 6y = 6$
2. $5x + 3y = 33$

- ☐ already alone
- ☐ coefficient 1 or -1
- ☐ divide first

4

1. $4x - 3y = -1$
2. $-x + 5y = 13$

- ☐ already alone
- ☐ coefficient 1 or -1
- ☐ divide first

5

1. $y = -3x + 5$
2. $5x + 2y = 8$

- ☐ already alone
- ☐ coefficient 1 or -1
- ☐ divide first

6

1. $3x + 9y = 9$
2. $2x - 5y = 17$

- ☐ already alone
- ☐ coefficient 1 or -1
- ☐ divide first

Pick one system. Tell why you chose that start.

PREVIEW

Preview · Bright Path Sped

My name _____ Date _____

Check the Solution 1

Put the point in both equations. Is it a solution?

Put x and y in the left side of each equation. Does it give the number on the right?

1 Is (3, 2) a solution?

1. $x + 2y = 7$

   gives ☐ compare with 7

2. $3x - y = 7$

   gives ☐ compare with 7

☐ **solution** ☐ **not a solution**

Show your work.

2 Is (4, 2) a solution?

1. $2x + y = 9$

   gives ☐ compare with 9

2. $x - 3y = 1$

   gives ☐ compare with 1

☐ **solution** ☐ **not a solution**

Show your work.

3 Is (5, 4) a solution?

1. $x - y = 1$

   gives ☐ compare with 1

2. $2x + y = 8$

   gives ☐ compare with 8

☐ **solution** ☐ **not a solution**

Show your work.

4 Is (-2, 1) a solution?

1. $3x + y = 5$

   gives ☐ compare with 5

2. $x + 2y = 0$

   gives ☐ compare with 0

☐ **solution** ☐ **not a solution**

Show your work.

PREVIEW

Preview · Bright Path Sped

My name _____ Date _____

Word Problems

Write a system. Solve it by substitution.

Let x and y stand for the two unknown numbers. Write two equations. Then use substitution.

1 A club has 24 students. There are 4 more girls than boys. How many boys (x) are in the club? How many girls (y)?

Equation 1: Equation 2:

Show your work.

x = y = ☐ **checked in both**

x = boys. y = girls.

2 A school play sold 18 tickets. Student tickets cost 4 dollars and adult tickets cost 7 dollars. The tickets brought in 90 dollars. How many student tickets (x) and how many adult tickets (y) were sold?

Equation 1: Equation 2:

Show your work.

x = y = ☐ **checked in both**

x = student tickets. y = adult tickets.

PREVIEW

Preview · Bright Path Sped

My name _____ Date _____

Find the Mistake

Find the mistake. Then fix it.

Devon is made up for practice. Each answer has one mistake.

1 **Devon was asked:**

Solve y = 2x + 1 and 3x + y = 11. Devon put 2x + 1 in for y in the FIRST equation.

Devon wrote: 2x + 1 = 2x + 1. He said the answer was always true.

What is wrong?

Write it the right way.

2 **Devon was asked:**

Get y alone in 2x + y = 7. Then finish the system with 3x - 2y = 7.

Devon wrote: y = 2x + 7. He moved 2x to the right side without changing its sign.

What is wrong?

Write it the right way.

3 **Devon was asked:**

Solve y = 3x - 2 and 2x + y = 8.

Devon found x = 2 and wrote: the solution is x = 2.

What is wrong?

Write it the right way.

4 **Devon was asked:**

Solve x = y + 2 and 3x + 2y = 16.

Devon wrote: 3y + 2 + 2y = 16. He multiplied only the first term by 3.

What is wrong?

Write it the right way.

PREVIEW

Preview · Bright Path Sped

My name _____ Date _____

Quiz

Pick the best answer. Write its letter.

Take your time. Guess if you are not sure.

1 Solve x + 2y = 9 for x. What do you get?

- **A** x = 2y + 9
- **B** x = -2y + 9
- **C** x = 2y - 9

2 You know y = 2x + 1. Which equation do you get when you put it in for y in 4x + y = 13?

- **A** 4x + (2x + 1) = 13
- **B** (2x + 1) + y = 13
- **C** 4(2x + 1) + y = 13

3 What is the solution of y = x + 3 and 2x + y = 15?

- **A** (7, 4)
- **B** (4, 8)
- **C** (4, 7)

4 What is the best way to start 4x + 8y = 20 and 5x + 3y = 11?

- **A** A variable is already alone
- **B** Divide first, then get one alone
- **C** Get a variable with a 1 in front alone

5 Is (2, 1) a solution of 2x + y = 5 and x + 3y = 5?

- **A** Yes, it works in both
- **B** No, it works in only one
- **C** No, it works in neither

6 You solve a system and find y = 4. What do you do next?

- **A** Stop: the solution is y = 4
- **B** Start over with the other equation
- **C** Put y = 4 in an equation to find x

PREVIEW

My name _____ Date _____

Cut and Sort: Where Do I Start?

Cut out the nine pieces. Sort each one into the right box.

Each piece is a system. Where would you start: a variable already alone, a coefficient of 1 or -1, or divide first?

Already alone	Coefficient 1 or -1	Divide first

Cut on the dashed lines: nine pieces, two cuts across and two cuts down.

$2x - y = 4$ $3x + 4y = 17$	$y = x + 5$ $2x + 3y = 20$	$4x - 12y = 8$ $7x + 2y = 37$
$x = -y + 7$ $5x - 2y = 14$	$6x + 3y = 24$ $5x + 2y = 19$	$x + 3y = 11$ $4x - 5y = -7$
$2x + 8y = 24$ $3x - 4y = 4$	$3x + 5y = 28$ $x = 4y - 2$	$6x + 5y = 14$ $-x + 4y = -12$

Which piece was hardest to sort? Why?

PREVIEW

Answer Key: Already Alone and Coefficient 1 or -1

Each line gives the expression for the variable that was alone, the solved line, then the two numbers. Equation 1 is the top equation. Accept any correct start that leads to the same point. Every point is checked in both equations in the code.

Item	System	Steps and answer
11.1	y = 2x - 1 3x + y = 9	**y = 2x - 1**; 5x = 10, x = 2; y = 3. **(2, 3)**
11.2	x = 3y - 4 2x - y = 7	**x = 3y - 4**; 5y = 15, y = 3; x = 5. **(5, 3)**
11.3	4x + 3y = 19 y = -x + 6	**y = -x + 6**; x = 1, x = 1; y = 5. **(1, 5)**
12.1	y = 4x - 5 2x + 3y = 13	**y = 4x - 5**; 14x = 28, x = 2; y = 3. **(2, 3)**
12.2	x = -2y + 7 3x - 2y = 5	**x = -2y + 7**; -8y = -16, y = 2; x = 3. **(3, 2)**
12.3	5x - 2y = -3 y = 3x + 2	**y = 3x + 2**; -x = 1, x = -1; y = -1. **(-1, -1)**
12.4	x = y + 4 2x + 5y = 22	**x = y + 4**; 7y = 14, y = 2; x = 6. **(6, 2)**
13.1	x + 2y = 11 3x - y = 5	**x = -2y + 11**; -7y = -28, y = 4; x = 3. **(3, 4)**
13.2	2x + y = 10 5x - 3y = -8	**y = -2x + 10**; 11x = 22, x = 2; y = 6. **(2, 6)**
13.3	4x + 3y = 25 x - 2y = -2	**x = 2y - 2**; 11y = 33, y = 3; x = 4. **(4, 3)**
14.1	x - 3y = 1 2x + 5y = 24	**x = 3y + 1**; 11y = 22, y = 2; x = 7. **(7, 2)**
14.2	5x + y = 13 3x + 2y = 5	**y = -5x + 13**; -7x = -21, x = 3; y = -2. **(3, -2)**
14.3	3x + 4y = 18 -x + 2y = 4	**x = 2y - 4**; 10y = 30, y = 3; x = 2. **(2, 3)**
14.4	2x - 5y = 5 3x + y = 16	**y = -3x + 16**; 17x = 85, x = 5; y = 1. **(5, 1)**

PREVIEW

Answer Key: Check the Solution, Word Problems

Each check puts the point in the equation as printed and compares it with the number on the right. In the word problems x and y are named in the problem.

Check the Solution pages 19, 20

Item	Point	Equation 1	Equation 2	Result
19.1	(3, 2)	x + 2y = 7: 1 × 3 + 2 × 2 = 7, **true**	3x - y = 7: 3 × 3 - 1 × 2 = 7, **true**	Solution
19.2	(4, 2)	2x + y = 9: 2 × 4 + 1 × 2 = 10, **false**	x - 3y = 1: 1 × 4 - 3 × 2 = -2, **false**	Not a solution: works in neither
19.3	(5, 4)	x - y = 1: 1 × 5 - 1 × 4 = 1, **true**	2x + y = 8: 2 × 5 + 1 × 4 = 14, **false**	Not a solution: works in equation 1 only
19.4	(-2, 1)	3x + y = 5: 3 × (-2) + 1 × 1 = -5, **false**	x + 2y = 0: 1 × (-2) + 2 × 1 = 0, **true**	Not a solution: works in equation 2 only
20.1	(3, 2)	x + 3y = 9: 1 × 3 + 3 × 2 = 9, **true**	2x - y = 4: 2 × 3 - 1 × 2 = 4, **true**	Solution
20.2	(2, 1)	4x + y = 9: 4 × 2 + 1 × 1 = 9, **true**	2x - y = -3: 2 × 2 - 1 × 1 = 3, **false**	Not a solution: works in equation 1 only
20.3	(1, 1)	2x - 3y = 4: 2 × 1 - 3 × 1 = -1, **false**	x + 2y = 9: 1 × 1 + 2 × 1 = 3, **false**	Not a solution: works in neither
20.4	(5, 4)	x - 2y = 4: 1 × 5 - 2 × 4 = -3, **false**	3x + y = 19: 3 × 5 + 1 × 4 = 19, **true**	Not a solution: works in equation 2 only

Word Problems page 21

Item	System	Steps and answer
21.1	x + y = 24 y = x + 4	**y = x + 4**; 2x = 20, x = 10; y = 14. **(10, 14)** x = 10 boys, y = 14 girls. Check: 1 × 10 + 1 × 14 = 24; y = 14; 1 × 10 + 4 = 14.
21.2	x + y = 18 4x + 7y = 90	**x = -y + 18**; 3y = 18, y = 6; x = 12. **(12, 6)** x = 12 student tickets, y = 6 adult tickets. Check: 1 × 12 + 1 × 6 = 18; 4 × 12 + 7 × 6 = 90.

PREVIEW

Substitution Tracker

One student, every scored sheet. Filled example: page 37.

Student _____ Teacher _____ Month _____

Page	Page type and set	Items	Right	Date	Notes
7	Substitution Words	6			
11	Already Alone 1: Guided	3			
12	Already Alone 2: On Your Own	4			
13	Get One Alone 1: Guided	3			
14	Get One Alone 2: On Your Own	4			
15	Divide First 1: Guided	3			
16	Divide First 2: On Your Own	4			
17	Pick the Start	6			
18	Mixed Practice	4			
19	Check the Solution 1	4			
20	Check the Solution 2	4			
21	Word Problems	2			
22	True or False	8			
23	Find the Mistake	4			
25	Quiz	6			
27	Cut and Sort: Where Do I Start?	9			

How to fill this in

Write how many items the student got right with no prompt, and the date. A blank means not tried yet, never wrong. There are 74 items on the 16 scored sheets. Answer keys: pages 28 to 32. Filled example: page 37.

This unit we are working on (your own standard or wording)

PREVIEW

Team Note

Use this page between team meetings or when a student moves classes, to hand off what changed without writing a note from scratch. Everything below is observable, with a blank for the number or the wording your team already uses.

Student _____ Team member _____ Date _____

Kind of sheet	Covered since last note (Y/N)	Items right	Still blank
Words			
Already alone			
Coefficient 1 or -1			
Divide first			
Pick the start, mixed			
Word problem			
Checking the solution			
True or false, mistakes			

What I saw (observable, not a conclusion)

- Solved ___ of 25 systems by substitution (pages 11 to 16 and 18).
- Picked the best start for ___ of 6 systems (page 17).
- Checked ___ of 8 points in both equations (pages 19, 20).
- Put the expression in parentheses and distributed to every term without a reminder: yes / no / with a reminder.

Next step

- Next page or set: ___, because ___ (what you saw).
- What to try in another class or at home: ___.
- What to keep doing because it is working: ___.
- Anything for the team meeting to decide: ___ (this page records what happened, never a label or a plan).

Summary, in one or two sentences, for whoever reads this next

A filled-in line, for reference

"Got 6 of 8 true or false sentences right on 10/20. Next step: reread the four steps on page 5 and ask why a point must work in both equations." That is the level of detail this page is built for. It matches the filled example on page 37.

PREVIEW

Jordan's Tracker (Invented Student)

Jordan P. is invented; nothing on this page describes a real student. The blank tracker is on page 33.

Student: Jordan P. (an invented student)

Teacher: Ms. Patel (invented)

Month: October

Page	Page type and set	Items	Right	Date	Notes
7	Substitution Words	6	5	10/5	Mixed up substitute and expression
11	Already Alone 1: Guided	3	3	10/6	-
12	Already Alone 2: On Your Own	4	3	10/8	Dropped a negative sign
13	Get One Alone 1: Guided	3	2	10/12	Moved a term without changing its sign
14	Get One Alone 2: On Your Own	4	3	10/14	Forgot to distribute to every term
15	Divide First 1: Guided	3	-	-	-
16	Divide First 2: On Your Own	4	-	-	-
17	Pick the Start	6	4	10/16	Picked divide first when there was a 1 in front
18	Mixed Practice	4	-	-	-
19	Check the Solution 1	4	4	10/19	-
20	Check the Solution 2	4	-	-	-
21	Word Problems	2	-	-	-
22	True or False	8	6	10/20	Put the expression back in the same equation
23	Find the Mistake	4	-	-	-
25	Quiz	6	5	10/22	Missed the best-start item
27	Cut and Sort: Where Do I Start?	9	-	-	-

PREVIEW

How to read it

Jordan P. has done **9 of 16** scored sheets and got **35 of 44** items right with no prompt. **2** sheets were all right and **7** carry a note. Every number comes from the table.

What the table points to

The lowest sheets are Get One Alone 1: Guided (2 of 3) and Pick the Start (4 of 6). That is where the next practice goes. The 7 sheets left blank are not tried yet, never wrong.