LESSON MAKER PRO

Keep the Solution

Add equations without changing what solves the system.

HIGH SCHOOL · A-REI.5

A-REI.5 "Given a system of two equations in two variables, show and explain why the sum of equivalent forms of the equations produces the same solution as the original system."

NAME _____ DATE _____

WHY ADDING WORKS

You can multiply an equation by a nonzero number, then add the two equations to make a new equation. Keep one of the original equations with the sum. Any solution to the original system satisfies the sum, and you can subtract the equation you kept to recover the other one.

WORKED EXAMPLE

Solve the system by adding the equations. Keep the first equation with the sum: $7x + 5y = 31$ and $3x - 5y = -1$.

1. Add: $(7x + 5y) + (3x - 5y) = 31 + (-1)$, so $10x = 30$.
2. Divide by 10: $x = 3$.
3. Use the first equation: $7(3) + 5y = 31$, so $y = 2$.
4. Subtract the first equation from $10x = 30$ to recover the second equation.

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

PRACTICE 6 problems

1 Add $x + y = 9$ and $x - y = 3$. Keep the first equation with the sum, then solve.

ANSWER _____

2 Add $2x + 3y = 12$ and $4x - 3y = 6$. Keep the second equation with the sum, then solve.

ANSWER _____

3 Add $3x + 2y = 14$ and $-3x + 5y = 14$. Keep the first equation with the sum, then solve.

ANSWER _____

4 Add $x + 2y = 11$ and $3x - 2y = 9$. Keep the first equation with the sum, then solve.

ANSWER _____

5 For $x + 2y = 14$ and $2x - y = 3$, multiply the second equation by 2. Add it to the first equation, keep the first equation, and solve.

ANSWER _____

6 Add $2x + 3y = 1$ and $4x - 3y = -7$. Keep the first equation with the sum and solve. Why does this preserve the system's solution?

ANSWER _____

APPLY IT Show your work

1 A school concert sells 26 tickets. Student tickets cost $8, adult tickets cost $12, and ticket sales total $264. Let s be student tickets and a be adult tickets. Write two equations. Add a multiple of one equation to the other to find how many of each ticket were sold.

WORK SPACE

ANSWER _____

2 At a school merch sale, hoodies cost $24 and T-shirts cost $16. A club sells 18 items for $352. Let h be hoodies and t be T-shirts. Write two equations. Add a multiple of one equation to the other to find how many of each item were sold.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For 2x + 3y = 12 and 4x - y = 10, multiply the first equation by -2 and add it to the second. Keep the second equation and solve. Explain why keeping only the sum would not be enough to find the original system's solution.

WORK SPACE AND ANSWER

Keep the Solution

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Add x + y = 9 and x - y = 3. Keep the first equation with the sum, then solve.	**2x = 12; (x, y) = (6, 3)**
2	Add 2x + 3y = 12 and 4x - 3y = 6. Keep the second equation with the sum, then solve.	**6x = 18; (x, y) = (3, 2)**
3	Add 3x + 2y = 14 and -3x + 5y = 14. Keep the first equation with the sum, then solve.	**7y = 28; (x, y) = (2, 4)**
4	Add x + 2y = 11 and 3x - 2y = 9. Keep the first equation with the sum, then solve.	**4x = 20; (x, y) = (5, 3)**
5	For x + 2y = 14 and 2x - y = 3, multiply the second equation by 2. Add it to the first equation, keep the first equation, and solve.	**5x = 20; (x, y) = (4, 5)**
6	Add 2x + 3y = 1 and 4x - 3y = -7. Keep the first equation with the sum and solve. Why does this preserve the system's solution?	**6x = -6; (x, y) = (-1, 1). Subtracting the first equation from the sum recovers the second equation.**

PART 2 · APPLY IT

1. **s + a = 26 and 8s + 12a = 264; 12 student tickets and 14 adult tickets** Add -8(s + a) = -208 to 8s + 12a = 264 to get 4a = 56. Then a = 14 and s = 12.
2. **h + t = 18 and 24h + 16t = 352; 8 hoodies and 10 T-shirts** Add -16(h + t) = -288 to 24h + 16t = 352 to get 8h = 64. Then h = 8 and t = 10.

CHALLENGE

The sum is -7y = -14, so y = 2. Keeping 4x - y = 10 gives x = 3, so (x, y) = (3, 2). The sum alone gives y = 2 but does not fix x; keeping the second equation also lets you recover the first.

Accept any equivalent sum and either original equation when the student correctly recovers the solution. A clear explanation states that subtracting the kept equation from the sum recovers the other equation.