LESSON MAKER PRO

Balance Proof Path

Solve equations by showing why every step stays true.

HIGH SCHOOL · HSA-REI.A.1

CCSS.Math.Content.HSA-REI.A.1 "Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution..."

NAME _____ DATE _____

KEEP BOTH SIDES EQUAL

Every new equation line must follow from the line before it. To keep an equation true, apply the same operation to both sides, then state the operation as your reason. You may also simplify an expression or combine like terms without changing its value.

WORKED EXAMPLE

Solve $4x + 11 = 35$. Show why each step is valid.

1. $4x + 11 - 11 = 35 - 11$ Reason: subtract 11 from both sides.
2. $4x = 24$ Reason: simplify both sides.
3. $4x/4 = 24/4$ Reason: divide both sides by 4.
4. $x = 6$ Reason: simplify both sides.

Answer: x = 6

PRACTICE 6 problems

1 Solve $x + 8 = 21$. For each new line, name the operation you apply to both sides.

ANSWER _____

2 Solve $9x = 72$. For each new line, name the operation you apply to both sides.

ANSWER _____

3 Solve $2x - 3 = 17$. For each new line, name the operation you apply to both sides.

ANSWER _____

4 Solve $x/3 + 2 = 10$. For each new line, name the operation you apply to both sides.

ANSWER _____

5 Solve $7(x + 2) = 77$. For each new line, name the operation you apply to both sides.

ANSWER _____

6 Solve $-3x + 5 = 20$. For each new line, name the operation you apply to both sides.

ANSWER _____

APPLY IT Show your work

1 A music app charges a $7 start fee and $9 for each month of service. Your total charge is $52. Write and solve an equation for the number of months, x. Explain why each operation keeps the equation balanced.

WORK SPACE

ANSWER _____

2 A robotics club already has $14 and earns $8 for each item sold at a fundraiser. The club has $54 after the fundraiser. Write and solve an equation for the number of items sold, x. Explain why each operation keeps the equation balanced.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Solve $5(x - 2) + 3 = 3x + 19$. Show each equation line and give a reason for each change. Then explain in one sentence why your final value must also satisfy the original equation.

WORK SPACE AND ANSWER

ANSWER KEY

Balance Proof Path

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve x + 8 = 21. For each new line, name the operation you apply to both sides.	**x + 8 - 8 = 21 - 8; x = 13. Reason: subtract 8 from both sides.**
2	Solve 9x = 72. For each new line, name the operation you apply to both sides.	**9x/9 = 72/9; x = 8. Reason: divide both sides by 9.**
3	Solve 2x - 3 = 17. For each new line, name the operation you apply to both sides.	**2x - 3 + 3 = 17 + 3; 2x = 20. Reason: add 3 to both sides. 2x/2 = 20/2; x = 10. Reason: divide both sides by 2.**
4	Solve x/3 + 2 = 10. For each new line, name the operation you apply to both sides.	**x/3 + 2 - 2 = 10 - 2; x/3 = 8. Reason: subtract 2 from both sides. 3(x/3) = 3(8); x = 24. Reason: multiply both sides by 3.**
5	Solve 7(x + 2) = 77. For each new line, name the operation you apply to both sides.	**7(x + 2)/7 = 77/7; x + 2 = 11. Reason: divide both sides by 7. x + 2 - 2 = 11 - 2; x = 9. Reason: subtract 2 from both sides.**
6	Solve -3x + 5 = 20. For each new line, name the operation you apply to both sides.	**-3x + 5 - 5 = 20 - 5; -3x = 15. Reason: subtract 5 from both sides. -3x/(-3) = 15/(-3); x = -5. Reason: divide both sides by -3.**

PART 2 · APPLY IT

1. **x = 5 months** Use 9x + 7 = 52. Subtract 7 from both sides to get 9x = 45, then divide both sides by 9.
2. **x = 5 items** Use 8x + 14 = 54. Subtract 14 from both sides to get 8x = 40, then divide both sides by 8.

CHALLENGE

5x - 10 + 3 = 3x + 19. Reason: distribute 5. 5x - 7 = 3x + 19. Reason: combine like terms. 2x - 7 = 19. Reason: subtract 3x from both sides. 2x = 26. Reason: add 7 to both sides. x = 13. Reason: divide both sides by 2. Because each step produced an equivalent equation, a value that satisfies the final equation also satisfies the original equation.

Accept equivalent equation chains and clear statements such as "add 3 to both sides" or "divide both sides by 9." In the challenge, accept a correct different order of valid equality-preserving steps, including combining like terms before or after moving variable terms.