LESSON MAKER PRO

Every Step Counts

Solve equations and justify each move.

HIGH SCHOOL · PC.A.E.20

PC.A.E.20 "Explain each step in solving an equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a clear-cut solution..."

NAME _____ DATE _____

KEEP EQUALITY IN VIEW

When you solve an equation, explain how each new line follows from the line before it. Adding the same number to both sides keeps an equation equivalent. Squaring both sides can create an answer that does not work in the original equation, so check any answer found that way.

WORKED EXAMPLE

Solve sqrt(x + 21) = x - 9. Check each possible answer.

1. Square both sides: $x + 21 = (x - 9)^2$.
2. Expand and rearrange: $0 = x^2 - 19x + 60$.
3. Factor: $0 = (x - 15)(x - 4)$, so $x = 15$ or $x = 4$.
4. Check the original equation: $x = 15$ gives $6 = 6$; $x = 4$ gives $5 = -5$, which is false.

Answer: x = 15

PRACTICE 6 problems

1 Solve $5x - 4 = 31$. Name one operation you use on both sides.

ANSWER _____

2 Solve $(x - 6)(x + 1) = 0$. Explain why your answers follow.

ANSWER _____

3 Solve $|x + 4| = 11$. Explain why there are two answers.

ANSWER _____

4 Solve $\sqrt{x} = x - 2$. Square both sides, then check each possible answer in the original equation.

ANSWER _____

5 Solve $5^x = 125$. Explain why your answer works.

ANSWER _____

6 Solve $(x + 5)/(x - 2) = 4$. State which value x cannot have and why.

ANSWER _____

APPLY IT Show your work

1 Six friends are considering sharing a $48 streaming subscription, but they have not decided how many will join. If two friends leave the group, each remaining person pays $4 more. Let x be the original number of friends. Write and solve an equation to find x, then check the costs.

WORK SPACE

ANSWER _____

2 A drone's height in meters, t seconds after a flight begins, is $h(t) = -t^2 + 8t + 9$ for $0 \le t \le 8$. At what times is the drone 24 meters high? Show the equation you solve and explain why both answers fit the flight.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student solves $\sqrt{x + 4} = x - 2$ by squaring both sides and gets $x = 0$ or $x = 5$. Check both values in the original equation. Which is the solution, and why did the student's method produce an extra answer?

WORK SPACE AND ANSWER

Every Step Counts

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Solve 5x - 4 = 31. Name one operation you use on both sides.	**x = 7. Add 4 to both sides, then divide both sides by 5.**
2	Solve (x - 6)(x + 1) = 0. Explain why your answers follow.	**x = 6 or x = -1. A product is zero when at least one factor is zero.**
3	Solve |x + 4| = 11. Explain why there are two answers.	**x = 7 or x = -15. The expression x + 4 can equal 11 or -11 because both have absolute value 11.**
4	Solve sqrt(x) = x - 2. Square both sides, then check each possible answer in the original equation.	**Squaring gives $x = (x - 2)^2$, so (x - 1)(x - 4) = 0. Only x = 4 works: sqrt(4) = 2, but sqrt(1) is not -1.**
5	Solve $5^x = 125$. Explain why your answer works.	**x = 3 because $5^3 = 125$.**
6	Solve (x + 5)/(x - 2) = 4. State which value x cannot have and why.	**x = 13/3. The value x = 2 is excluded because it makes the denominator zero.**

PART 2 · APPLY IT

1. **x = 6 friends. Each originally pays $8; after two leave, each pays $12.** Set 48/(x - 2) = 48/x + 4, with x > 2. Multiplying by x(x - 2) gives $x^2 - 2x - 24 = 0$, whose only solution greater than 2 is x = 6.
2. **t = 3 seconds and t = 5 seconds.** Set $-t^2 + 8t + 9 = 24$ and factor $t^2 - 8t + 15 = (t - 3)(t - 5) = 0$. Both times are in the given interval and give a height of 24 meters.

CHALLENGE

Only x = 5 works: sqrt(9) = 3 = 5 - 2. At x = 0, sqrt(4) = 2 but 0 - 2 = -2. Squaring makes 2 and -2 equal, so an answer found after squaring must be checked.

Accept equivalent equations and justifications that identify a valid operation on both sides. For radical equations, require a check in the original equation before accepting a solution.