Name _____ Date _____

Justifying Each Step with Properties of Equality

Directions: These questions use six reasons. The addition, subtraction, multiplication and division properties of equality do the same operation to both sides of an equation, and division is only by a nonzero number. The distributive property multiplies a number by each term inside parentheses. Combining like terms adds or subtracts terms with the same variable part on one side. Each step of a solved equation here does exactly one of these things.

1. Lena solved $3(x + 2) + 2x = 21$ in four steps. Match each step to the reason that allows it.

Write the letter of the matching answer on each line.

1. _____ From $3(x + 2) + 2x = 21$ to $3x + 6 + 2x = 21$
2. _____ From $3x + 6 + 2x = 21$ to $5x + 6 = 21$
3. _____ From $5x + 6 = 21$ to $5x = 15$
4. _____ From $5x = 15$ to $x = 3$

Choices for question 1

A. Combining like terms (add or subtract terms with the same variable part)
B. Division property of equality (divide both sides by the same nonzero number)
C. Subtraction property of equality (subtract the same amount from both sides)
D. Distributive property (multiply each term inside parentheses)

2. Suppose x is a number that makes $3x + 4 = 19$ true. Which reason explains why $3x = 15$ must also be true for that same x?

A. Subtracting 4 from two equal numbers gives two equal results.
B. Dividing both sides by 4 turns $3x + 4 = 19$ into $3x = 15$.
C. Subtracting 4 from only one side of an equation keeps the two sides equal.
D. Any two expressions that contain x are equal to each other.

3. Omar solved $3(x/2 - 2) - x = 4$ in four steps. Match each step to the reason that allows it.

Write the letter of the matching answer on each line.

1. _____ From $3(x/2 - 2) - x = 4$ to $3x/2 - 6 - x = 4$
2. _____ From $3x/2 - 6 - x = 4$ to $x/2 - 6 = 4$
3. _____ From $x/2 - 6 = 4$ to $x/2 = 10$
4. _____ From $x/2 = 10$ to $x = 20$

Choices for question 3

A. Combining like terms (add or subtract terms with the same variable part)
B. Addition property of equality (add the same amount to both sides)
C. Distributive property (multiply each term inside parentheses)
D. Multiplication property of equality (multiply both sides by the same number)

4. To finish solving $-4x = 28$, Ava divides both sides by -4 and gets $x = -7$. Why is this step allowed?

A. Only the side with x needs to be divided, so 28 can stay as it is.

B. Both sides of an equation can be divided by the same nonzero number, and -4 is not zero.

C. Dividing both sides by a negative number turns the equal sign around.

D. Both sides of an equation can be divided by any number, even 0.

5. Which step uses the multiplication property of equality?

A. From $x/6 = -2$ to $x = -12$

B. From $6(x - 2) = 18$ to $6x - 12 = 18$

C. From $6x + x = 14$ to $7x = 14$

D. From $x + 6 = -2$ to $x = -8$

6. Mason solved $4x - 7 = 2x + 9$ and wrote a reason next to each step.

1. $2x - 7 = 9$ (subtraction property of equality)
2. $2x = 16$ (distributive property)
3. $x = 8$ (division property of equality)

Which reason is wrong?

A. Distributive property, for going from $2x - 7 = 9$ to $2x = 16$

B. Subtraction property of equality, for going from $4x - 7 = 2x + 9$ to $2x - 7 = 9$

C. Division property of equality, for going from $2x = 16$ to $x = 8$

7. Which of these are correct first steps for solving $2(x + 1) = 14$? Select the two correct steps.

☐ A. Divide both sides by 2 to get $x + 1 = 7$.

☐ B. Use the distributive property to get $2x + 2 = 14$.

☐ C. Subtract 1 from both sides to get $2x = 13$.

☐ D. Multiply both sides by 2 to get $x + 1 = 28$.

☐ E. Subtract 2 from both sides to get $x + 1 = 12$.

8. What value of x makes $5(x - 3) + 2x = 48$ true?