Solving Equations with the Distributive Property

Explore ideas and representations

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QUICK REVIEW

Distribute to every term, then undo addition and multiplication on both sides. For $3(x+2)=21$, expand to $3x+6=21$, subtract 6 to get $3x=15$, and divide by 3 to get $x=5$. Check $3(5+2)=21$.

Worked example

Equation: solve $3(x+(2))=21$ and check.

1. Distribute: $3x+(6)=21$.
2. Subtract (6): $3x=15$.
3. Divide by (3): $x=15\div(3)=5$.
4. Check: $3(5+(2))=21$.

Answer: $x=5$.

Practice Problems

Show your thinking.

1. Integer balance: solve $2(x+(3))=16$ and check.

2. Bar model: model the balance $3(x+(-4))=6$ with matching operations on both sides. Find the unknown.

3. Substitution check: test the proposed solution $x=-2$ in $-2(x+(5))=-4$. Find the correct solution.

4. Build a total: choose the missing right side C so $\frac{1}{2}(x+(3))=C$ has solution $x=8$, then solve your equation.

5. Fix a step: a student changes $4(x+(-\frac{3}{2}))=4$ directly to $x=1$, ignoring the constant inside the parentheses.

6. Ticket rule: a cost model satisfies $-3(x+(-2))=-6$ dollars. Find the unknown quantity and explain why $x=4$ fits the total.

7. Locker-code rule: solve $5(x+(2))=30$ and check.

8. Token-count rule: choose the missing right side C so $\frac{3}{2}(x+(-3))=C$ has solution $x=8$, then solve your equation.

9. Tile-pack rule: model the balance $-4(x+(5))=-12$ with matching operations on both sides. Find the unknown.

10. Meter-offset rule: test the proposed solution $x=\frac{7}{2}$ in $6(x+(-\frac{7}{2}))=-6$. Find the correct solution.

Answer Key

1. $x = 5$.
2. $x = 6$.
3. $x = -3$.
4. $C = \frac{11}{2}$; $x = 8$.
5. $x = \frac{5}{2}$.
6. $x = 4$.
7. $x = 4$.
8. $C = \frac{15}{2}$; $x = 8$.
9. $x = -2$.
10. $x = \frac{5}{2}$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Distribute: $2x + (6) = 16$.
2. Subtract (6): $2x = 10$.
3. Divide by (2): $x = 10 \div (2) = 5$.
4. Check: $2(5 + (3)) = 16$.

Problem 2

1. Distribute: $3x + (-12) = 6$.
2. Subtract (-12): $3x = 18$.
3. Divide by (3): $x = 18 \div (3) = 6$.
4. Check: $3(6 + (-4)) = 6$.

Problem 3

1. The proposal gives -6, not -4.
2. Distribute: $-2x + (-10) = -4$.
3. Subtract (-10): $-2x = 6$.
4. Divide by (-2): $x = 6 \div (-2) = -3$.
5. Check: $-2(-3 + (5)) = -4$.

Problem 4

1. Use the given $x = 8$ first: $C = \frac{1}{2}(8 + 3) = \frac{11}{2}$.
2. Distribute: $\frac{1}{2}x + (\frac{3}{2}) = \frac{11}{2}$.
3. Subtract $(\frac{3}{2})$: $\frac{1}{2}x = 4$.
4. Divide by $(\frac{1}{2})$: $x = 4 \div (\frac{1}{2}) = 8$.
5. Check: $\frac{1}{2}(8 + (3)) = \frac{11}{2}$.

Problem 5

1. Distribute: $4x + (-6) = 4$.
2. Subtract (-6): $4x = 10$.
3. Divide by (4): $x = 10 \div (4) = \frac{5}{2}$.
4. Check: $4(\frac{5}{2} + (-\frac{3}{2})) = 4$.

Problem 6

1. Distribute: $-3x + (6) = -6$.
2. Subtract (6): $-3x = -12$.
3. Divide by (-3): $x = -12 \div (-3) = 4$.
4. Check: $-3(4 + (-2)) = -6$.

Problem 7

1. Distribute: $5x + (10) = 30$.
2. Subtract (10): $5x = 20$.
3. Divide by (5): $x = 20 \div (5) = 4$.
4. Check: $5(4 + (2)) = 30$.

Problem 8

1. Use the given $x = 8$ first: $C = \frac{3}{2}(8 - 3) = \frac{15}{2}$.
2. Distribute: $\frac{3}{2}x + (-\frac{9}{2}) = \frac{15}{2}$.
3. Subtract $(-\frac{9}{2})$: $\frac{3}{2}x = 12$.
4. Divide by $(\frac{3}{2})$: $x = 12 \div (\frac{3}{2}) = 8$.
5. Check: $\frac{3}{2}(8 + (-3)) = \frac{15}{2}$.

Problem 9

1. Distribute: $-4x + (-20) = -12$.
2. Subtract (-20): $-4x = 8$.
3. Divide by (-4): $x = 8 \div (-4) = -2$.
4. Check: $-4(-2 + (5)) = -12$.

Problem 10

1. The proposal gives 0, not -6.
2. Distribute: $6x + (-21) = -6$.
3. Subtract (-21): $6x = 15$.
4. Divide by (6): $x = 15 \div (6) = \frac{5}{2}$.
5. Check: $6(\frac{5}{2} + (-\frac{7}{2})) = -6$.

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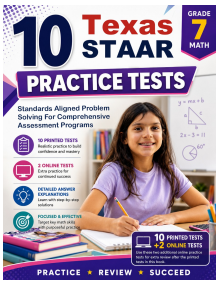

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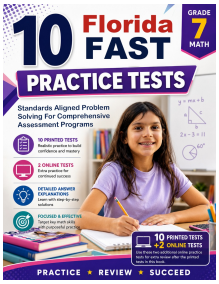

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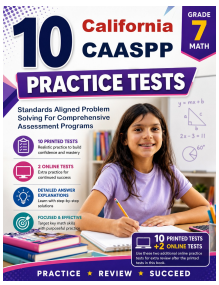

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