Solving Two-Step Equations

Explore ideas and representations

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

Undo addition or subtraction on both sides, then undo multiplication or division on both sides. To solve $3x + 4 = 19$, subtract 4 to get $3x = 15$, then divide by 3 to get $x = 5$. Check by substituting into the original equation.

Worked example

Equation: solve $3x + 4 = 19$ and check.

1. Subtract (4) from both sides: $3x + 4 - (4) = 19 - (4)$, so $3x = 15$.
2. Divide by (3): $x = 15 \div (3) = 5$.
3. Check: $3(5) + (4) = 19$.
Answer: $x = 5$.

Practice Problems

Show your thinking.

1. Isolate x in $5x - 7 = 23$. Check by substitution.

2. Solve $-4x + 9 = -3$. Keep the sign of the coefficient when dividing.

3. Find the input for $\frac{x}{3} - 5 = 2$. What undoes dividing by 3?

4. Solve $\frac{3}{4}x + 2 = -4$. State the reciprocal you use.

5. Find x in $2x - \frac{7}{2} = 1$. Leave your answer as a fraction.

6. Can $x = 0$ satisfy $11 - 6x = 11$? Verify and show why it is the only solution.

7. Choose C so $7x + 4 = C$ is true when $x = -2$. Then solve the completed equation.

8. Choose B so $-3x + B = \frac{3}{2}$ is true when $x = -\frac{5}{2}$. Then check the equation.

9. For $19 = 8x - 13$, write the equivalent equation after adding 13 to both sides, then solve.

10. Solve $-\frac{x}{2} - 4 = 3$. Which signed number divides both sides at the last step?

Answer Key

1. $x = 6$.
2. $x = 3$.
3. $x = 21$. Multiply by 3.
4. $x = -8$. Use $\frac{4}{3}$.
5. $x = \frac{9}{4}$.
6. $x = 0$. Yes, and it is the only solution.
7. $x = -2$. $C = -10$.
8. $x = -\frac{5}{2}$. $B = -6$.
9. $x = 4$. The next equation is $8x = 32$.
10. $x = -14$. Divide by $-\frac{1}{2}$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Subtract (-7) from both sides: $5x - 7 - (-7) = 23 - (-7)$, so $5x = 30$.
2. Divide by (5): $x = 30 \div (5) = 6$.
3. Check: $5(6) + (-7) = 23$.

Problem 2

1. Subtract (9) from both sides: $-4x + 9 - (9) = -3 - (9)$, so $-4x = -12$.
2. Divide by (-4): $x = -12 \div (-4) = 3$.
3. Check: $-4(3) + (9) = -3$.

Problem 3

1. Write $\frac{x}{3}$ as $\frac{1}{3}x$. Multiplying by 3 undoes division by 3 once the fraction term is alone.
2. Subtract (-5) from both sides: $\frac{1}{3}x - 5 - (-5) = 2 - (-5)$, so $\frac{1}{3}x = 7$.
3. Divide by $(\frac{1}{3})$: $x = 7 \div (\frac{1}{3}) = 21$.
4. Check: $\frac{1}{3}(21) + (-5) = 2$.

Problem 4

1. The reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$, because $\frac{3}{4} \cdot \frac{4}{3} = 1$.
2. Subtract (2) from both sides: $\frac{3}{4}x + 2 - (2) = -4 - (2)$, so $\frac{3}{4}x = -6$.
3. Divide by $(\frac{3}{4})$: $x = -6 \div (\frac{3}{4}) = -8$.
4. Check: $\frac{3}{4}(-8) + (2) = -4$.

Problem 5

1. Subtract $(-\frac{7}{2})$ from both sides: $2x - \frac{7}{2} - (-\frac{7}{2}) = 1 - (-\frac{7}{2})$, so $2x = \frac{9}{2}$.
2. Divide by (2): $x = \frac{9}{2} \div (2) = \frac{9}{4}$.
3. Check: $2(\frac{9}{4}) + (-\frac{7}{2}) = 1$.

Problem 6

1. Substitution gives $11 - 6(0) = 11$. Rewrite the left side as $-6x + 11$.
2. Subtract (11) from both sides: $-6x + 11 - (11) = 11 - (11)$, so $-6x = 0$.
3. Divide by (-6): $x = 0 \div (-6) = 0$.
4. Check: $-6(0) + (11) = 11$.

Problem 7

1. Substitute first: $C = 7(-2) + 4 = -14 + 4 = -10$.
2. Subtract (4) from both sides: $7x + 4 - (4) = -10 - (4)$, so $7x = -14$.
3. Divide by (7): $x = -14 \div (7) = -2$.
4. Check: $7(-2) + (4) = -10$.

Problem 8

1. The product is $(-3)(-\frac{5}{2}) = \frac{15}{2}$. Then $B = \frac{3}{2} - \frac{15}{2} = -6$.
2. Subtract (-6) from both sides: $-3x - 6 - (-6) = \frac{3}{2} - (-6)$, so $-3x = \frac{15}{2}$.
3. Divide by (-3): $x = \frac{15}{2} \div (-3) = -\frac{5}{2}$.
4. Check: $-3(-\frac{5}{2}) + (-6) = \frac{3}{2}$.

Problem 9

1. Swap sides without changing equality: $8x - 13 = 19$.
2. Subtract (-13) from both sides: $8x - 13 - (-13) = 19 - (-13)$, so $8x = 32$.
3. Divide by (8): $x = 32 \div (8) = 4$.
4. Check: $8(4) + (-13) = 19$.

Problem 10

1. The coefficient of x is $-\frac{1}{2}$. Divide by $-\frac{1}{2}$ to undo its multiplication.
2. Subtract (-4) from both sides: $-\frac{1}{2}x - 4 - (-4) = 3 - (-4)$, so $-\frac{1}{2}x = 7$.
3. Divide by $(-\frac{1}{2})$: $x = 7 \div (-\frac{1}{2}) = -14$.
4. Check: $-\frac{1}{2}(-14) + (-4) = 3$.

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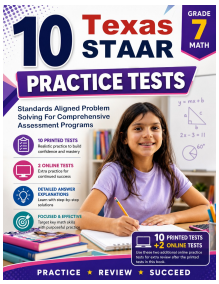

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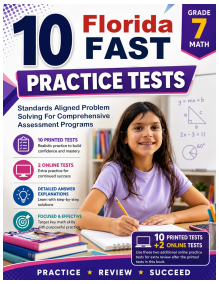

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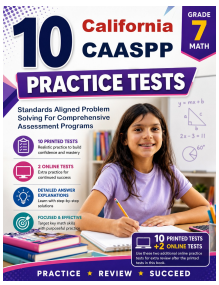

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