

Solving Multi-Step Linear Equations

Grade 8 math · Worksheet Answer Key · Standards: 8.EE.C.7a, 8.EE.C.7b

Each solution lists the balance steps in order and checks the answer in the original equation where useful. Final answers are in bold; equations with no solution or infinitely many solutions are labeled in words.

Standards: 8.EE.C.7a, 8.EE.C.7b · **Level:** Grade 8

Problem 1 One-variable equations

(a) Add 8: $5x = 35$. Divide by 5: $x = 7$. (b) Subtract 3: $\frac{x}{4} = 6$. Multiply by 4: $x = 24$.

(a) $x = 7$ (b) $x = 24$

Problem 2 Variable on both sides

Subtract $2x$ from both sides: $x + 7 = 15$. Subtract 7: $x = 8$. Check: $31 = 31$.

$x = 8$

Problem 3 Distribute first

Distribute: $4x + 12 = 32$. Subtract 12: $4x = 20$. Divide by 4: $x = 5$.

$x = 5$

Problem 4 Combine like terms

Combine: $4x + 9 = 25$. Subtract 9: $4x = 16$. Divide: $x = 4$.

$x = 4$

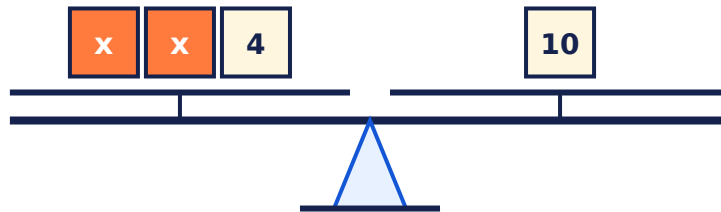
Problem 5 Fraction coefficient

Multiply both sides by the reciprocal $\frac{3}{2}$: $x = 18 \cdot \frac{3}{2} = 27$.

$x = 27$

Problem 6 Balance scale

The equation is $3x + 4 = x + 10$. Remove one x from each side: $2x + 4 = 10$. Remove 4: $2x = 6$. So $x = 3$.



After removing one x from each side.

$x = 3$

Problem 7 Both sides variable

(a) Subtract $3x$: $4x - 5 = 19$. Add 5: $4x = 24$. So $x = 6$. (b) Add $2x$: $9 = 7x - 12$. Add 12: $21 = 7x$. So $x = 3$.

(a) $x = 6$ (b) $x = 3$

Problem 8 Distribute on both sides

Distribute: $6x - 15 = 2x + 14$. Subtract $2x$: $4x - 15 = 14$. Add 15: $4x = 29$. So $x = \frac{29}{4} = 7.25$.

$x = \frac{29}{4}$

Problem 9 Clear the fractions

Multiply every term by 10: $5x + 2x = 140$. Then $7x = 140$, so $x = 20$. Check: $10 + 4 = 14$.

$x = 20$

Problem 10 Decimal coefficients

Subtract $0.5x$: $3.2 = 0.8x - 0.8$. Add 0.8: $4 = 0.8x$. Divide by 0.8: $x = 5$. Check: $5.7 = 5.7$.

$x = 5$

Problem 11 How many solutions?

(a) Subtract $4x$: $6 = 9$, false, so none (panel A). (b) Distribute: $3x + 6 = 3x + 6$, always true, so infinitely many (panel B). (c) $3x = 9$, so $x = 3$ (panel C).

(a) none (b) infinitely many (c) one solution, $x = 3$

Problem 12 Choosing k

(a) With $k = 6$ the x terms cancel and leave $5 = -3$, which is false. (b) With $k = 4$ both sides are identical.

(a) $k = 6$ (b) $k = 4$

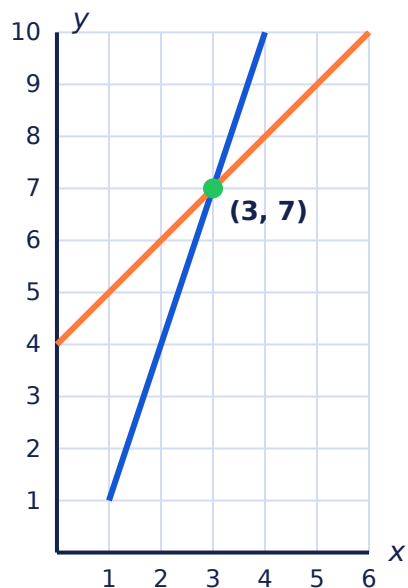
Problem 13 Rational coefficient

Multiply both sides by $\frac{8}{7}$: $x + 4 = 16$. Subtract 4: $x = 12$. Check: $\frac{7}{8} \cdot 16 = 14$.

$x = 12$

Problem 14 Graph and equation

The lines meet at $(3, 7)$, so $x = 3$. Algebra: subtract x : $2x - 2 = 4$. Add 2: $2x = 6$. So $x = 3$.



Intersection at $(3, 7)$.

$x = 3$

Problem 15 Gym membership

Set $25 + 18m = 23m$. Subtract $18m$: $25 = 5m$, so $m = 5$. Cost: $25 + 18 \cdot 5 = 115$ and $23 \cdot 5 = 115$.

5 months; \$115

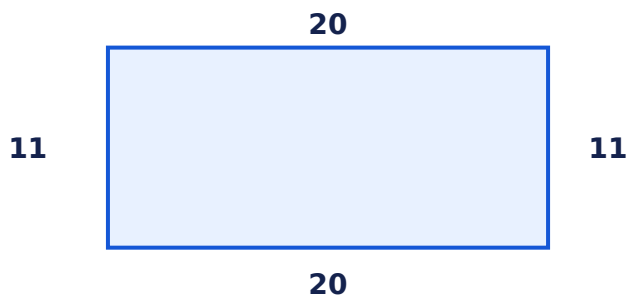
Problem 16 Two taxi companies

Set $4 + 2.5m = 1.6 + 3.1m$. Subtract $2.5m$: $4 = 1.6 + 0.6m$. Subtract 1.6 : $2.4 = 0.6m$, so $m = 4$. Charge: $4 + 2.5 \cdot 4 = 14$ and $1.6 + 3.1 \cdot 4 = 14$.

4 miles; \$14.00

Problem 17 Garden rectangle

Perimeter: $2[(3x + 2) + (x + 5)] = 62$. Simplify: $2(4x + 7) = 62$, so $4x + 7 = 31$ and $x = 6$. Length = $3 \cdot 6 + 2 = 20$ and width = $6 + 5 = 11$. Check: $2(31) = 62$.



Dimensions.

$x = 6$; length 20 ft; width 11 ft

Problem 18 Consecutive odd integers

Let the integers be n , $n + 2$ and $n + 4$. Then $3n + 6 = 87$, so $3n = 81$ and $n = 27$. The integers are 27, 29 and 31, and $27 + 29 + 31 = 87$.

27, 29 and 31

Problem 19 What does $8 = 8$ mean?

After distributing, both sides are the same expression, $2x + 8$. The variable canceled and the statement $8 = 8$ is true, so every value of x works. For no solution, try $2x + 3 = 2x + 7$, which reduces to the false statement $3 = 7$.

Infinitely many solutions; example with none: $2x + 3 = 2x + 7$

Problem 20 Fractions on both sides

Multiply every term by 4: $(3x - 2) + 4 = 2(x + 7)$. Simplify: $3x + 2 = 2x + 14$. Subtract $2x$: $x + 2 = 14$. So $x = 12$. Check: $\frac{34}{4} + 1 = 9.5$ and $\frac{19}{2} = 9.5$.

$x = 12$