

Solving Systems of Linear Equations Three Ways

Grade 9 – Algebra 1 math · Worksheet Answer Key · Standards: A-REI.C.5, A-REI.C.6, A-REI.D.11, A-CED.A.3

Each answer key states the method and the key step, then the ordered pair and a check in the original equations. If you used a different method, compare your final pair: it must be the same.

Standards: A-REI.C.5, A-REI.C.6, A-REI.D.11, A-CED.A.3 · **Level:** Grade 9 Algebra 1

Problem 1 Check a solution

First equation: $3 + 1 = 4$ ✓. Second equation: $2(3) - 1 = 5$ ✓.

Yes, (3, 1) is a solution.

Problem 2 Check a failing pair

First: $3(2) - 7 = -1$ ✓. Second: $2 + 2(-1) = 0$, not 1.

No, it fails the second equation.

Problem 3 Substitution with $y = 2x$

$x + 3x = 28$, so $4x = 28$ and $x = 7$. Then $y = 21$.

Check: $7 + 21 = 28$ ✓.

(7, 21)

Problem 4 Substitution with $x = y + 4$

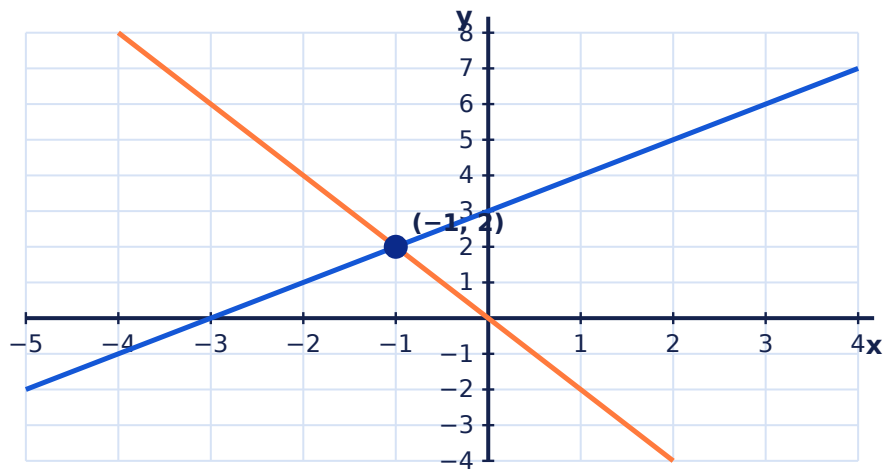
$2(y + 4) + y = 17$, so $3y + 8 = 17$ and $y = 3$. Then $x = 7$.

Check: $2(7) + 3 = 17$ ✓.

(7, 3)

Problem 5 Read the graph

The lines cross where $x = -1$ and $y = 2$. Check with equations $y = x + 3$ and $y = -2x$: $2 = -1 + 3$ ✓ and $2 = -2(-1)$ ✓.



Crossing point: $(-1, 2)$.

$(-1, 2)$

Problem 6 Elimination by adding

Add: $2x = 20$, so $x = 10$. Then $10 + y = 15$ gives $y = 5$.

Check: $10 - 5 = 5$ ✓.

$(10, 5)$

Problem 7 Elimination with opposite terms

Add: $11x = 33$, so $x = 3$. Then $21 + 3y = 27$ gives $y = 2$.

Check: $12 - 6 = 6$ ✓.

$(3, 2)$

Problem 8 Scale one equation

Multiply the second equation by 5: $15x - 5y = 25$. Add to the first: $17x = 51$, so $x = 3$.

Then $3(3) - y = 5$ gives $y = 4$.

Check: $2(3) + 5(4) = 26$ ✓.

$(3, 4)$

Problem 9 Scale both equations

Multiply the first by 2 and the second by 3: $8x + 6y = 50$ and $9x - 6y = 18$. Add: $17x = 68$, so $x = 4$.

Then $16 + 3y = 25$ gives $y = 3$.

Check: $12 - 6 = 6$ ✓.

(4, 3)

Problem 10 No solution

Subtract the equations: $0 = 6$, which is false.

The graph shows parallel lines with the same slope $-1/2$ and different intercepts.

No solution

Problem 11 Infinitely many solutions

Multiply the second equation by 2: $10x - 4y = 14$, identical to the first.

Subtracting gives $0 = 0$, a true statement.

Infinitely many solutions (same line)

Problem 12 Why elimination works

Subtract $2(x + y) = 18$ from $2x + 5y = 33$: $3y = 15$, so $y = 5$ and $x = 4$.

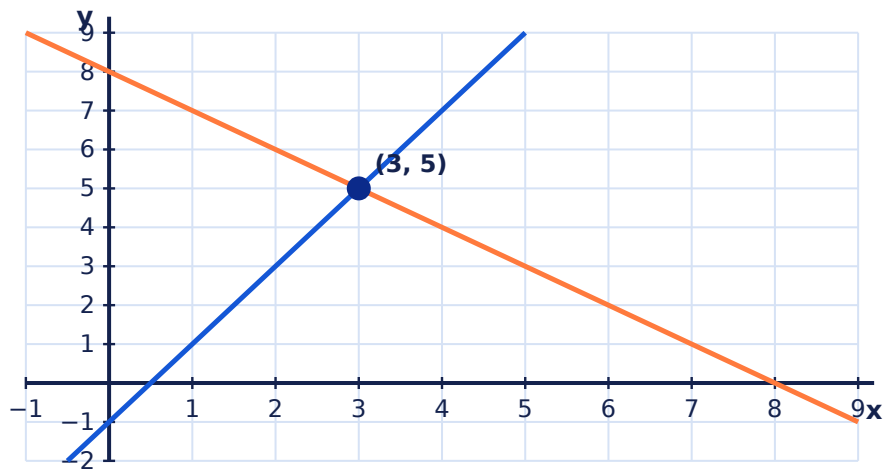
The original system gives $4 + 5 = 9$ and $8 + 25 = 33$, so $(4, 5)$ satisfies both systems.

The new second equation is true whenever both originals are true, so the solution is unchanged.

(4, 5) in both systems

Problem 13 Solve by graphing

The first line has y-intercept -1 and slope 2, passing through $(0, -1)$ and $(3, 5)$; the second passes through $(0, 8)$ and $(8, 0)$. They cross at $(3, 5)$.



The graphs cross at (3, 5).

Check: $2(3) - 1 = 5$ ✓ and $-3 + 8 = 5$ ✓.

(3, 5)

Problem 14 Two functions equal

Set $4x - 7 = -x + 13$, so $5x = 20$ and $x = 4$.

$f(4) = 9$ and $g(4) = -4 + 13 = 9$.

The graphs of f and g cross at (4, 9).

$x = 4$ and the common output 9

Problem 15 Ticket sales

Let a be adults and s students: $a + s = 480$ and $12a + 7s = 4,530$.

Substitute $s = 480 - a$: $12a + 7(480 - a) = 4,530$, so $5a + 3,360 = 4,530$ and $a = 234$. Then $s = 246$.

Check: $234(12) + 246(7) = 2,808 + 1,722 = 4,530$ ✓.

234 adult and 246 student tickets

Problem 16 Coffee mixture

Let x and y be pounds: $x + y = 10$ and $8x + 14y = 104$ (since $10 \times 10.40 = 104$).

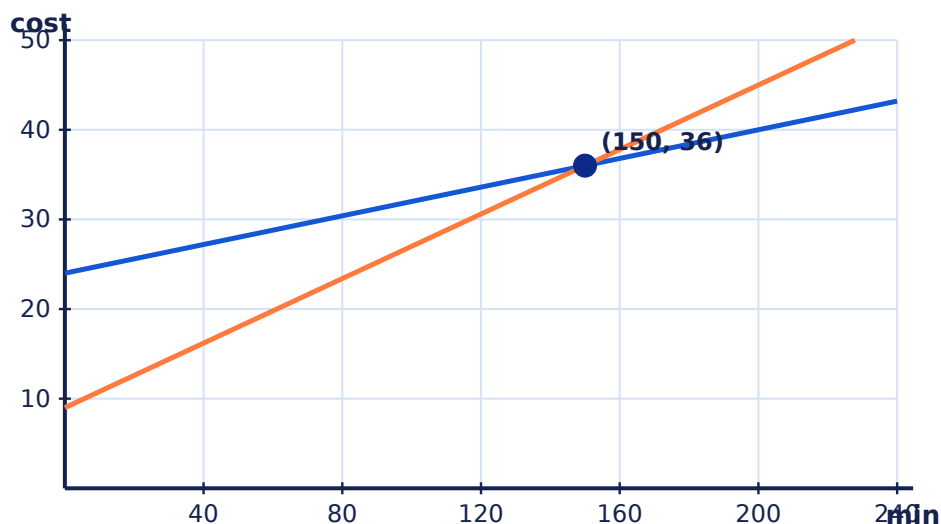
$8x + 14(10 - x) = 104$ gives $-6x = -36$ and $x = 6$, so $y = 4$.

Check: $48 + 56 = 104$ ✓.

6 pounds of \$8 beans and 4 pounds of \$14 beans

Problem 17 Phone plans

$24 + 0.08m = 9 + 0.18m$, so $15 = 0.10m$ and $m = 150$. Bill: $24 + 12 = \$36$.



The bills are equal at 150 minutes: \$36.

At 150 minutes; \$36

Problem 18 Kayak and river

Let b be the paddling speed and c the current. With the current: $b + c = 18 \div 2 = 9$. Against it: $b - c = 18 \div 3 = 6$.

Add: $2b = 15$, so $b = 7.5$ and $c = 1.5$.

Kayaker 7.5 mi/h; river 1.5 mi/h

Problem 19 Nickels and dimes

$n + d = 35$ and $5n + 10d = 280$ (in cents).

$5n + 10(35 - n) = 280$ gives $-5n = -70$, so $n = 14$ and $d = 21$.

Check: $70 + 210 = 280$ ✓.

14 nickels and 21 dimes

Problem 20 Garden dimensions

$$l = 2w + 3 \text{ and } 2l + 2w = 66.$$

$$2(2w + 3) + 2w = 66 \text{ gives } 6w + 6 = 66 \text{ and } w = 10, \text{ so } l = 23.$$

$$\text{Check: } 2(23) + 2(10) = 66 \checkmark.$$

10 feet by 23 feet