

Fix it 1 Line them up

Simultaneous equations · ANSWERS

Write each equation as the x term, the y term, = the number. Label them (1) and (2), x under x and y under y .

EXAMPLE

Line up $y = 2x - 5$ and $3x + y = 20$.

1. Take $2x$ from both sides: $-2x + y = -5$.
2. (1) $-2x + y = -5$
3. (2) $3x + y = 20$
4. x under x , y under y , the numbers after the $=$.

YOUR TURN

- 1 Line it up: x term, y term, = the number.
 $5y + 2x = 9$

$$2x + 5y = 9$$

- 2 Line it up.
 $3x = 14 - 4y$

$$3x + 4y = 14$$

- 3 Line it up.
 $2y = 5x + 1$

$$-5x + 2y = 1 \text{ (or } 5x - 2y = -1)$$

Check: A term that moves across the $=$ changes sign. Pick a pair that fits the old equation: it fits the new one too.

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Fix it 2 Match or multiply?

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Look first: do the x terms or the y terms already have the same number in front, sign aside? Then do not multiply. If not, multiply to make one pair match.

EXAMPLE

(1) $2x + 5y = 16$

(2) $3x + y = 11$

Match or multiply?

1. x : 2 and 3. No match.
2. y : 5 and 1. No match.
3. $5y$ is 5 lots of y , so (2) $\times 5$ makes $5y$ in both.

YOUR TURN

- 1 (1) $4x - 3y = 2$
 (2) $x + 3y = 13$
 Multiply? If so, which equation, and by what?

No: $-3y$ and $3y$ match

- 2 (1) $5x + 2y = 1$
 (2) $x + 3y = 8$
 Multiply? If so, which equation, and by what?

(2) $\times 5$, to match x

- 3 (1) $3x + 4y = 10$
 (2) $2x - 5y = 14$
 Multiply both so the x terms match.

(1) $\times 2$ and (2) $\times 3$

Check: Read your two matched terms: the same number in front, whatever the signs.

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Fix it 3 Multiply every term

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Multiply every term by the number: the x term, the y term and the number after the $=$, each with its sign.

EXAMPLE

(2) $x - 4y = -2$. Multiply it by 3.

1. $3 \times x = 3x$

2. $3 \times (-4y) = -12y$

3. $3 \times (-2) = -6$

4. (3) $3x - 12y = -6$

YOUR TURN

1 Multiply $4x + y = 9$ by 2.

$$8x + 2y = 18$$

2 Multiply $3x - 2y = 5$ by 4.

$$12x - 8y = 20$$

3 Multiply $2x - 3y = -4$ by -2 .

$$-4x + 6y = 8$$

Check: Divide every term of your answer by the number. You get the old equation back.

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Fix it 4 Add or subtract?

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Same term, sign included ($3y$ and $3y$, $-2y$ and $-2y$): subtract. Opposite terms ($3y$ and $-3y$): add. Not sure? Do both and see which removes a letter.

EXAMPLE

(1) $4x + 3y = 22$

(2) $2x - 3y = 2$

1. $3y$ and $-3y$ are opposite terms: add.

2. (1) + (2): $6x = 24$

3. Not sure? Do both and see. (1) - (2) gives $2x + 6y = 20$: nothing goes.

YOUR TURN

1 (1) $5x + 2y = 19$

(2) $3x + 2y = 13$

Add or subtract? Write what is left.

$$\text{Subtract: } 2x = 6$$

2 (1) $3x - 4y = 1$

(2) $x + 4y = 7$

Add or subtract? Write what is left.

$$\text{Add: } 4x = 8$$

3 (1) $6x - 5y = 4$

(2) $6x - 2y = 10$

Add or subtract? Write what is left.

$$\text{Subtract: } -3y = -6 \text{ (or } 3y = 6)$$

Check: One letter has gone. If both are still there, you needed the other one.

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Fix it 5 Find the first letter

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$8y = 4$ means 8 lots of y make 4. Divide the number after the $=$ by the number in front: $y = \frac{4}{8} = \frac{1}{2}$.

EXAMPLE

$6y = 3$. Find y .

1. 6 lots of y make 3, so each y is less than 1.

2. Divide 3 by 6: $y = \frac{3}{6}$

3. $y = \frac{1}{2}$

4. Check: $6 \times \frac{1}{2} = 3 \checkmark$

YOUR TURN

1 $5x = -20$. Find x .

$$x = \underline{\underline{-4}}$$

2 $4y = 2$. Find y .

$$y = \underline{\underline{\frac{1}{2}}}$$

3 $-6x = 9$. Find x .

$$x = \underline{\underline{-\frac{3}{2} \text{ (or } -1\frac{1}{2})}}$$

Check: Multiply your answer by the number in front. You get back the number after the $=$.

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Fix it 6 Substitute back

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Put the letter you found into one of the equations, in a bracket. Then solve for the other letter.

EXAMPLE

$x = 3$. Find y from $2x - 5y = 16$.

1. $2(3) - 5y = 16$

2. $6 - 5y = 16$

3. $-5y = 10$

4. $y = -2$

YOUR TURN

1 $x = 4$. Find y from $3x + y = 17$.

$$y = \underline{\underline{5}}$$

2 $y = -2$. Find x from $4x - 3y = 26$.

$$x = \underline{\underline{5}}$$

3 $x = \frac{1}{2}$. Find y from $6x + 5y = 23$.

$$y = \underline{\underline{4}}$$

Check: A negative value goes in a bracket: $-3(-2) = +6$.

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Fix it 7 Check in the other one

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Put both values into the equation you did not use to find the second letter. It must come out true. If not, look for the slip.

EXAMPLE

(1) $3x + 2y = 8$

(2) $5x - 2y = 24$

$x = 4, y = -2$ found from (1). Check it.

1. Use (2), the one you did not use.

2. $5(4) - 2(-2) = 20 + 4 = 24 \checkmark$

3. Both are true: it is the solution.

YOUR TURN

1 (1) $2x + y = 7$

(2) $x - y = 2$

Is $x = 3, y = 1$ the solution? Check both.

Yes: both are true

2 (1) $4x + y = 13$

(2) $3x - y = 4$

Is $x = 2, y = 5$ the solution? Check both.

No: (2) gives 1, not 4

3 (1) $3x + 2y = 10$

(2) $x - 3y = 7$

Ali says $x = -1, y = 4$. Is Ali right?

No: (1) gives 5, not 10

Check: A pair that fits one equation only is not the solution.

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Fix it 8 From words

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Write a Let line first: each letter is a number, with its unit. Then one equation for each fact.

EXAMPLE

5 plant pots and 2 seed trays cost £13.

3 pots and 2 trays cost £9.

1. Let p = the cost of one pot in pounds, t = one tray.

2. (1) $5p + 2t = 13$

3. (2) $3p + 2t = 9$

YOUR TURN

1 2 adult and 3 child ferry tickets cost £31. 2 adult and 1 child cost £21. Let a and c be the prices in pounds of one adult and one child ticket. Write two equations.

$2a + 3c = 31, 2a + c = 21$

2 Two numbers add to 23. Their difference is 7. Let x be the bigger number and y the smaller. Write two equations.

$x + y = 23, x - y = 7$

3 A rectangle is 5 cm longer than it is wide. Its perimeter is 38 cm. Let x cm be the length and y cm the width. Write two equations.

$x - y = 5, 2x + 2y = 38$

Check: Read each equation back in words. It says what the question says.

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