

# Solving Systems by Elimination

Name: \_\_\_\_\_

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## Q Quick Review

**Elimination method:** combine the two equations (by adding or subtracting them) to eliminate one variable. Steps: **(1)** line up like terms; **(2)** if needed, multiply one or both equations so that one variable's coefficients are opposites; **(3)** add the equations — one variable disappears; **(4)** solve the resulting one-variable equation; **(5)** substitute back to find the other variable. Elimination is best when neither equation is conveniently solved for a variable. Same special outcomes as before:  $0 = 0$  means infinitely many solutions,  $0 = \text{nonzero}$  means no solution.

## PRACTICE

Solve each system by elimination.

- |                                 |       |                                   |       |
|---------------------------------|-------|-----------------------------------|-------|
| 1. $x + y = 10, x - y = 2$      | _____ | 11. $2x - y = 5, 3x + y = 15$     | _____ |
| 2. $2x + y = 7, 2x - y = 1$     | _____ | 12. $x + 3y = 10, 2x - y = 6$     | _____ |
| 3. $3x + 2y = 12, 3x - y = 6$   | _____ | 13. $4x - 3y = 7, 2x + 3y = 5$    | _____ |
| 4. $x + 2y = 8, x - y = 2$      | _____ | 14. $x + y = 8, x + y = 8$        | _____ |
| 5. $5x + 3y = 17, 2x - 3y = -3$ | _____ | 15. $5x + 2y = 4, 5x + 2y = 10$   | _____ |
| 6. $4x + y = 11, 2x + y = 7$    | _____ | 16. $6x + 5y = 23, -6x + y = -11$ | _____ |
| 7. $3x + 2y = 8, x + y = 3$     | _____ | 17. $3x - 4y = 5, 6x + 4y = 22$   | _____ |
| 8. $2x + 3y = 13, x - y = 1$    | _____ | 18. $x + y = 6, x - y = 0$        | _____ |
| 9. $x + y = 5, 2x + 2y = 10$    | _____ | 19. $7x + 2y = 24, 3x - 2y = 6$   | _____ |
| 10. $3x + y = 5, 3x + y = 7$    | _____ | 20. $5x - y = 11, 2x + y = 9$     | _____ |

## ◆ Word Problems

21. A number puzzle says two numbers have a sum of 30 and a difference of 8. Write a system and find the two numbers.

\_\_\_\_\_

22. A bakery sold 40 croissants and 50 muffins for \$185. The next day it sold 30 croissants and 20 muffins for \$116. Find the price of each.

\_\_\_\_\_

23. Adult tickets are \$10, children's \$6. Total tickets: 200; total revenue: \$1600. How many of each?

\_\_\_\_\_

24. A boat travels 30 miles downstream in 2 hours and 30 miles upstream in 3 hours. Find the boat speed and current speed.

\_\_\_\_\_



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## Answer Keys

- |  |  |
|--|--|
| <p>1. (6, 4)</p> <p>2. (2, 3)</p> <p>3. (8/3, 2)</p> <p>4. (4, 2)</p> <p>5. (2, 7/3)</p> <p>6. (2, 3)</p> <p>7. (2, 1)</p> <p>8. (3.2, 2.2)</p> <p>9. infinitely many</p> <p>10. no solution</p> <p>11. (4, 3)</p> <p>12. (4, 2)</p> | <p>13. (2, 1/3)</p> <p>14. infinitely many</p> <p>15. no solution</p> <p>16. (13/6, 2)</p> <p>17. (3, 1)</p> <p>18. (3, 3)</p> <p>19. (3, 3/2)</p> <p>20. (20/7, 23/7)</p> <p>21. 19 and 11</p> <p>22. \$3 croissant, \$1.30 muffin</p> <p>23. 100 adult, 100 child</p> <p>24. <math>b = 12.5</math>, <math>c = 2.5</math> mph</p> |
|--|--|

### Step-by-Step Tutor Notes

1. For a table question, slow down and locate the exact row, column, or cell before calculating. Add:  $2x = 12 \Rightarrow x = 6$ ,  $y = 4$ . This gives (6, 4).
2. For a table question, slow down and locate the exact row, column, or cell before calculating. Add:  $4x = 8 \Rightarrow x = 2$ ,  $y = 3$ . This gives (2, 3).
3. Read the table by matching the correct row and column first, then use the count or total that fits the question. Subtract:  $3y = 6 \Rightarrow y = 2$ . Then  $3x + 4 = 12 \Rightarrow x = \frac{8}{3}$ . This gives (8/3, 2).
4. Read the table by matching the correct row and column first, then use the count or total that fits the question. Subtract:  $3y = 6 \Rightarrow y = 2$ ,  $x = 4$ . This gives (4, 2).
5. For a table question, slow down and locate the exact row, column, or cell before calculating. Add:  $7x = 14 \Rightarrow x = 2$ . Then  $10 + 3y = 17 \Rightarrow y = \frac{7}{3}$ . This gives (2, 7/3).
6. Read the table by matching the correct row and column first, then use the count or total that fits the question. Subtract:  $2x = 4 \Rightarrow x = 2$ ,  $y = 3$ . This gives (2, 3).
7. Move carefully through the arithmetic; one clean operation usually unlocks the next one. Multiply second by  $-2$ :  $-2x - 2y = -6$ . Add:  $x = 2$ ,  $y = 1$ . After simplifying, the answer is (2, 1).
8. Multiply second by  $-2$ :  $-2x + 2y = -2$ . Add:  $5y = 11 \Rightarrow y = \frac{11}{5} = 2.2$ . Then  $x = \frac{16}{5} = 3.2$ .
9. This is a good place to slow down, check the notation, and simplify cleanly. Second is twice the first — same line. So the answer is infinitely many.
10. Keep the order of operations in view, then simplify without skipping the sign check. Subtract:  $0 = -2$ . False — parallel lines. After simplifying, the answer is no solution.
11. Read the table by matching the correct row and column first, then use the count or total that fits the question. Add:  $5x = 20 \Rightarrow x = 4$ ,  $y = 3$ . This gives (4, 3).
12. Multiply second by 3:  $6x - 3y = 18$ . Add to first:  $7x = 28 \Rightarrow x = 4$ ,  $y = 2$ .
13. Read the table by matching the correct row and column first, then use the count or total that fits the question. Add:  $6x = 12 \Rightarrow x = 2$ . Then  $8 - 3y = 7 \Rightarrow y = \frac{1}{3}$ . This gives (2, 1/3).
14. This is a good place to slow down, check the notation, and simplify cleanly. Same equation. So the answer is infinitely many.
15. Use the clue in the question first, then let the arithmetic finish the job. Same left side, different right — parallel. So the answer is no solution.
16. Use the labels on the display first; they tell you which count or total belongs in the answer. Add:  $6y = 12 \Rightarrow y = 2$ . Then  $-6x + 2 = -11 \Rightarrow -6x = -13 \Rightarrow x = \frac{13}{6}$ . This gives (13/6, 2).
17. Use the labels on the display first; they tell you which count or total belongs in the answer. Add:  $9x = 27 \Rightarrow x = 3$ , then  $9 - 4y = 5 \Rightarrow y = 1$ . This gives (3, 1).
18. Use the labels on the display first; they tell you which count or total belongs in the answer. Add:  $2x = 6 \Rightarrow x = 3$ ,  $y = 3$ . This gives (3, 3).
19. Use the labels on the display first; they tell you which count or total belongs in the answer. Add:  $10x = 30 \Rightarrow x = 3$ , then  $21 + 2y = 24 \Rightarrow y = \frac{3}{2}$ . This gives (3, 3/2).
20. Read the table by matching the correct row and column first, then use the count or total that fits the question. Add:  $7x = 20 \Rightarrow x = \frac{20}{7}$ . Then  $y = 9 - 2x = \frac{23}{7}$ . This gives (20/7, 23/7).
21. For a table question, slow down and locate the exact row, column, or cell before calculating.  $x + y = 30$ ,  $x - y = 8$ . Add:  $2x = 38 \Rightarrow x = 19$ ,  $y = 11$ . This gives 19 and 11.
22.  $40c + 50m = 185$ ,  $30c + 20m = 116$ . Multiply first by 3, second by 4:  $120c + 150m = 555$  and  $120c + 80m = 464$ . Subtract:  $70m = 91 \Rightarrow m = 1.30$ . Substitute back:  $30c + 20(1.30) = 116$ , so  $30c = 90$  and  $c = 3$ .
23.  $a + c = 200$ ,  $10a + 6c = 1600$ . Multiply first by  $-6$ :  $-6a - 6c = -1200$ . Add:  $4a = 400 \Rightarrow a = 100$ ,  $c = 100$ .
24.  $b + c = 15$  (downstream),  $b - c = 10$  (upstream). Add:  $2b = 25 \Rightarrow b = 12.5$ ,  $c = 2.5$ .



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