

# Solving Systems of Two Equations

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

A **system of equations** is two equations sharing the same two variables. The **solution** is the  $(x, y)$  pair that makes *both* equations true at once — on a graph, it is the point where the two lines cross. Two handy methods: **substitution** (solve one equation for a variable, then plug it into the other) and **elimination** (add or subtract the equations to cancel a variable). Always find both  $x$  and  $y$ , and check your pair in both equations.

◇ **Example:** Solve the system  $y = 2x + 1$  and  $3x + y = 16$ .

⇒ The first equation already tells us what  $y$  equals, so this is a perfect setup for substitution. Wherever we see  $y$  in the second equation, we replace it with  $2x + 1$ : that gives  $3x + (2x + 1) = 16$ . Combine like terms:  $5x + 1 = 16$ , so  $5x = 15$  and  $x = 3$ . Now back-substitute into the first equation to get  $y$ :  $y = 2(3) + 1 = 7$ . So the lines cross at  $(3, 7)$ .

**Answer:**  $(3, 7)$

## PRACTICE

Solve each system. Write the solution as an ordered pair  $(x, y)$ .

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

## ◆ Word Problems

21. Two numbers add to 20, and their difference is 6. Find the two numbers. \_\_\_\_\_
22. At a snack stand, 2 pretzels and 1 juice cost \$8, while 1 pretzel and 1 juice cost \$5. Find the price of each. \_\_\_\_\_
23. A theater sold 30 tickets in all. Adult tickets cost \$10 and child tickets \$6, for a total of \$236. How many adult tickets were sold? \_\_\_\_\_
24. A farmer has chickens and cows totaling 12 animals with 34 legs in all. How many chickens are there? \_\_\_\_\_



## Answer Keys

- |  |   |
|--|---|
| <p>1. (5, 5)</p> <p>2. (3, 6)</p> <p>3. (3, 4)</p> <p>4. (5, 3)</p> <p>5. (4, 12)</p> <p>6. (7, 4)</p> <p>7. (3, 5)</p> <p>8. (3, 12)</p> <p>9. (7, 3)</p> <p>10. (7, 5)</p> <p>11. (7, 2)</p> <p>12. (4, 3)</p> | <p>13. (4, 2)</p> <p>14. (3, 5)</p> <p>15. (4, 1)</p> <p>16. (4, 2)</p> <p>17. (5, 9)</p> <p>18. (4, 2)</p> <p>19. (4, -4)</p> <p>20. (4, -3)</p> <p>21. 13 and 7</p> <p>22. pretzel \$3, juice \$2</p> <p>23. 14 adult tickets</p> <p>24. 7 chickens</p> |
|--|---|

### Step-by-Step Explanations

- |   |   |
|---|---|
| <p>1. Substitute <math>y = x</math>: <math>x + x = 10</math>, so <math>x = 5</math> and <math>y = 5</math>.</p> <p>2. Substitute: <math>x + 2x = 9</math>, so <math>3x = 9</math>, <math>x = 3</math>, <math>y = 6</math>.</p> <p>3. Substitute: <math>x + (x + 1) = 7</math>, so <math>2x = 6</math>, <math>x = 3</math>, <math>y = 4</math>.</p> <p>4. Substitute: <math>x + (x - 2) = 8</math>, so <math>2x = 10</math>, <math>x = 5</math>, <math>y = 3</math>.</p> <p>5. Substitute: <math>2x + 3x = 20</math>, so <math>5x = 20</math>, <math>x = 4</math>, <math>y = 12</math>.</p> <p>6. Substitute: <math>(y + 3) + y = 11</math>, so <math>2y = 8</math>, <math>y = 4</math>, <math>x = 7</math>.</p> <p>7. Substitute: <math>x + (2x - 1) = 8</math>, so <math>3x = 9</math>, <math>x = 3</math>, <math>y = 5</math>.</p> <p>8. Substitute: <math>x + 4x = 15</math>, so <math>5x = 15</math>, <math>x = 3</math>, <math>y = 12</math>.</p> <p>9. Add the equations: <math>2x = 14</math>, so <math>x = 7</math>, then <math>y = 3</math>.</p> <p>10. Add: <math>2x = 14</math>, so <math>x = 7</math>, then <math>y = 5</math>.</p> <p>11. Add: <math>2x = 14</math>, so <math>x = 7</math>, then <math>y = 2</math>.</p> <p>12. Subtract the second from the first: <math>x = 4</math>, then <math>y = 3</math>.</p> <p>13. Subtract: <math>2x = 8</math>, so <math>x = 4</math>, then <math>y = 2</math>.</p> <p>14. Subtract: <math>y = 5</math>, then <math>x = 8 - 5 = 3</math>.</p> | <p>15. Add the equations: <math>3x = 12</math>, so <math>x = 4</math>, then <math>y = 1</math>.</p> <p>16. Add: <math>3x = 12</math>, so <math>x = 4</math>, then <math>y = 2</math>.</p> <p>17. Substitute: <math>2x + (x + 4) = 19</math>, so <math>3x = 15</math>, <math>x = 5</math>, <math>y = 9</math>.</p> <p>18. Substitute <math>x = 2y</math>: <math>3(2y) + 2y = 16</math>, so <math>8y = 16</math>, <math>y = 2</math>, <math>x = 4</math>.</p> <p>19. Add: <math>2x = 8</math>, so <math>x = 4</math>, then <math>y = -4</math>.</p> <p>20. Subtract: <math>x = 4</math>, then <math>y = 1 - 4 = -3</math>.</p> <p>21. With <math>x + y = 20</math> and <math>x - y = 6</math>, add them: <math>2x = 26</math>, so <math>x = 13</math> and <math>y = 7</math>.</p> <p>22. Let <math>p</math> and <math>j</math> be the prices: <math>2p + j = 8</math> and <math>p + j = 5</math>. Subtract: <math>p = 3</math>, then <math>j = 2</math>.</p> <p>23. With <math>a + c = 30</math> and <math>10a + 6c = 236</math>, substitute <math>c = 30 - a</math>: <math>10a + 6(30 - a) = 236</math>, so <math>4a = 56</math> and <math>a = 14</math>.</p> <p>24. With <math>c + w = 12</math> and <math>2c + 4w = 34</math>, substitute <math>w = 12 - c</math>: <math>2c + 4(12 - c) = 34</math>, so <math>-2c = -14</math> and <math>c = 7</math>.</p> |
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