

Systems of Equations

Name: _____

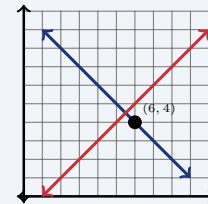
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Quick Review and Helpful Hints

A system is two equations with two variables; the solution is the (x, y) pair that makes *both* true. Solve by *elimination* (add or subtract the equations to cancel a variable) or *substitution* (replace one variable using the other equation). Then back-substitute to find the second variable.

▷ **Example:** Solve $x + y = 10$ and $x - y = 2$. **Work:** Add the two equations to cancel y : $2x = 12$, so $x = 6$. Put $x = 6$ into $x + y = 10$: $6 + y = 10$, so $y = 4$.
★ **Answer:** $(6, 4)$



The lines cross at the solution.

◆ Practice Problems

Solve each system. Write the answer as (x, y) .

1. $x + y = 5, x - y = 1$

2. $x + y = 8, x - y = 2$

3. $x + y = 10, x - y = 4$

4. $x + y = 9, x - y = 3$

5. $x + y = 7, x - y = -1$

6. $y = x + 1, x + y = 7$

7. $y = 2x, x + y = 9$

8. $x + y = 12, x - y = 2$

9. $y = x - 2, x + y = 10$

10. $2x + y = 10, x - y = 2$

11. $x + 2y = 11, x - y = 2$

12. $x + y = 6, 2x + y = 8$

13. $x - y = 5, x + y = 11$

14. $3x + y = 10, x + y = 4$

◆ Word Problems

15. Two numbers add up to 20 and differ by 4. Find the two numbers.

16. A pen and a pencil together cost \$5. The pen costs \$3 more than the pencil. Find each price.

17. The sum of two numbers is 15 and their difference is 3. Find the numbers.

18. A student buys x notebooks and y pens for a total of 7 items. The number of pens is 1 more than twice the notebooks. Solve the system $x + y = 7$ and $y = 2x + 1$.



Answer Keys

- | | | |
|-----------|------------|-----------------|
| 1. (3, 2) | 7. (3, 6) | 13. (8, 3) |
| 2. (5, 3) | 8. (7, 5) | 14. (3, 1) |
| 3. (7, 3) | 9. (6, 4) | 15. (12, 8) |
| 4. (6, 3) | 10. (4, 2) | 16. \$4 and \$1 |
| 5. (3, 4) | 11. (5, 3) | 17. (9, 6) |
| 6. (3, 4) | 12. (2, 4) | 18. (2, 5) |

Step-by-Step Explanations

1. Add the two equations so y cancels: $(x + y) + (x - y) = 5 + 1$ gives $2x = 6$, so $x = 3$. Put $x = 3$ into $x + y = 5$ to get $y = 2$. The solution is $(3, 2)$.
2. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Add to cancel y : $2x = 10$, so $x = 5$. Then $5 + y = 8$ gives $y = 3$. So the final answer is $(5, 3)$.
3. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Add: $2x = 14$, so $x = 7$. Then $7 + y = 10$ gives $y = 3$. So the final answer is $(7, 3)$.
4. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Add: $2x = 12$, so $x = 6$. Then $6 + y = 9$ gives $y = 3$. So the final answer is $(6, 3)$.
5. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Add: $2x = 6$, so $x = 3$. Then $3 + y = 7$ gives $y = 4$. So the final answer is $(3, 4)$.
6. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Substitute $y = x + 1$ into $x + y = 7$: $x + (x + 1) = 7$, so $2x = 6$, $x = 3$. Then $y = 3 + 1 = 4$. So the final answer is $(3, 4)$.
7. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Substitute $y = 2x$: $x + 2x = 9$, so $3x = 9$, $x = 3$. Then $y = 2(3) = 6$. So the final answer is $(3, 6)$.
8. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Add: $2x = 14$, so $x = 7$. Then $7 + y = 12$ gives $y = 5$. So the final answer is $(7, 5)$.
9. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Substitute $y = x - 2$: $x + (x - 2) = 10$, so $2x = 12$, $x = 6$. Then $y = 6 - 2 = 4$. So the final answer is $(6, 4)$.
10. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Add the equations so y cancels: $3x = 12$, so $x = 4$. Then $4 - y = 2$ gives $y = 2$. So the final answer is $(4, 2)$.
11. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Subtract the second from the first so x cancels: $3y = 9$, so $y = 3$. Then $x - 3 = 2$ gives $x = 5$. So the final answer is $(5, 3)$.
12. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Subtract the first from the second so y cancels: $x = 2$. Then $2 + y = 6$ gives $y = 4$. So the final answer is $(2, 4)$.
13. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Add: $2x = 16$, so $x = 8$. Then $8 + y = 11$ gives $y = 3$. So the final answer is $(8, 3)$.
14. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Subtract the second from the first so y cancels: $2x = 6$, so $x = 3$. Then $3 + y = 4$ gives $y = 1$. So the final answer is $(3, 1)$.
15. Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Write $x + y = 20$ and $x - y = 4$. Add them: $2x = 24$, so $x = 12$, then $y = 8$. The numbers are 12 and 8. So the final answer is $(12, 8)$.
16. Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Write $p + c = 5$ and $p - c = 3$. Add them: $2p = 8$, so the pen is $p = \$4$ and the pencil is $c = \$1$. So the final answer is \$4 and \$1.
17. Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Write $x + y = 15$ and $x - y = 3$. Add: $2x = 18$, so $x = 9$, then $y = 6$. So the final answer is $(9, 6)$.
18. A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Substitute $y = 2x + 1$ into $x + y = 7$: $x + (2x + 1) = 7$, so $3x = 6$, $x = 2$. Then $y = 5$. The solution is $(2, 5)$. So the final answer is $(2, 5)$.



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