Solving Systems of Linear Equations—Explanation & Practice

EXAMPLES:

A) **Solve using the substitution method**:

$$\mathbf{2x + 5y = 11}$$
$$\mathbf{x = y + 2}$$

Substitute $y + 2$ for x.

$$\begin{aligned} 2x + 5y &= 11 \\ 2(y + 2) + 5y &= 11 \\ 2y + 4 + 5y &= 11 \\ 7y &= 7 \\ y &= 1 \end{aligned}$$

Then substitute 1 for y and solve for x.

$$\begin{aligned} x &= y + 2 \\ x &= 1 + 2 \\ x &= 3 \end{aligned}$$

The solution is (3, 1)

B) **Solve using the elimination method**:

$$\mathbf{3x - 2y = 16}$$
$$\mathbf{x + y = 2}$$

Multiply the second equation by 2 and then add.

$$\begin{aligned} 3x - 2y &= 16 \\ \underline{2x + 2y} &\underline{= 4} \\ 5x \qquad &= 20 \\ x &= 4 \end{aligned}$$

Then substitute 4 for x and solve for y.

$$\begin{aligned} 3x - 2y &= 16 \\ 3 \cdot 4 - 2y &= 16 \\ 12 - 2y &= 16 \\ y &= -2 \end{aligned}$$

The solution is (4, –2)

SOLVE.

1. $x + y = 7$
   $y = x - 3$

2. $y = x + 1$
   $3x + y = 9$

3. $a + b = -4$
   $b = a - 6$

4. $x + 3y = -7$
   $y = 2x$

5. $y - 3x = -7$
   $2y - x = 6$

6. $r - 3s = 0$
   $2r + 4s = 10$

7. $6x - y = 1$
   $6x = y - 3$

8. $3x = y + 5$
   $x + 2y = 4$

9. $y - 4x = -18$
$2x + 3y = 2$

10. $a + b = 9$
$a - b = 7$

11. $x - 2y = -5$
$y - 2x = 10$

12. $6c + 5d = 9$
$c - 5d = -16$

13. $r + 4s = 14$
$r - s = 4$

14. $2a = 7b$
$a + 3 = 5b$

15. $3x = 8y + 5$
$x + 6y - 6 = 0$

16. $x - 3y = 5$
$-2x + 6y = -10$

17. $3x - 2y = -17$
$2x + 3y = -33$

18. $1.5x + 3y = 24$
$3x - 0.5y = 9$

19. $x - \frac{2}{3}y = 19$
$\frac{1}{3}x + y = -12$

20. $2x - \frac{1}{2}y = \frac{7}{6}$
$\frac{1}{3}x + 2y = -\frac{1}{2}$

ANSWERS:

1. (5, 2)
2. (2, 3)
3. (1, –5)
4. (–1, –2)
5. (4, 5)
6. (3, 1)
7. No solution (lines are parallel)
8. (2, 1)
9. (4, –2)
10. (8, 1)
11. (–5, 0)
12. (–1, 3)
13. (6, 2)
14. (7, 2)
15. $\left(3, \frac{1}{2}\right)$
16. Infinitely many solutions that satisfy x – 3y = 5. (They are the same line.)
17. (–9, –5)
18. (4, 6)
19. (9, –15)
20. $\left(\frac{1}{2}, -\frac{1}{3}\right)$