

9-5 Multiplication with the Addition-or-Subtraction Method

Objective: To use multiplication with the addition-or-subtraction method to solve systems of linear equations.

Example 1 Solve: $3x - y = 9$
 $2x + 5y = -11$

Solution 1. Multiply both sides of the first equation by 5 so that the y-terms are opposites.

$$5(3x - y) = 5(9) \rightarrow 15x - 5y = 45$$

$$2x + 5y = -11 \rightarrow 2x + 5y = -11$$

2. Add similar terms.

$$17x = 34$$

3. Solve the resulting equation.

$$x = 2$$

4. Substitute 2 for x in either original equation to find the value of y.

$$3(2) - y = 9$$

$$6 - y = 9$$

$$-y = 3$$

$$y = -3$$

5. The check is left for you.

The solution is (2, -3).

CAUTION Check your solution in the original equations as a transformed equation could contain an error.

Solve each system by using multiplication with the addition-or-subtraction method.

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|---|---|--|
| 1. $2x + y = 7$
$3x - 4y = 5$ (3, 1) | 2. $3a + 5b = 1$
$a + 2b = 0$ (2, -1) | 3. $2x - y = 8$
$x - 4y = -3$ (5, 2) |
| 4. $m + 2n = 9$
$3m - 5n = 5$ (5, 2) | 5. $a - 2b = 1$
$3a + b = -4$ (-1, -1) | 6. $3x - 2y = -1$
$x + y = 3$ (1, 2) |
| 7. $5x - y = -4$
$4x - 3y = -1$ (-1, -1) | 8. $2m + 3n = 6$
$m + 2n = 5$ (-3, 4) | 9. $2x - y = 8$
$x - 8y = 4$ (4, 0) |
| 10. $x + 3y = -2$
$4x + 7y = 7$ (7, -3) | 11. $x + 3y = 5$
$3x + 2y = -6$ (-4, 3) | 12. $5x - 2y = -3$
$x + 3y = -4$ (-1, -1) |
| 13. $3x - 2y = 5$
$x - 4y = -5$ (3, 2) | 14. $5x - y = 14$
$4x - 3y = 20$ (2, -4) | 15. $3x + 2y = 2$
$-7x + y = -16$ (2, -2) |

9-5 Multiplication with the Addition-or-Subtraction Method (continued)

Example 2 Solve: $3a + 2b = 4$
 $11a + 5b = 3$

Solution 1. Transform both equations by multiplication so that the b-terms are the same.

$$5(3a + 2b) = 5(4) \rightarrow 15a + 10b = 20$$

$$2(11a + 5b) = 2(3) \rightarrow 22a + 10b = 6$$

2. Subtract similar terms.

$$-7a = 14$$

3. Solve the resulting equation.

$$a = -2$$

4. Substitute for a in either original equation to find the value of b.

$$3(-2) + 2b = 4$$

$$-6 + 2b = 4$$

$$2b = 10$$

$$b = 5$$

5. The check is left for you. The solution is (-2, 5).

Solve each system by using multiplication with the addition-or-subtraction method.

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|--|--|---|
| 16. $3t - 8z = -2$
$7t + 4z = 18$ (2, 1) | 17. $6a + 7c = 8$
$2a + 5c = 8$ (-1, 2) | 18. $4x + 9y = 3$
$-7x + 3y = -24$ (3, -1) |
| 19. $2x - 3y = 18$
$3x + 4y = -7$ (3, -4) | 20. $4x + 3y = -14$
$6x - 2y = -8$ (-2, -2) | 21. $3a + 4b = 4$
$2a - 3b = 14$ (4, -2) |
| 22. $5m - 2n = -1$
$4m + 5n = -14$ (-1, -2) | 23. $2x + 7y = 5$
$3x - 5y = 23$ (6, -1) | 24. $4x - 3y = 10$
$5x + 6y = -7$ (1, -2) |
| 25. $2x + 3y = 9$
$3x + 5y = 16$ (-3, 5) | 26. $5x - 4y = 5$
$2x + 3y = 25$ (5, 5) | 27. $5a - 2c = 1$
$4a + 5c = 47$ (3, 7) |
| 28. $6x - 5y = 12$
$8x - 3y = 16$ (2, 0) | 29. $7x - 5y = 20$
$3x + 2y = 21$ (5, 3) | 30. $6x + 5y = 13$
$5x + 9y = 6$ (3, -1) |
| 31. $3x + 2y = 4$
$11x + 5y = 3$ (-2, 5) | 32. $2x + 7y = -3$
$3x + 5y = 1$ (2, -1) | 33. $4x - 5y = 3$
$3x + 2y = -15$ (-3, -3) |

Mixed Review Exercises

Factor completely.

$$6mn(m - 3n^2)$$

$$(3c + 4d)(3c - 4d)$$

1. $4 - 16x + 16x^2$ $4(1 - 2x)^2$

2. $6m^2n - 18mn^3$

3. $9c^2 - 16d^2$

4. $x^2 + 7x + 10$
 $(x + 2)(x + 5)$

5. $2y^2 + 7y + 3$
 $(2y + 1)(y + 3)$

6. $p^2 - 5p - 14$
 $(p - 7)(p + 2)$

Find the constant of variation.

7. y varies directly as x, and y = 63 when x = 9.

8. t varies directly as s, and t = -24 when s = 96.

9. p is directly proportional to n, and p = 27 when n = 36.

10. h is directly proportional to k, and h = 30 when k = 6.