Unit 9: Lesson 03 — Solving two linear equations by substitution

In the previous lesson we found the solution to a system of two linear equations by graphically **finding the intersection point** of the two lines.

Here, we will find that same (x, y) point by **strictly algebraic means**.

Example 1 (when *y* is isolated in one of the equations): Solve this system by substitution:

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

$y = (3x + 4)$ → $x - y = 2$
$y = 3(-3) + 4$ → $x - (3x + 4) = 2$
$y = -9 + 4$ → $x - 3x - 4 = 2$
$y = \boxed{-5}$ → $-2x = 4 + 2$
$x = \frac{6}{-2} = \boxed{-3}$

or (- 3, - 5)

Example 2 (when *x* is isolated in one of the equations): Find the intersection point of these lines.

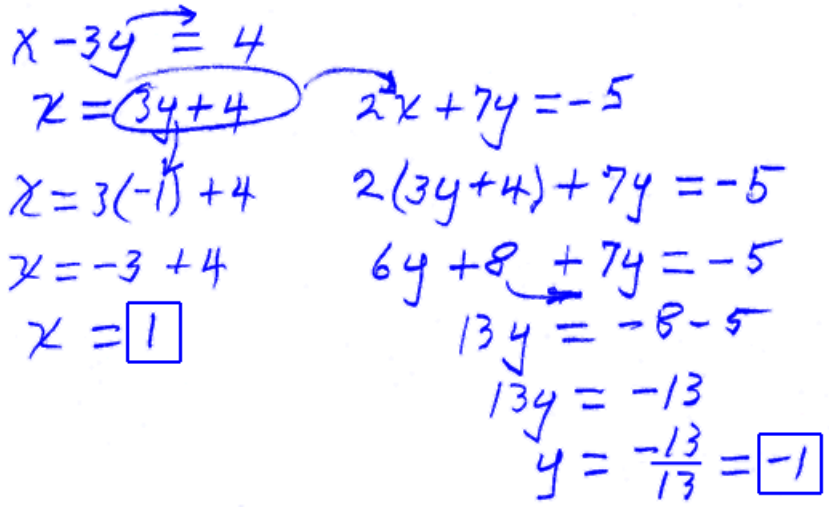
$x = y - 2$
$x + 2y - 1 = 0$

$x = (y - 2)$ → $x + 2y - 1 = 0$
$x = 1 - 2$ → $y - 2 + 2y - 1 = 0$
$x = \boxed{-1}$ → $3y - 3 = 0$
$3y = 3$
$y = \frac{3}{3} = \boxed{1}$

or (-1, 1)

Example 3 (when neither variable is isolated):

x – 3y = 4
2x + 7y = -5



or (1, – 1)

Assignment: Solve the following systems using the substitution method.

1. $x + y = 8$; $y = 3x$

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2. $y = 3x - 8$; $x + y = 4$

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3. $3x - 5y = 11$; $x = 3y + 1$

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4. $x + 4y = 1$; $2x + y = 9$

5. $2a + 7b = 3$; $a = 1 - 4b$

6. $p - 5q = 2$; $2p + q = 4$

7. $-4a + 5b = 17$; $5a - b = 5$

8. $y = 3x - 13$; $4x + 5y = 11$

9. $2x + 3y = 1$; $-3x + y = 15$

10. $8 = x - y$; $x + 3y = 12$