

ACT Study Modules

TOPIC: Solving Systems of Equations (Substitution)

Follow this link: [Solving systems of equations using substitution](#)

Substitution is one of the algebraic methods of solving a system of equations. We will look at 2 cases of solving systems using substitution and one application problem.

Case 1: When both equations are in slope-intercept form, $y = mx + b$

Step 1: Set the two ' $mx + b$ ' sides equal to each other.

Step 2: Move the mx -term from the right side to the left side by performing the opposite operation. (Example: If the x -term is negative, add it to both sides; if it is positive, subtract it from both sides)

Step 3: Move the b -term (the constant) from the left side to the right side by performing the opposite operation. (Example: If the b -term is negative, add it to both sides; if it is positive, subtract it from both sides)

Step 4: Divide both sides of the equation by the coefficient (number in front of) the x -term.

Step 5: Substitute the x -value you got in step 4 back into one of the original equations given (you get to choose!)

Step 6: Simplify the right side of the equation to obtain the value for ' y .'

Step 7: Write your answer as an ordered pair: (x, y) .

Sample Problem: Solve the system of equations

$$y = 5x + 4$$

$$y = 3x - 2$$

Step 1: Set the two ' $mx + b$ ' sides equal to each other.

$$5x + 4 = 3x - 2$$

Step 2: Move the mx -term from the right side to the left side by performing the opposite operation.

$$\begin{array}{r} 5x + 4 = 3x - 2 \\ \underline{-3x \quad -3x} \\ 2x + 4 = -2 \end{array}$$

Step 3: Move the b -term (the constant) from the left side to the right side by performing the opposite operation.

$$\begin{array}{r} 2x + 4 = -2 \\ \underline{-4 \quad -4} \\ 2x = -6 \end{array}$$

Step 4: Divide both sides of the equation by the coefficient (number in front of) the x -term.

$$\begin{array}{r} \frac{2x}{2} = \frac{-6}{2} \\ x = -3 \end{array}$$

Step 5: Substitute the x-value you got in step 4 back into one of the original equations given.

$$y = 5x + 4$$

$$y = 5(-3) + 4$$

Step 6: Simplify the right side of the equation to obtain the value for 'y.'

$$y = -15 + 4$$

$$y = -11$$

Step 7: Write your answer as an ordered pair: (x, y).

$$(-3, -11)$$

Case 2: When one equation is in standard form, $Ax + By = C$, and one equation is in slope-intercept form $y = mx + b$.

Step 1: Identify the equation that is already solved for y.

Step 2: Substitute the side with ' $mx + b$ ' into the standard form equation for the y-value.

Step 3: Distribute through the parenthesis.

Step 4: Combine like terms.

Step 5: Move the constant term from the left side to the right side by performing the opposite operation.

Step 6: Divide both sides of the equation by the coefficient of the x-term.

Step 7: Substitute the x-value you got in step 4 back into the original equation that is in slope-intercept form.

Step 8: Simplify the right side of the equation to obtain the value for 'y.'

Step 9: Write your answer as an ordered pair: (x, y).

Sample Problem: Solve the system of equations

$$4x - 2y = -14$$

$$y = 3x + 5$$

Step 1: Identify the equation that is already solved for y.

$$y = 3x + 5$$

Step 2: Substitute the side with ' $mx + b$ ' into the standard form equation for the y-value.

$$4x - 2(3x + 5) = -14$$

Step 3: Distribute through the parenthesis.

$$4x - 6x - 10 = -14$$

Step 4: Combine like terms.

$$-2x - 10 = -14$$

Step 5: Move the constant term from the left side to the right side by performing the opposite operation.

$$\begin{array}{r} -2x - 10 = -14 \\ +10 \quad +10 \end{array}$$

$$-2x = -4$$

Step 6: Divide both sides of the equation by the coefficient of the x-term.

$$\begin{array}{r} \frac{-2x}{-2} = \frac{-4}{-2} \\ x = 2 \end{array}$$

Step 7: Substitute the x-value you got in step 4 back into the original equation that is in slope-intercept form.

$$y = 3x + 5$$

$$y = 3(2) + 5$$

Step 8: Simplify the right side of the equation to obtain the value for 'y.'

$$y = 6 + 5$$

$$y = 11$$

Step 9: Write your answer as an ordered pair: (x, y).

$$(2, 11)$$

Practice:

Solve the systems of equations below using the substitution method

1. $y = 6x - 11$
 $-2x - 3y = -7$

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

3. $2x - 3y = -1$
 $y = x - 1$

4. $-3x - 3y = 3$
 $y = -5x - 17$