

# Solving Simultaneous Equations by the Substitution Method - PDF Copy

The presentation contains the slides below with the objective of: Understanding what is meant by solving a pair of equations simultaneously, b. Solving simultaneous equations using the substitution method

**Simultaneous Equations - Substitution**

**Objective**  
 Understand what is meant solving a pair of equations simultaneously  
 Solve simultaneous equations using the substitution method

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Here are a pair of equations that we are calling A and B

$$y = x + 3 \quad \text{A}$$

$$y = 2x - 1 \quad \text{B}$$

The only numbers that fit into both A and B are  $x = 4$  and  $y = 7$

$$7 = 4 + 3 \quad \text{A}$$

$$7 = 2 \times 4 - 1 \quad \text{B}$$

When we find the numbers that will fit into a pair of equations like this, it is called solving the equations simultaneously

2

For these pairs of equations, the values of  $x$  and  $y$  are whole numbers between and including 2 and 8. By trying these numbers, find the solutions

- $y = x + 4$   
 $y = 2x$   
 $x = 4$  and  $y = 8$
- $y = x + 3$   
 $y = 2x$   
 $x = 3$  and  $y = 6$
- $y = x + 2$   
 $y = 2x - 3$   
 $x = 5$  and  $y = 7$
- $y = x + 3$   
 $y = 3x - 1$   
 $x = 2$  and  $y = 5$

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Using Substitution to Solve a Pair of Simultaneous Equations

Here are a pair of equations that we are going to call...

$$y = 2x + 5 \quad \text{A}$$

$$y = 5x - 1 \quad \text{B}$$

We are going to solve these simultaneously by a method called substitution...

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The values of the  $y$  terms in A and B are the same

$$y = 2x + 5 \quad \text{A}$$

$$y = 5x - 1 \quad \text{B}$$

Here is the value of  $y$  in terms of  $x$  in equation B

Substitute this value for the  $y$  term in A like this...

$$5x - 1 = 2x + 5 \quad \text{A}$$

$$5x - 2x = 5 + 1$$

$$3x = 6$$

Solve this equation

$$x = 6 \div 3$$

$$x = 2$$

To find the value of  $y$  use  $x = 2$  in either A or B like this...

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We've chosen B so when  $x = 2$  then...

$$y = 2x + 5 \quad \text{A}$$

$$y = 5x - 1 \quad \text{B}$$

$$y = 5 \times 2 - 1$$

$$\rightarrow y = 9$$

The solutions for this pair of simultaneous equations are...

$$x = 2$$

To find the value of  $y$  use  $x = 2$  in either A or B like this...

$$y = 9$$

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Using substitution, solve these:

- $y = 2x + 4$   
 $y = 3x - 1$   
 $x = 5$  and  $y = 14$
- $y = x + 6$   
 $y = 5x - 2$   
 $x = 2$  and  $y = 8$
- $y = 3x + 8$   
 $y = 5x - 6$   
 $x = 7$  and  $y = 29$
- $y = 2x + 10$   
 $y = 4x + 6$   
 $x = 2$  and  $y = 14$
- $y = 2x + 15$   
 $y = 5x + 6$   
 $x = 3$  and  $y = 27$
- $y = 3x + 16$   
 $y = 7x + 4$   
 $x = 3$  and  $y = 25$

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Using Substitution with a Linear and Quadratic Equation

Here is a quadratic equation that we have called A and a linear equation that we have called B

$$y = x^2 + 2x - 8 \quad \text{A}$$

$$y = 6 - 3x \quad \text{B}$$

We can solve this pair of equations using the substitution method like this...

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Substitute  $-3x$  for the  $y$  value in A

$$y = x^2 + 2x - 8 \quad \text{A}$$

$$y = 6 - 3x \quad \text{B}$$

$$\rightarrow 6 - 3x = x^2 + 2x - 8$$

Rearrange to make a quadratic equation like this...

$$0 = x^2 + 2x + 3x - 8 - 6$$

$$0 = x^2 + 5x - 14$$

$$0 = (x - 2)(x + 7)$$

We need two numbers with product of  $-14$  and a sum of  $5$

Solve  $x = 2$

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- $y = x^2 + 8x + 12$   
 $y = x$   
Using substitution, solve these...  
 $x = -3$  and  $-4$
- $y = x^2 + 8x + 10$   
 $y = 3x$   
 $x = -2$  and  $-5$
- $y = x^2 - 5x - 5$   
 $y = 1 - 4x$   
 $x = -2$  and  $3$
- $y = x^2 - 4x - 7$   
 $y = 3 - x$   
 $x = -2$  and  $5$
- $y = x^2 - 5x - 35$   
 $y = 2x - 5$   
 $x = -3$  and  $10$
- $y = x^2 + x$   
 $y = x + 25$   
 $x = -5$  and  $5$

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- $y = x^2 + 8x + 12$   
 $y = x$   
 $x = -3$  and  $-4$
- $y = x^2 + 8x + 10$   
 $y = 3x$   
 $x = -2$  and  $-5$
- $y = x^2 - 5x - 5$   
 $y = 1 - 4x$   
 $x = -2$  and  $3$
- $y = x^2 - 4x - 7$   
 $y = 3 - x$   
 $x = -2$  and  $5$
- $y = x^2 - 5x - 35$   
 $y = 2x - 5$   
 $x = -3$  and  $10$
- $y = x^2 + x$   
 $y = x + 25$   
 $x = -5$  and  $5$

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