

# Solving Systems by Substitution Method

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8:10 AM

## PRE-CALCULUS 11 INEQUALITIES & SYSTEMS OF EQUATIONS SOLVING SYSTEMS BY SUBSTITUTION METHOD

### A. Definitions

1. **linear system:** a set of equations where all equations are linear.
2. **non-linear system:** a set of equations where at least one of the equations is non-linear.
3. **solving a system:** determining the coordinates of the point of intersection.

### B. Substitution Method

#### **Rules**

1. Isolate a variable in one of the equations.
2. Substitute the value into the other equation and solve for one of the variables.
3. Take the answer(s) for one variable and substitute to find the remaining variable answer(s).

### C. Solve the following linear system.

$$1) \begin{cases} 7x - 2y = 20 \\ 3x + y = 3 \end{cases}$$

$$\begin{array}{r} 3x + y = 3 \\ -3x \quad -2x \end{array}$$

$$y = -3x + 3$$

$$7x - 2y = 20$$
$$7x - 2(-3x + 3) = 20$$

$$7x + 6x - 6 = 20$$

$$13x - 6 = 20$$

$$\frac{13}{13}x = \frac{26}{13}$$

$$\underline{\underline{x = 2}}$$

$$3x + y = 3$$
$$3(2) + y = 3$$
$$\begin{array}{r} 6 + y = 3 \\ -6 \quad -6 \end{array}$$

$$\underline{\underline{y = -3}}$$

$$\boxed{\text{Solution } (2, -3)}$$

$$2) \begin{cases} x+3y=11 \\ 2x-3y=4 \end{cases}$$

$$x + \cancel{3y} = 11$$

$$x = \underline{-3y + 11}$$

$$2x - 3y = 4$$

$$2(-3y + 11) - 3y = 4$$

$$-6y + 22 - 3y = 4$$

$$-9y + \cancel{22} = \cancel{-4} \quad -\frac{4}{22}$$

$$\underline{-9y = -18}$$

$$\underline{y = 2}$$

$$x + 3y = 11$$

$$x + 3(2) = 11$$

$$x + \cancel{6} = \cancel{11} \quad -6$$

$$\underline{\underline{x = 5}}$$

Solution (5, 2).

$$3) \begin{cases} 6x-2y=21 \\ 4x+3y=1 \end{cases}$$

$$4x + \cancel{3y} = 1$$

$$\frac{4}{4}x = \frac{-3y}{4} + \frac{1}{4}$$

$$x = \underline{-\frac{3}{4}y + \frac{1}{4}}$$

$$6x - 2y = 21$$

$$6\left(-\frac{3}{4}y + \frac{1}{4}\right) - 2y = 21$$

$$-\frac{9}{2}y + \frac{3}{2} - 2y = 21$$

$$-\frac{13}{2}y + \cancel{\frac{3}{2}} = \cancel{21} \quad -\frac{3}{2}$$

$$\underline{-\frac{13}{2}y = \frac{39}{2} \div -\frac{13}{2}}$$

$$\underline{\underline{y = -3}}$$

$$4x + 3y = 1$$

$$4x + 3(-3) = 1$$

$$4x - \cancel{9} = 1 \quad +9$$

$$\frac{4}{4}x = \frac{10}{4}$$

$$\underline{\underline{x = \frac{5}{2}}}$$

Solution  $\left(\frac{5}{2}, -3\right)$

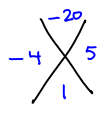
D. Solving Non-Linear Systems

$$1) \begin{aligned} y &= -2x^2 + 10 \\ x - 2y &= -15 \end{aligned}$$

$$x - 2y = -15$$

$$x - 2(-2x^2 + 10) = -15$$

$$x + 4x^2 - 20 = -15$$



$$4x^2 + x - 5 = 0$$

$$(x - \frac{4}{4})(x + \frac{5}{4}) = 0$$

$$(x - 1)(4x + 5) = 0$$

$$x = 1, -\frac{5}{4}$$

$$y = -2x^2 + 10$$

$$y = -2(1)^2 + 10$$

$$y = 8$$

$$y = -2x^2 + 10$$

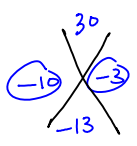
$$y = -2\left(-\frac{5}{4}\right)^2 + 10$$

$$y = -\frac{25}{8} + 10$$

$$y = \frac{55}{8}$$

Solution  $(1, 8)$  or  $\left(-\frac{5}{4}, \frac{55}{8}\right)$

$$2) \begin{aligned} y &= 2x^2 - 7x + 3 \\ y &= -x^2 + 6x - 7 \end{aligned}$$



$$y = -x^2 + 6x - 7$$

$$(2x^2 - 7x + 3) = -x^2 + 6x - 7$$

$$2x^2 - 7x + 3 = -x^2 + 6x - 7$$

$$3x^2 - 13x + 10 = 0$$

$$(x - \frac{10}{3})(x - \frac{3}{3}) = 0$$

$$(3x - 10)(x - 1) = 0$$

$$x = \frac{10}{3}, 1$$

$$y = -x^2 + 6x - 7$$

$$y = -\left(\frac{10}{3}\right)^2 + 6\left(\frac{10}{3}\right) - 7$$

$$= \frac{17}{9}$$

$$y = -x^2 + 6x - 7$$

$$y = -(1)^2 + 6(1) - 7$$

$$y = -2$$

Solution  $\left(\frac{10}{3}, \frac{17}{9}\right)$  or  $(1, -2)$

PRE-CALCULUS 11  
INEQUALITIES & SYSTEMS OF EQUATIONS  
SOLVING SYSTEMS BY SUBSTITUTION ASSIGNMENT

Solve the following systems of equations.

1)  $x + y = 9$   
 $2x + y = 11$

2)  $x + y = 1$   
 $3x - y = 11$

3)  $2x + 3y = 11$   
 $5x - y = -15$

4)  $3x + 2y = 19$   
 $2x - 3y = -9$

5)  $2x + 5y = -2$   
 $5x - 2y = 24$

6)  $3x - 4y = -15$   
 $5x + y = -2$

7)  $7x + 6y = 2$   
 $x + 8y = -4$

8)  $8x - y = 16$   
 $2x - 3y = 2$

9)  $3x + 6y = 4$   
 $x - 2y = 1$

10)  $y = -x + 5$   
 $y = (x + 1)^2$

11)  $y = 3x - 2$   
 $y = x^2 + 4x - 2$

12)  $y = 2x^2 + 12x + 18$   
 $y = -(x + 3)^2 + 12$

Answers

1) (2,7)

2) (3,-2)

3) (-2,5)

4) (3,5)

5) (4,-2)

6) (-1,3)

7)  $\left(\frac{4}{5}, -\frac{3}{5}\right)$

8)  $\left(\frac{23}{11}, \frac{8}{11}\right)$

9)  $\left(\frac{7}{6}, \frac{1}{12}\right)$

10) (-4,9) & (1,4)

11) (0,-2) & (-1,-5)

12) (-5,8) & (-1,8)