

Solving a System of Equations by Substitution

Example 1: Find the solution of each system by substitution.

$$\begin{aligned} \text{a)} \quad x^2 + 4x - y &= 7 \\ 2x - y &= -1 \end{aligned}$$

Solve either equation for one of the variables.

I choose to solve equation (2) for y it's easier to solve. I'm avoiding the equation with the x^2 .

$$\begin{aligned} 2x - y &= -1 \\ -y &= -2x - 1 \\ y &= 2x + 1 \end{aligned}$$

now substitute this expression $(2x + 1)$ into the other equation $x^2 + 4x - y = 7$ for y .

$$\begin{aligned} x^2 + 4x - y &= 7 \\ x^2 + 4x - (2x + 1) &= 7 \quad (\text{notice only one variable ! Now solve for } x.) \end{aligned}$$

$$x^2 + 4x - 2x - 1 = 7$$

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

$$(x + 4)(x - 2) = 0$$

$x = -4$ and $x = 2$ (now "back substitute" these values into the original equation we solved for y)

$$y = 2x + 1$$

$$y = 2(-4) + 1$$

$$\underline{y = -7}$$

$$y = 2x + 1$$

$$y = 2(2) + 1$$

$$\underline{y = 5}$$

Solution are: $(-4, -7)$ and $(2, 5)$

Check $(-4, -7)$	Check $(2, 5)$
$x^2 + 4x - y = 7$	$x^2 + 4x - y = 7$
$(-4)^2 + 4(-4) - (-7) = 7 \quad ?$	$(2)^2 + 4(2) - (5) = 7 \quad ?$
$16 - 16 + 7 = 7$	$4 + 8 - 5 = 7 \quad ?$
$7 = 7 \text{ YES !}$	$7 = 7 \text{ YES !}$
Check $(-4, -7)$	Check $(2, 5)$
$2x - y = -1$	$2x - y = -1$
$2(-4) - (-7) = -1$	$2(2) - (5) = -1$
$-1 = -1 \text{ YES !}$	$-1 = -1 \text{ YES !}$