Systems of 2×2 Linear Equations

Questions

Exercise 1. (isolated) Solve $\begin{cases} y = 5x + 5 \\ y = -16x + 362 \end{cases}$.

Exercise 2. (isolated) Solve $\begin{cases} y = 20x + 62 \\ y = 21x + 60 \end{cases}$.

Exercise 3. (of the type $\pm y$) Solve $\begin{cases} 16x - 1y = -211 \\ 15x + 1y = -197 \end{cases}$.

Exercise 4. (estàndard) Solve $\begin{cases} 11x + 9y = 5 \\ 2x + 5y = -26 \end{cases}$.

Solutions

1 $x = 17$, $y = 90$.

2 $x = 2$, $y = 102$.

3 $x = -14$, $y = 13$.

4 $x = 7$, $y = -8$.

Resolution

1 We will solve it by the method of substitution, since both y's are isolated: we equate the two expressions of the y's. We obtain the equation:

$$5x + 5 = -16x + 362,$$

which we solve: $5x + 16x = 362 - 5 \Rightarrow 21x = 357 \Rightarrow x = \frac{357}{21} \Rightarrow x = 17.$

We now proceed to substitute x into either of the two expressions for y. However, if we do so in both, then we can verify that we have the system well solved when the two results coincide: $y = 5 \cdot 17 + 5 = 90$; $y = -16 \cdot 17 + 362 = 90$.

Therefore, the solutions to the system are $x = 17$ i $y = 90$.

2 We will solve it by the method of substitution, since both y's are isolated: we equate the two expressions of the y's. We obtain the equation:

$$20x + 62 = 21x + 60,$$

which we solve: $20x - 21x = 60 - 62 \Rightarrow -1x = -2 \Rightarrow x = \frac{-2}{-1} \Rightarrow x = 2.$

We now proceed to substitute x into either of the two expressions for y. However, if we do so in both, then we can verify that we have the system well solved when the two results coincide: $y = 20 \cdot 2 + 62 = 102$; $y = 21 \cdot 2 + 60 = 102$.

Therefore, the solutions to the system are $x = 2$ i $y = 102$.

3 We will solve it by the method of elimination. We already have the y terms with coefficients of the same absolute value but opposite sign. Therefore, we simply add the two equations:

$$-1y = -13$$

Thus, $y = 13$.

We now proceed to substitute y into either of the two original equations: $16x + 1 \cdot (13) = -211$. Solving the equation, we find that $x = -14$.

Therefore, the solutions to the system are $x = -14$ i $y = 13$.

4 We will solve it by the method of elimination. We multiply the first equation by 2 and the second equation by 11, and then change the sign of the second equation:

$$\begin{cases} 11x + 9y = & 5 \\ 2x + 5y = & -26 \end{cases} \Rightarrow \begin{cases} 22x + 18y = & 10 \\ 2x - 5y = & -26 \end{cases}$$

$$\Rightarrow \begin{cases} 22x + 18y = & 10 \\ 22x + 55y = & -286 \end{cases} \Rightarrow \begin{cases} 22x + 18y = & 10 \\ -22x - 55y = & 286 \end{cases}$$

At this point, we add the equations: $-37y = 296$. Thus, $y = -8$.

We now proceed to substitute y into either of the two original equations: $11x + 9 \cdot (-8) = 5$. Solving the equation, we find that $x = 7$.

Therefore, the solutions to the system are $x = 7$ i $y = -8$.

About

The solutions of these exercises have been calculated automatically using free software (see project worksheet.cc): although all expressions and final results are correct, maybe some might be simplified more.

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