**Day 9: Linear Systems – Pre-Notes**

There are two algebraic methods to solve a linear system. They are substitution and elimination.

***Substitution Method***

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| --- | --- |
| STEP 1 | Choose an equation and solve for one variable in terms of the other variable. |
| STEP 2 | Substitute the expression from **STEP 1** into the other equation. |
| STEP 3 | Solve for the unknown variable. |
| STEP 4 | To solve for the other variable, substitute the solution from **STEP 3** into the equation found in **STEP 1**. |
| STEP 5 | Write an ordered pair of the two found values |
| STEP 6 | Check the solution in both original equations. |

**Example 1**: Solve the system of equations by using substitution.

STEP 1:

After choosing the first equation: , solve for y

STEP 2:

Substitute the expression from STEP 1 into the other equation.

STEP 3:

Solve for the unknown variable (*x* in this case).

*Distribute the 4.*

*Combine like terms.*

*Subtract 4 from both sides*.

*Divide both sides by −5.*

STEP 4:

To solve for the other variable, substitute the solution from **STEP 4** into the equation found in **STEP 1**.

STEP 5:

Write an ordered pair of the two found values.

(−2, 5)

STEP 6:

Check the solution in both original equations.

|  |  |
| --- | --- |
| First Equation: | Second Equation: |
|  |  |

**Example 2**: Solve the system of equations by using substitution.

STEP 1:

Not necessary b/c both equations are written as *y*=. Choose the first equation:

STEP 2:

Substitute the expression from STEP 1 into the other equation.

STEP 3:

Solve for the unknown variable (*x* in this case).

*Add 2x to both sides.*

*Subtract 4 from both sides*

*Divide both sides by 3*

STEP 4:

To solve for the other variable, substitute the solution from **STEP 4** into the equation found in **STEP 1**.

STEP 5:

Write an ordered pair of the two found values.

(1, 5)

STEP 6:

Check the solution in both original equations.

|  |  |
| --- | --- |
| First Equation: | Second Equation: |
|  |  |

**Question 1:**

Solve the system of equations by using substitution.

Solution: (2, 5)

**FAQ: When do I use the substitution method?**

**Answer: When one variable is already solved for OR it would be very easy to solve for a variable.**

***Elimination Method***

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| --- | --- |
| STEP 1 | Choose a variable in the equations to eliminate. |
| STEP 2 | If necessary, multiply one or both equations by a number that will make the coefficients of one of the variables in the equations the same but with opposite signs. |
| STEP 3 | Add the equations together to eliminate one of the variables. |
| STEP 4 | Solve for the unknown variable. |
| STEP 5 | To solve for the other variable, substitute the solution from **STEP 4** into either equation and solve for the other variable. |
| STEP 6 | Write an ordered pair of the two found values. |
| STEP 7 | Check the solution in both original equations. |

**Example 3**: Solve the system of equations by using elimination.

STEP 1 and 2:

Choose to eliminate the variable *y* since the coefficients are the same with opposite signs. No need to multiply either equation.

STEP 3:

Add the equations together to eliminate the variable *y*. Notice that .

STEP 4:

Solve for the unknown variable.

*Divide both sides by 8*

STEP 5:

To solve for the other variable, substitute the solution from **STEP 4** into either equation and solve for the other variable.

STEP 6:

Write an ordered pair of the two found values.

(4, 1)

STEP 7:

Check the solution in both original equations.

|  |  |
| --- | --- |
| First Equation: | Second Equation: |
|  |  |

**Example 4**: Solve the system of equations by using elimination.

STEP 1 and 2:

Choose to eliminate the variable *y* because then you only need to multiply the first equation. Multiply the ENTIRE first equation by −4 so that the coefficients of *y* in the equations are the same but with opposite signs.

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STEP 3:

Add the equations together to eliminate the variable *y*. Notice that .

STEP 4:

Solve for the unknown variable.

STEP 5:

To solve for the other variable, substitute the solution from **STEP 4** into either equation and solve for the other variable.

STEP 6:

Write an ordered pair of the two found values.

(−2, 5)

STEP 7:

Check the solution in both original equations.

|  |  |
| --- | --- |
| First Equation: | Second Equation: |
|  |  |

**Question 2:**

Solve the system of equations by using elimination.

Solution: (2, 1)

**FAQ: When do I use the elimination method?**

**Answer: When it would not be easy to solve for a variable. Many times this means that both the *x* and *y* terms have coefficients that are not equal to 1 or -1.**