**?**

**W2K**

**Words to Know**

*Fill in this table as you work through the lesson. You may also use the glossary to help you.*

the system of

equations.

of

**Apply** the strategy for solving using

substitution.

different.

or

**Verify** the

**Recognize** if the

slopes are the

**Solve** a linear system of equations.

**Lesson Goals**

**Lesson Question**

|  |  |
| --- | --- |
|  | the ratio of the change in the dependent values (outputs) to the change in the independent values (inputs) between two points on a line |
|  | the point or points that make all equations in a system true |
|  | to take the place of; to replace |
|  | to examine; to study very carefully and in detail |


## Finding the Number of Solutions

The **solution to a system of equations** is the point or points that make all equations in the system true.

*Complete the table.*

|  |  |  |  |
| --- | --- | --- | --- |
| **System of Equations** | **Slopes** | ***y*-Intercepts** | **Number of Solutions** |
| *y* = 2*x* − 6, *y* = 3*x* + 4 | Different |  |  |
| 1 1*y* = 3 *x* − 2, *y* = 3 *x* − 4 | Same | Different | None |
| *y* = −5*x* + 6, *y* = −5*x* + 6 |  | Same |  |

**Slide**

the solution.

4.

1. Solve to determine the value of the unknown variable.
2. Write the solution to the system of equations as an ordered pair.

to create a one-variable linear equation.

1. Use

**Using the Substitution Method When One Variable Is Known**

**PROCEDURE**

**2**

(2, 7)

3. Write the solution to the system of equations as an ordered pair.

*y* = 7

2

= *x*

2 

4

= 2*x* + 3 − 3

4 = 2*x*

7 −

2. Solve to determine the value of the unknown variable.

= 2*x* + 3

1. Use substitution to create a one-variable linear equation.

To identify the slope, rewrite as *y* = 0*x* + 7. We expect to have one solution.

*y* = 2*x* + 3

*y* = 7

**Substitution Method**

Solve the system of equations.

**5**

**7**

5. Verify the solution.

pair.

4. Write the solution to the system of equations as an

**3. Substitute** the value of the variable into either original equation to solve for the other variable.

variable in the equation.

2. Solve to determine the

**The Substitution Method with Two Variables**

**PROCEDURE**

1. Use substitution to create a one-variable linear equation.

**Slide**

**Graphing the System to Verify the Solution**

Examine the system of equations.

*Locate the intersection point on the graph.*

*y*  4 *x*  2

*x* = 4

1

4. Verify the solution.

Solution: ( , −3)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | 4 | *y* |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | 2 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | *x* |
|  | 4 |  | 2 |  |  |  | 2 |  | 4 |
|  |  |  |  | 2 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | 4 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

**Slide**

*x* =

4 4

4*x*  8

= 2*x* + 8 − 2*x*

4*x* = 8

6*x* −

2. Solve to determine the unknown variable in the equation.

6*x* + 1 − 1 = 2*x* + 9 − 1

6*x* = 2*x* +

+ 9

6*x* + 1 =

1. Use substitution to create a one-variable linear equation.

*y* = 6*x* + 1

*y* = 2*x* + 9

**Substitution Method**

Solve the system of equations using the substitution method.

**7**

, 13)

(

4. Write the solution to the system of equations as an ordered pair.

) + 1

*y* = 6*x* + 1

*y* = 6(

*y* = 13

3. Substitute the value of the variable into either original equation to solve for the other variable.

*y* = 6*x* + 1

*y* = 2*x* + 9

**Substitution Method**

Solve the system of equations using the substitution method.

***x*** = ***2* was found in the first two steps.**

**Slide**

## Verifying the Solution Algebraically

Examine the system of equations.

*y* = 6*x* + 1

*y* = 2*x* + 9

5. Verify the solution. Solution: (2, 13)

Substitute (2, 13) into both equations.

*y* = 6*x* + 1 13 = 6(2) + 1

13 = True

*y* = 2*x* + 9

13 = 2( ) + 9

13 = 13 True

**Substitution Method on Parallel Lines**

**Analyze** the system of equations in which the slopes are the same.

*y* = 3*x* − 3

*y* = 3*x* + 1

The slopes are the

.

The *y*-intercepts are different.

These two lines are

.

So, we will have no

.



**10**

**12**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | 4 | *y* |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | 2 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | *x* |
|  | 4 |  | 2 |  |  |  | 2 |  | 4 |
|  |  |  |  | 2 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | 4 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

**Slide**

3*x* − 3*x* = 3*x* + 4 − 3*x*

= 4 False

The result 0 = 4 does not give us a value of either variable, and the statement is false. This means that we have no solution.

+ 4

3*x* =

Substitute 3*x* − 3 for *y* in the second equation.

3*x* − 3 = 3*x* + 1

3*x* − 3 + 3 = 3*x* + 1 +

*y* = 3*x* − 3

*y* = 3*x* + 1

**Solve the system of equations using substitution.**



**Substitution Method of Solving Equivalent Equations**

Analyze the system of equations in which the slopes and *y*-intercepts are the same.

*y*  2 *x*  2

1

*y*  2 *x*  2

This means both equations represent the same line, and we should expect

many solutions.

1

**12**

**14**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | 4 | *y* |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | 2 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | *x* |
|  | 4 |  | 2 |  |  |  | 2 |  | 4 |
|  |  |  |  | 2 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | 4 |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |

**Slide**

## Substitution Method of Solving Equivalent Equations

Examine the system of equations in which the slopes and the intercepts are the same.

1

*y*  2 *x*  2,

1

*y*  2 *x*  2

1*x*  2 

1

2 *x*  2 



1

2 *x*  2

1

2 *x*  2  2

**14**

1

2

2 *x* 

1 1

2 *x*  2 *x* 

0 = 0 True

This tells us there are infinitely solutions to this system of equations.


# **Summary** Using Substitution to Solve Systems

**?**

How do you solve a system of equations using the substitution method?

**Lesson Question**

**Answer**

*Use this space to write any questions or thoughts about this lesson.*