**Using Graphs to Solve**

**Section 1**

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| 00:00:00 | TEACHER: So how do you use graphs to solve a system of |
| 00:00:04 | two linear equations? You can graph two equations written in slope-intercept form and then examine the graph to determine the solution. Let's see how to graph an equation that's already in slope-intercept form. |

**Section 2**

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| 00:00:00 | TEACHER: Let's take a look at solving a system of equations |
| 00:00:02 | using a graph. We need to graph the system of equations to determine the solution to the system of equations. Well the graph a system of equations, it's best to start by putting both equations in slope-intercept form. You'll notice that both of these equations, right here, are already in slope-intercept form. So first we'll graph y equals x plus 2. |
| 00:00:25 | Well let's look at the different parts of this equation. We can see that the slope is 1, since the coefficient of x is 1, even though it's not usually written. And the y-intercept is going to be positive 2. So let me going ahead and first plot the y-intercept at 0, 2. That's the y-intercept. |
| 00:00:44 | Now I can use the slope to plot a couple more points and graph this equation. Well the slope is 1, or 1/1, so I go up 1 over 1 put another point. I rise up 1, run over 1, 1, 1 and put another point. Now I can sketch in the line of this graph. Now we'll graph y equals 5x minus 6. The slope is 5 and the y-intercept, negative 6. |
| 00:01:14 | So I'm going to start at the y-intercept, which is going to be at 0, negative 6. There's the y-intercept. Now I'm going to use the slope. The slope is 5 or 5/1, so I go up 5-- 1, 2, 3, 4, 5 over 1, and I plot the second point. Let me plot a third point. 1, 2, 3, 4, 5 and over 1. |
| 00:01:32 | It's going to fall right there, on this other line, already. So let me go ahead and sketch in the line of this graph. There. Now we have both equations graphed. Well, notice that the lines intersect and have one point in common. This point is 2, 4. |
| 00:01:54 | The system of equations has 1 solution that appears to be at the point 2, 4. So this is how you can solve a system of equations using a graph. |

**Section 5**

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| 00:00:00 | TEACHER: Let's take a look at checking the solution. |
| 00:00:02 | This problem has already been solved. After graphing both equations, y equals the opposite of x and y equals 2 x plus 6. We find that they intersect at the point negative 2, 2. this is the solution to this system of equations. We can check our solution by following these steps right here. The first step is to substitute x |
| 00:00:26 | and y into each equation. So let me go ahead and do it with the first equation. Let me substitute negative 2, 2 into the equation y equals the opposite of x. y is equivalent to 2. And the opposite of x, x is negative 2. That's the first step The next step is to simplify. |
| 00:00:43 | So 2 equals-- well, the opposite of negative 2 is 2. The last step is to check for true statements. Does 2 equal 2? It definitely does. So this is a true statement. Let's do the same steps for this second equation where we're substituting negative 2, 2 into y equals 2x plus 6. Step 1 is to substitute x, y in each equation. |
| 00:01:05 | y's value is 2. x's value is negative 2 plus 6. Next step is to simplify. 2 equals 2 times negative 2 is negative 4 plus 6. 2 equals negative 4 plus 6 is 2. Now the last step is to check for true statements yes. That is a true statement. All right. |
| 00:01:28 | As you can see, the solution for both equations is that 2 is equal to 2, which is a true statement for both equations. So, negative 2, 2 is a solution for the system. |

**Section 7**

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| 00:00:01 | TEACHER: We're looking at how do you use graphs to solve a |
| 00:00:04 | system of two linear equations? A system of equations has either one solution, no solution, or infinitely many solutions. Examining the graphs of the equations is the quickest way to determine how many solutions a system of equations has. Using graphing as a method of finding the intersection of two lines is very helpful, especially when the equations |
| 00:00:27 | are already in slope-intercept form. Usually, if you need to graph a linear equation that's in standard form, like these two equations here, it'll be easier to first convert it to slope-intercept form as you see here. |

**Section 8**

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| 00:00:00 | TEACHER: Let's take a look at this example of rewriting |
| 00:00:02 | equations in slope-intercept form. If you need to graph linear equations, it's usually worth converting them into slope-intercept form if they're not in that form already. So we are going to convert each equation to slope-intercept form, y equals mx plus b. To convert 3x plus y equals 1, we want to isolate y on the left side of the equation. |
| 00:00:24 | To get 3x on the right side of the equation, we're going to use inverse operations. So the opposite of adding 3x would be to subtract 3x from both sides. So 3x minus 3x ends up being 0, so y equals negative 3x plus 1. And now the equation is in slope-intercept form. Now we're ready to convert the second equation. |
| 00:00:45 | First thing we're going to do is distribute 2 to both terms inside the parentheses. So 2 times x is 2x plus 2 times 2y is 4y is equal to negative 16. Now we're going to subtract 2x from each side. 2x minus 2x is 0, so that just leaves us with 4y equals negative 2x minus 16. The next step is to divide both sides by 4. |
| 00:01:14 | 4 divided by 4 is 1, so that just leaves us with 1y. We have negative 2/4x minus 4. The last step is to simplify the fraction. Now we get y equals negative 1/2x minus 4. And now this equation is also in slope-intercept form. So why is it worth it to put these equations in slope-intercept form? Notice how easily we can identify the slope and the |
| 00:01:41 | y-intercept. Here's the slope, y-intercept. Here's the slope, and the y-intercept. With these two pieces of information, we can graph the lines. |

**Section 10**

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| 00:00:01 | TEACHER: Let's look at |
| 00:00:01 | graphing a system of equations. We're going to graph a system of equations. y equals negative 3x plus 1. y equals negative 1/2x minus 4. The first step in the process is to graph both lines using the y-intercept and the slope. So let me go ahead and graph the first line that represents the first equation. |
| 00:00:21 | Here's the y-intercept. And that's where I'm going to start. I'm going to start at positive 1 on the y-axis. Then I'm going to use the slope, right here, of negative 3. This is actually negative 3/1, rise over run. So I go down 3 and over 1. I'm going to plot a second point. |
| 00:00:37 | Go down 3 and over 1. I'm going to plot a third point. Then I'm going to sketch in the line of this graph. Now I'm ready to graph the second equation with a line. Right here is the y-intercept. It's at negative 4. So I'm going to negative 4 on the y-axis, I'm going to use the slope here to plot a couple more points. |
| 00:00:57 | It's negative 1/2. So that means that it's a negative 1, so I go down 1 and over 2. Down 1 and over 2. Let me go ahead and sketch in the line that represents the second equation. Next step is to locate the intersection if one exists. Well there is an intersection that exists, and |
| 00:01:16 | I've located it. Now I'm ready to state the solution of the system. Well where do the lines intersect? Well they intersect at the point 2, negative 5. So this is the solution to the system. Now I'm ready to verify that the solution is 2, negative 5. I'm going to substitute 2, negative 5 into each equation. So let me start over here with the first equation. |
| 00:01:43 | 3 times the quantity of x, which is 2, plus y, which is negative 5, is equal to 1. So 3 times 2 is 6 plus negative 5 is equal to 1. 6 plus a negative 5 is a positive 1, 1 is equal to 1. That is a true statement. Let me go ahead and substitute 2, negative 5 into the second equation. 2 times the quantity x is 2, plus 2 times a negative 5 is |
| 00:02:14 | equal to negative 16. Let me simplify. 2 times 2 that's plus, 2 times negative 5 is negative 10, equals negative 16. That's going to be 2 times, well 2 plus negative 10, that's negative 8, is equal to negative 16. 2 times negative 8 is negative 16. Negative 16 equals negative 16. |
| 00:02:39 | This is also a true statement. So because we have two true statements, this verifies that the solution is, indeed, 2, negative 5. |

**Section 12**

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| 00:00:00 | TEACHER: Let's take a look at this example of finding a |
| 00:00:02 | solution using a graph. We're going to find the solution of this system of equations by graphing both lines. Notice that both equations that you see here need to be converted to slope-intercept form. Remember that in slope-intercept form, y equals mx plus b, the y needs to be isolated on one side of the equal sign using inverse operations. |
| 00:00:26 | So let me go ahead and start with this equation here. The 6x plus 3y is equal to 9. Let me go ahead and rewrite it real quick, here. The first step in the process is to subtract 6x from each side. Because 6x minus 6x leaves us with 0. So we just have 3y is equal to negative 6x plus 9. Now the next step in the process is to divide both |
| 00:00:52 | sides by 3. We need to get y by itself, or isolate it. 3 divided by 3 is 1. So that's just 1y is equal to negative 6 divided by 3, that's negative 2x plus 9 divided by 3 is 3. Now we have it in slope-intercept form. y equals negative 2x plus 3. Let's go ahead and convert this equation right over here. |
| 00:01:13 | We'll do x plus 1/2y is equal to negative 2. Well the first step in this process is to subtract x from each side. x minus x is 0. So now we have 1/2y equals the opposite of x, or negative x, minus 2. Now how do we get rid of that 1/2? Well right we're multiplying 1/2 times y. |
| 00:01:38 | What's the inverse? Division. And when we divide by a fraction, we multiply by its reciprocal, which would be 2/1 or just 2. So we're going to multiply both sides by 2. These two cancel. We just have y equals, 2 times a negative x, that's a negative 2x minus 4. |
| 00:01:57 | It's in slope-intercept form. y equals negative 2x minus 4. If we examine both equations, notice that they have the same slope, negative 2, but they have different y-intercepts. Well we now can determine that this is a system with no solution, because the lines are parallel. Lines are parallel if they have the same slope and different y-intercepts. |
| 00:02:24 | But let's graph the equations to verify. Let me go ahead and graph this equation first. We'll go to the y-intercept, which is positive 3. Let me plot that point. The slope is negative 2 over 1. So I go down 2 over 1, down 2 over 1, and I can sketch in the line that represents the graph of the first equation. Let me graph the second equation. |
| 00:02:44 | The y-intercept is right here, it's at negative 4, so let me put a point there. Let me use the slope, negative 2/1. Down 2 over 1, down 2 over 1. Let me sketch in the graph of that equation, which is that line. Well the graph now verifies that the equations create parallel lines, thus having no solution, because parallel |
| 00:03:08 | lines will never intersect. |