2/1

Solving Systems: Elimination

Today, we need to solve a mystery:
What are Ms. Oldham and Ms. Wise's favorite numbers?

- They are not the same number.
- They could be negative (-) or positive (+)
- Thier sum is 18.
- They are both prime.

To find them Let's consider other fave numbers:

$$\begin{bmatrix} \_\_ + \_\_ \\ \_\_ + \_\_ \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$$

① ② answers vary

Add the numbers in box (matrix) 1 → ___
Add the numbers in box (matrix) 2 → ___
How do the sums compare? The two sides are equal.

Will these equality hold if we multiply one equation?

$2 \cdot (\_\_ + \_\_) = (\_\_) \cdot 2 \rightarrow \begin{bmatrix} \_\_ & \_\_ \\ \_\_ & \_\_ \end{bmatrix} = \begin{bmatrix} \_\_ \\ \_\_ \end{bmatrix}$

$\_\_ + \_\_ = \_\_$

Are the two matrices equal again?
Yes
What patterns are you seeing?

Let's use the patterns to solve the mystery!

Let Ms. Oldham's favorite number be x
and Ms. Wise's favorite number be y.
We know that the sum of x and y is 18.
So we have:

$$x + y = 18$$

Do you know enough to solve for x and y?

Here is one more hint: $x + 3y = 32$

$$x + y = 18$$
$$-1(x + 3y = 32) \quad \text{• Multiply equation \#2 by } -1$$

$$x + y = 18 \quad \text{• add the 2 equations together}$$
$$+ \; -x - 3y = -32$$
$$0 - 2y = -14$$
$$y = 7 \quad \text{• Now, we know x or y! we can solve for the other.}$$

$$x + y = 18 \quad \text{• Choose an equation and solve for the remaining variable.}$$
$$x + 7 = 18$$
$$x = 11$$

Ms. Oldham's favorite number is 11.
Ms. Wise's favorite number is 7.

Congratulations! You just used ELIMINATION!

Solving Systems by Elimination

1. Arrange the equations with like terms in columns.
2. Multiply, if necessary, to create opposite coefficients for one variable.
3. Add/Subtract the equations.
4. Substitute the value to solve for the other variable.
5. Write your answer as an ordered pair.
6. Check your answer.

1. $2x-2y=-8$
$+\ 2x+2y=4$
$4x+0=-4$
$4x=-4$
$x=-1$

$2(-1)-2y=-8$
$-2-2y=-8$
$-2y=-6$
$y=3$

(-1, 3)

check:
$2(-1)-2(3)=-8$
$-2-6=-8$ ✓

2. $4x+3y=16$
$+\ 2x-3y=8$
$6x+0=24$
$6x=24$
$x=4$

$4(4)+3y=16$
$16+3y=16$
$3y=0$
$y=0$

whiteboard
(4,0) ✓

3. $3x+2y=7$
$+\ -3x+4y=5$
$0+6y=12$
$6y=12$
$y=2$

$3x+2(2)=7$
$3x+4=7$
$3x=3$
$x=1$

(1,2)
$3(1)+2(2)=7$ ✓
$-3(1)+4(2)=5$ ✓

4. $4(2x-3y=-2)$ → $8x-12y=-8$
$2(-4x+5y=2)$ → $-8x+10y=4$
$0-2y=-4$
$y=2$

$2x-3(2)=-2$
$2x-6=-2$
$2x=4$
$x=2$

(2,2)
$2(2)-3(2)=-2$
$4-6=-2$ ✓

* ask for alternate numbers

5. $4(5x+2y=7)$ → $20x+8y=28$
$5(-4x+y=-16)$ → $-20x+5y=80$
$0+13y=-52$
$y=-4$

$5x+2(-4)=7$
$5x-8=7$
$5x=15$
$x=3$

(3,-4)

6. $-4(2x+3y=1)$ → $-8x-12y=-4$
$2(4x-2y=10)$ → $+\ 8x-4y=20$
$0-16y=16$
$y=-1$

$2x+3(-1)=1$
$2x-3=1$
$2x=4$
$x=2$

(2,-1)