

SOLVING SYSTEMS OF EQUATIONS BY ELIMINATION

USE THE ELIMINATION METHOD FOR SOLVING SYSTEMS WHEN YOU DON'T HAVE A GRAPH

STEPS FOR SOLVING BY ELIMINATION

1. **LINE UP** THE VARIABLES
2. **ADD** THE EQUATIONS.
3. **SOLVE** FOR THE FIRST VARIABLE (X OR Y)
4. **SUBSTITUTE** THE VARIABLE FROM STEP 3 AND SOLVE FOR THE OTHER VARIABLE.
5. **CHECK:** PLUG X AND Y INTO EQUATION.

EXAMPLE 1: THE "Y" CANCELS OUT

$$\begin{array}{r} 4x + 3y = 16 \\ + \quad 2x - 3y = 8 \\ \hline 6x = 24 \\ \frac{6x}{6} = \frac{24}{6} \\ x = 4 \end{array}$$

Now plug $x=4$ back in to either original equation

$$\begin{array}{r} 4(4) + 3y = 16 \\ 16 + 3y = 16 \\ -16 \quad -16 \\ \hline 3y = 0 \\ \frac{3y}{3} = \frac{0}{3} \\ y = 0 \end{array}$$

so $x=4$ or $(4, 0)$

EXAMPLE 2: THE "X" CANCELS OUT

$$\begin{array}{r} -x + 2y = -8 \\ + \quad x + 2y = 4 \\ \hline 4y = -4 \\ \frac{4y}{4} = \frac{-4}{4} \\ y = -1 \end{array}$$

or $x=6$
 $y=-1$ or $(6, -1)$

or $x+2(-1)=4$
 $x-2=4$
 $+2+2$
 $x=6$

EXAMPLE 3: THE VARIABLES ARE NOT LINED UP

$$\begin{array}{r} 3x + 2y = 7 \\ 4y - 3x = 5 \end{array}$$

x AND y ARE ON THE SAME SIDE SO MOVE THEM AROUND

$$\begin{array}{r} 3x + 2y = 7 \\ -3x + 4y = 5 \\ \hline 6y = 12 \\ \frac{6y}{6} = \frac{12}{6} \\ y = 2 \end{array}$$

← NOW SOLVE

$(1, 2)$

$$\begin{array}{r} 3x + 2(2) = 7 \\ 3x + 4 = 7 \\ -4 \quad -4 \\ \hline 3x = 3 \\ \frac{3x}{3} = \frac{3}{3} \\ x = 1 \end{array}$$

EXAMPLE 4: THE VARIABLES ARE ON THE WRONG SIDE OF THE EQUAL

$$\begin{array}{r} y = -x + 10 \\ 5x - y = 2 \end{array}$$

x AND y ARE NOT ON THE SAME SIDE. MOVE x TO THE OPPOSITE SIDE OF THE EQUAL SIGN

$$\begin{array}{r} y = -x + 10 \\ +x \quad +x \\ \hline x + y = 10 \\ \begin{array}{r} x + y = 10 \\ 5x - y = 2 \\ \hline 6x = 12 \\ x = 2 \end{array} \end{array}$$

$(2, 8)$

$$\begin{array}{r} 2 + y = 10 \\ -2 \quad -2 \\ \hline y = 8 \end{array}$$

IF YOU DO NOT HAVE VARIABLES THAT CANCEL OUT, YOU WILL NEED TO **MULTIPLY** TO GET TERMS THAT WILL CANCEL

HOW TO FIGURE OUT WHICH NUMBER(S) TO MULTIPLY:

FOR EXAMPLE: IF YOU WANT THE X TERM TO BE -4 MULTIPLY THE ~~ENTIRE~~ **ENTIRE EQUATION (EVERY TERM)**

$$-4(3y + x = -6)$$

$$-12y - 4x = 24$$

- 1) PICK A VARIABLE (X OR Y)
- 2) MULTIPLY EACH EQUATION BY THE OPPOSITE COEFFICIENT

If terms are positive/negative then your multiplication terms are **BOTH POSITIVE**

If terms are both the same sign then your multiplication terms need to be **ONE POSITIVE and ONE NEGATIVE**

EXAMPLE 5: VARIABLES ARE POSITIVE/NEGATIVE

$$\begin{array}{r} 3(3x + y = 8) \\ 1(7x - 3y = 8) \end{array} = \begin{array}{r} 9x + 3y = 24 \\ 7x - 3y = 8 \end{array}$$

$$16x = 32$$

$$\boxed{x=2}$$

$$\boxed{(2, 2)}$$

$$9(2) + 3y = 24$$

$$18 + 3y = 24$$

$$\begin{array}{r} -18 \quad -18 \\ \hline 3y = 6 \end{array}$$

$$3y = 6$$

$$\boxed{y=2}$$

EXAMPLE 6: BOTH VARIABLES ARE SAME SIGN

$$\begin{array}{r} -3(5x + 2y = -10) \\ 5(3x + 6y = 66) \end{array}$$

YOU CAN CHOOSE X OR Y
I LIKE TO PICK WHICHEVER IS SMALLER

$$\begin{array}{r} -15x - 6y = 30 \\ 15x + 30y = 330 \end{array}$$

$$24y = \del{300} 360$$

$$\boxed{y=15}$$

$$\boxed{(-8, 15)}$$

$$-15x - 6(15) = 30$$

$$-15x - 90 = 30$$

$$-15x = 120$$

$$\boxed{x=-8}$$