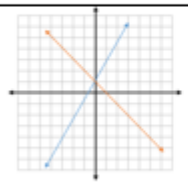
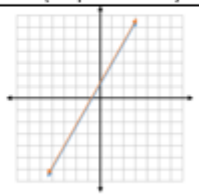
Packet 9: Systems of Linear Equations

Dear Parents/Guardians,

Packet 9 introduces systems of linear equations. Students solve systems using three typical methods; graphing, substitution and elimination. Students use systems of linear equations to solve real-life problems.

What is a System of Linear Equations?

A system of linear equations is a set of two or more linear equations with the same variables. The solution set is the set of values that, when substituted in for the variables, makes all of the equations in the system true. Students will graph systems of linear equations to determine how many solution sets it will have.

One Solution Set	No Solution Set	Infinitely Many Solution Sets
When the lines intersect at only one point.	When the lines are parallel, they will never intersect.	When the lines are the same (equivalent).
		
$\begin{cases} y = 2x + 1 \\ y = -x + 1 \end{cases}$	$\begin{cases} y = 2x + 1 \\ y = 2x - 2 \end{cases}$	$\begin{cases} y = 2x + 1 \\ 2y - 4x = 2 \end{cases}$

Solving Systems of Linear Equations by Substitution

Substitution is a good strategy to use when there is an isolated variable, or it is easy to isolate a variable.

$$\begin{cases} y + 3x = 1 \\ 2x - 4 = y \end{cases}$$

1. Since y is isolated in the second equation, replace the y in the first equation with $2x - 4$. Replace with $2x - 4$

$$y + 3x = 1 \longrightarrow (2x - 4) + 3x = 1$$

2. Solve for x.

$$\begin{aligned} (2x - 4) + 3x &= 1 \\ 5x - 4 &= 1 \\ 5x &= 1 \\ x &= 1 \end{aligned}$$

3. Replace 1 for x in one of the original equations to solve for y.

$$\begin{aligned} 2x - 4 &= y \\ 2(1) - 4 &= y \\ -2 &= y \end{aligned}$$

4. The solution set for the system is (1,-2).

Solving Systems of Linear Equations by Elimination

Elimination is a good strategy to use when there is a variable that could be eliminated easily by using properties of equality (Refer to Packet 6 for more on properties of equality.).

$$\begin{cases} 4x + y = -15 \\ -3x - 2y = 10 \end{cases}$$

Notice that the first (red) equation could be rewritten if both sides of the equation are multiplied by 2 (multiplication property of equality).	$2(4x + y) = 2(-15)$ $8x + 2y = -30$
Using the addition property of equality, add the expressions (from the blue and green equations) on both sides together. By doing this, we have eliminated the y's and can now solve for x.	$8x + 2y = -30$ $+(-3x) - 2y = +10$ $5x = -20$ $x = -4$
Substitute x = -4 into one of the original equations to solve for y. The solution set is (-4, -1).	$4x + y = -15$ $4(-4) + y = -15$ $-16 + y = -15$ $y = -1$

By the end of the packet, your student should know…

When and why systems of linear equations have no solution, one solution, or infinitely many solutions Lesson 9.1

How to solve systems of linear equations using a graphing method Lesson 9.1

How to solve systems of linear equations using a substitution method Lesson 9.2

How to solve systems of linear equations using properties of equality Lesson 9.3

Additional Resources

Resource Guide (RG)
Part 1, pages 41-43, 51-54

Substitution:
https://youtu.be/XTz9AnU7nLM

Elimination:
https://youtu.be/8kRG7jlBMAY