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Systems of Linear Inequalities

Unit 6 Lesson 6

SYSTEM OF LINEAR INEQUALITIES

Students will be able to:

Be able to solve systems of linear inequalities in two variables and express the solutions as the intersection of the corresponding half-planes.

Key Vocabulary:

- Solve System of Linear Inequalities
- Linear Equality
- Graph representation

SYSTEM OF LINEAR INEQUALITIES

A SYSTEM OF LINEAR INEQUALITIES

Is a set of inequalities with multiple variables often solved with a particular specification of the values of all variables that simultaneously satisfy all the inequalities.

A system of inequalities can be solved graphically and non-graphically.

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STEPS TO SOLVE SYSTEM OF LINEAR INEQUALITIES

- Graph each linear inequality as an equality, giving values or finding the intercepts with the axes.
- If you have closed dots \leq, \geq , it must be graphed a complete line (including the boundary) and if you have open dots $>, <$, it must be graphed as a dotted line (excluding the boundary in the case of a strict inequality)
- After graphing both lines, prove the solution by evaluating a point that belongs to the region you consider is the solution region and if it satisfies the linear inequalities, then that proves that is the solution region.
- Represent with a straight line and with a dotted line (excluding the boundary in the case of a strict inequality)

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Sample Problem 1: Solve the following inequalities and graph its solution

$$\begin{cases} x + y \leq 4 \\ 3x + y \leq 6 \end{cases}$$

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Sample Problem 1:

We have to graph each of the linear function that compound the system. One easy way to graph each linear function is to find its intercepts with the axes.

- $y = -x + 4$

$$x = 0 \rightarrow y = 4 \rightarrow (0,4)$$

$$y = 2 \rightarrow x = 2 \rightarrow (2,2)$$

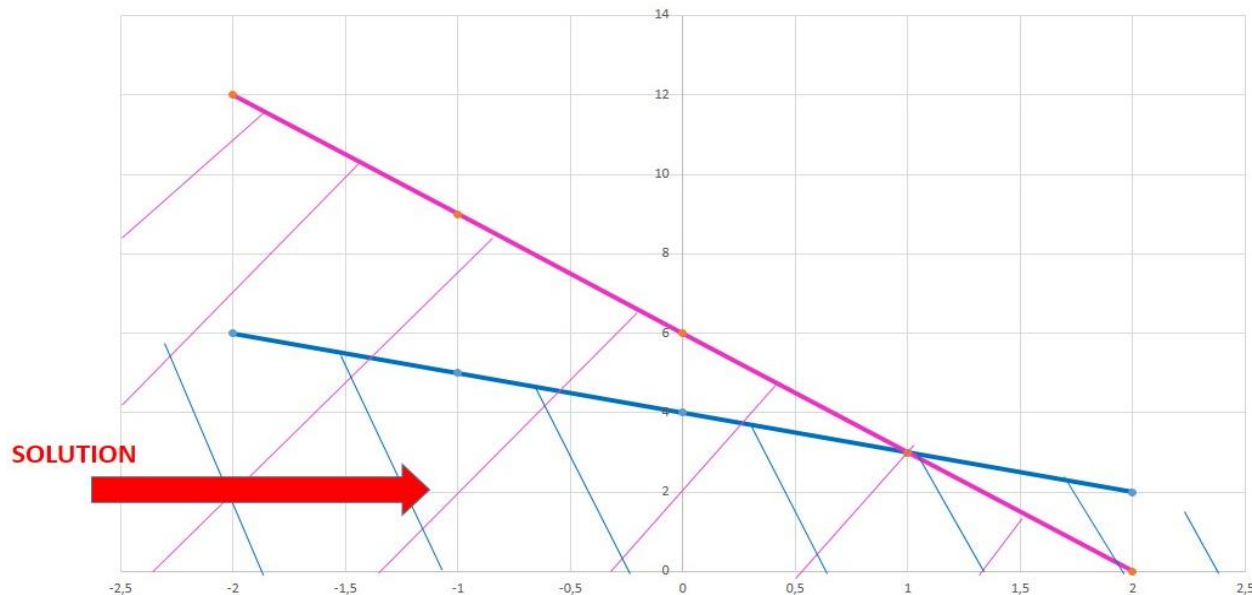
- $y = -3x + 6$

$$x = 0 \rightarrow y = 6 \rightarrow (0,6)$$

$$y = 0 \rightarrow x = 2 \rightarrow (2,0)$$

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Sample Problem 1:



Proving with the point $(0, 2)$ that belongs to the solution region to verify if it satisfies the inequalities:

$$2 \leq -0 + 4 \rightarrow 2 < 4$$

$$2 < -3(0) + 6 \rightarrow 2 < 6$$

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Sample Problem 2: Solve the following inequalities and graph its solution

$$\begin{cases} y - x < 4 \\ 2x + y \geq 1 \end{cases}$$

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Sample Problem 2:

We have to graph each of the linear function that compound the system. One easy way to graph each linear function is to find its intercepts with the axes.

- $y = x + 4$

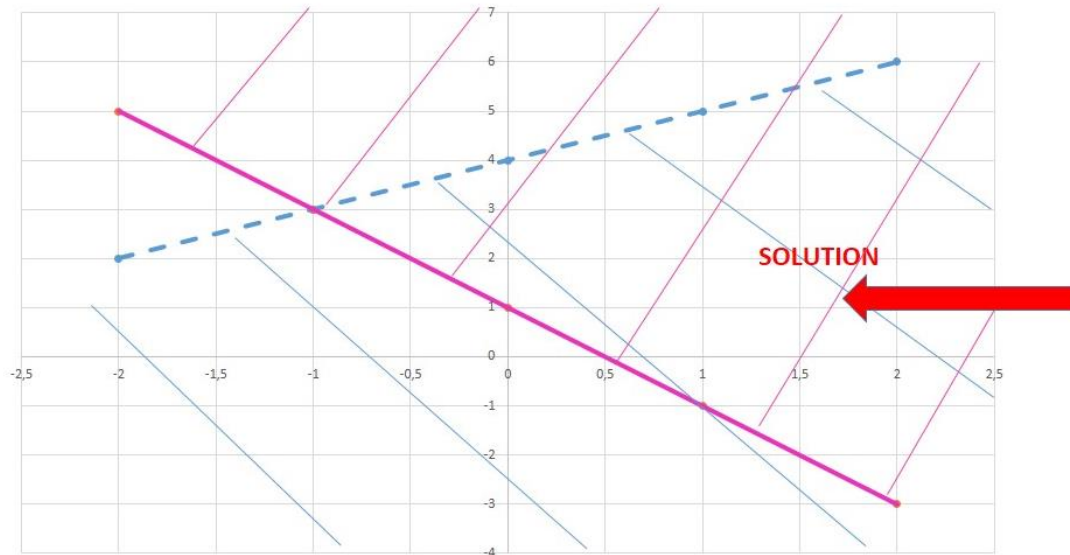
$$x = 0 \rightarrow y = 4 \rightarrow (0,4)$$

$$y = 0 \rightarrow x = -4 \rightarrow (-4,0)$$

- $y = -2x + 1$

$$x = 0 \rightarrow y = 1 \rightarrow (0,1)$$

$$y = 0 \rightarrow x = 1/2 \rightarrow (1/2,0)$$



The segmented line is because the border of the line does not belong to the solution and the straight line is because the border of the line belongs to the solution.

Proving with the point (1,2) that belongs to the solution region to verify if it satisfies the inequalities:

$$y - x < 4 \rightarrow 2 - 1 < 4 \rightarrow 1 < 4$$

$$2x + y \geq 1 \rightarrow 2(1) + 2 \geq 1 \rightarrow 4 > 1$$

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Sample Problem 3: Word problem

A teacher works giving college tutoring for \$12 per hour. She also works giving high school tutoring for \$6. She is allowed to work 30 hours per week and she wants to make at most \$120. Write and graph a system of linear inequalities.

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Sample Problem 3: Word problem

- SOLUTION

Let's define the variables that represent the system:

X= hours worked giving college tutoring

Y= Hours worked giving high school tutoring

As a college tutor she earns \$12 per hour and as editor \$6 to make at most \$120, so the inequality is represented as follows:

$$12x + 6y \leq 120 \rightarrow \text{simplifying} \rightarrow 2x + y \leq 20$$

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She is allowed to work at most 30 hours, so:

$$x + y \leq 30$$

Finally we have the system:

$$\begin{cases} y \leq -2x + 20 \\ y \leq -x + 30 \end{cases}$$

We have to graph each of the linear function that compound the system. One easy way to graph each linear function is to find its intercepts with the axes.

$$y = -2x + 20$$

$$x = 0 \rightarrow y = 20 \rightarrow (0, 20)$$

$$y = 16 \rightarrow x = 2 \rightarrow (2, 16)$$

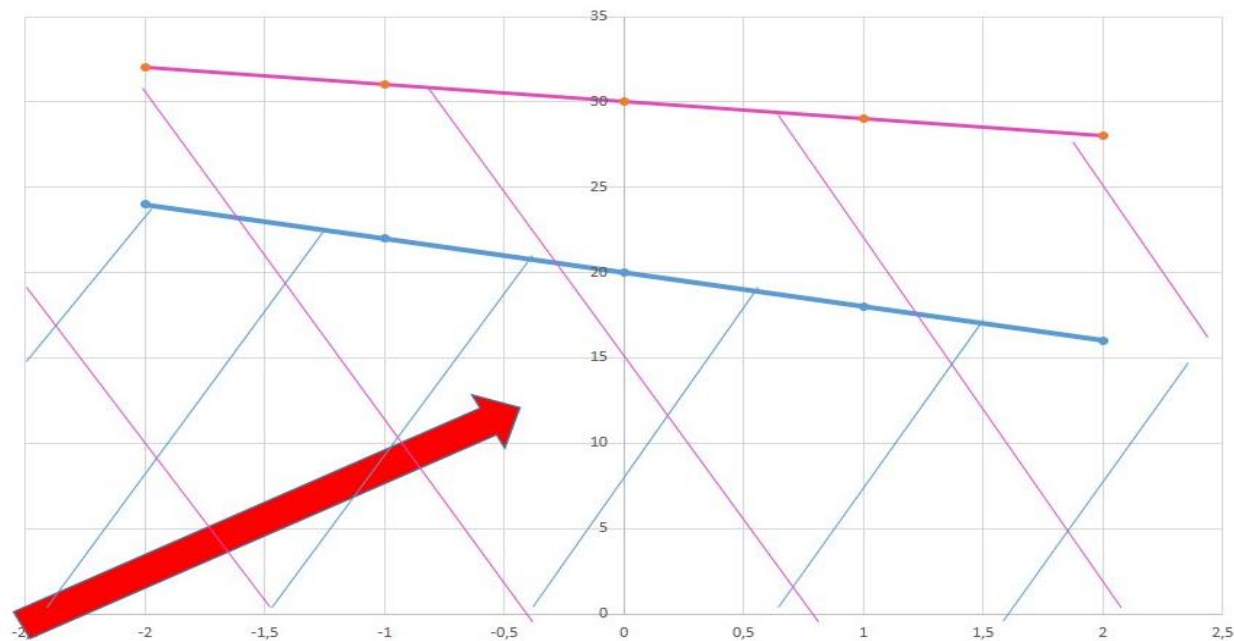
$$y = -x + 30$$

$$x = 0 \rightarrow y = 30 \rightarrow (0, 30)$$

$$y = 32 \rightarrow x = -2 \rightarrow (-2, 32)$$



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SOLUTION

Proving with the point (1, 10) that belongs to the solution region to verify if it satisfies the inequalities:

$$10 \leq -2(1) + 20 \rightarrow 10 < 18$$

$$10 \leq -1 + 30 \rightarrow 10 < 29$$