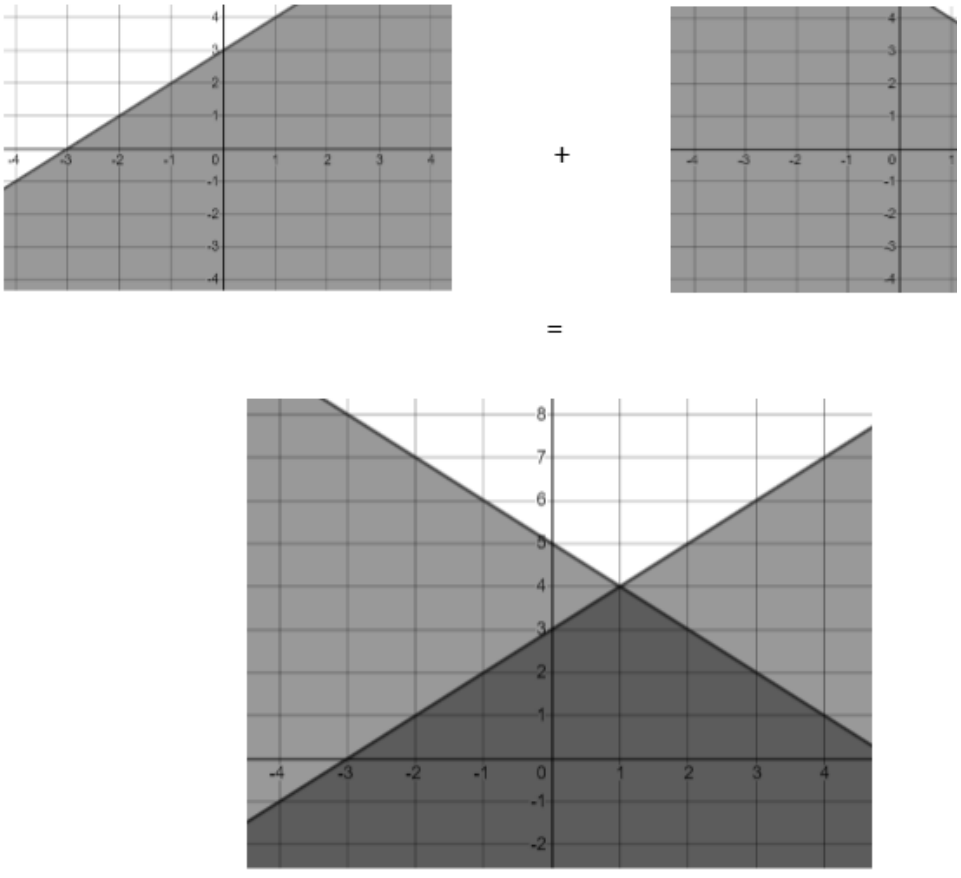
5.4 - Systems / Linear Equalities

FOUNDATIONS OF MATH 11 Ch. 5 – Day 4: Systems of Equations / Line

In the last section, we learned how to graph inequalities. In this section, graph and solve a system of linear inequalities.

Just like a system of linear equations, the solution to a system of linear in points that are shared between both inequalities:



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It can get a little messy when shading a graph for multiple inequalities, "fringe shading" or "reverse shading" where we shade near the bounda side that the inequalities don't share. This way it's easier to inspect the

Example

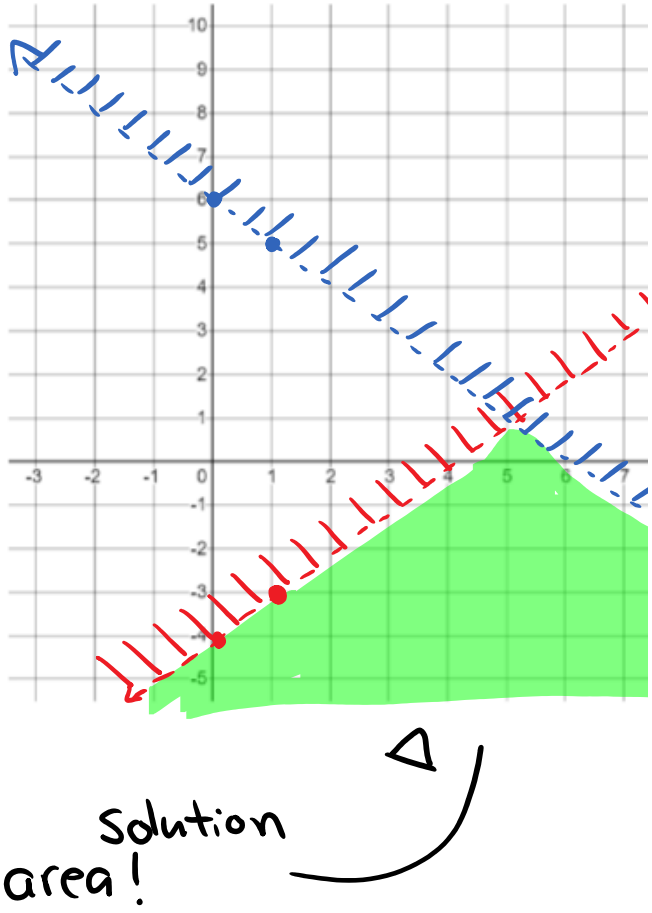
Use fringe shading to show the solution area of the following system of inequalities.

$x - y > 4$
$x + y < 6$

$-y > 4 - x$
$y < -4 + x$
$y < -x + 6$

Test Point: (0,0)
$(0) < -4$
False, shade other side.
Fringe shading shade other side...

Test Point: (0,0)



Solution area!

Example

Janine makes two types of clothing for her store by hand: sweaters and v
500g of wool and 6 hours to make one sweater, and 400g of wool and 9
one vest. Currently, she has 2kg (2000g) of wool and 36 hours to dedicat
clothes. What are all the possible combinations of sweaters and vests Jar
her store?

Firstly, we'll set some variables:

let x = # of sweaters

let y = # of scarves

We also know that $x \geq 0$ and $y \geq 0$. Why is this?

We can't have a negative amount of clothes

So technically, we'll have a system of more than two inequalities, but mo

By inspecting the amount of wool we have available, explain why the ine
$500x + 400y \leq 2000$ (which can be reduced to $5x + 4y \leq 20$) is true.

For every sweater made, 500g of wool is required

For every scarf, 400g is required.

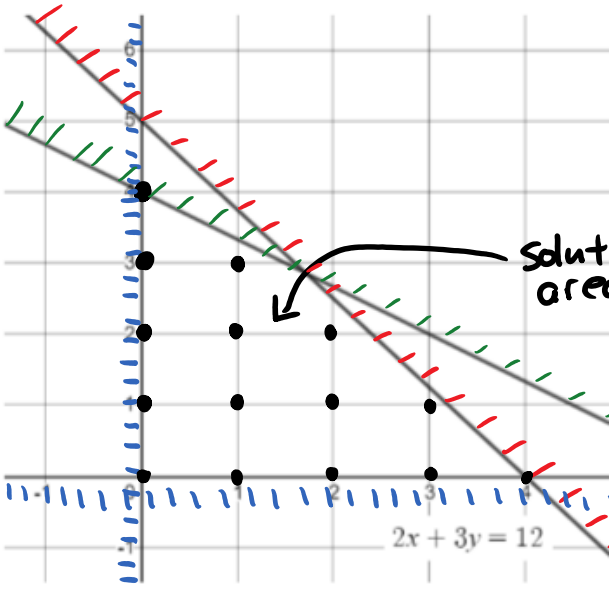
cannot exceed

By inspecting the amount of time we have available, explain why the ine
$6x + 9y \leq 36$ (which can be reduced to $2x + 3y \leq 12$) is also true

The graph of the two inequalities is shown here.

$5x + 4y \leq 20$ is represented by the half plane below the line $5x + 4y = 20$

$2x + 3y \leq 12$ is represented by the half plane below the line $2x + 3y = 12$.



Remember when we said we will have more than two inequalities in our system? Now we're going to use $x \geq 0$ and $y \geq 0$ as well. $x \geq 0$ is everything **to the right** of the y-axis and $y \geq 0$ is everything to the **above** the x-axis.

If we tried to shade all of these regions, it would get messy and difficult to see the solution, so we'll use fringe shading to shade what isn't the solution.

Because we assume that Janine is only making whole sweaters and vests, the solution will be all the points in the solution area that have whole number coordinates. Do we count the points which lie on the axes / inequality lines in the above graph. Do we count the points which lie on the axes / inequa

Yes. Because the line was solid (≤) the points on the line are included.

If it was dashed (<) it would not be included.

List all possible combinations of sweaters and vests Janine can make.

up to 4 scarves.