

Systems of Inequalities

Graphing an Inequality

An inequality will contain a

\geq 'greater than or equal to'

\leq 'less than or equal to'

The points that satisfy the inequality $5x - 3y \leq 15$ will satisfy either

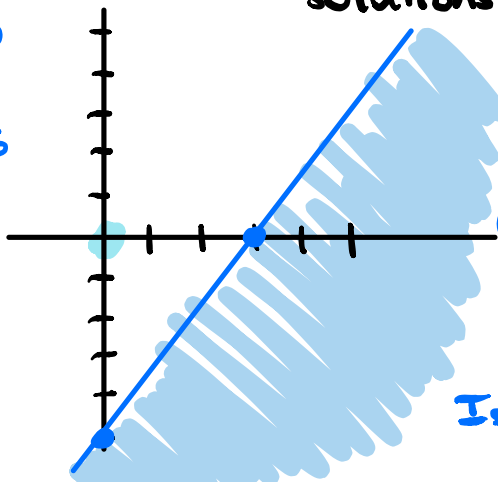
$$5x - 3y = 15 \quad \text{or} \quad 5x - 3y < 15$$

↑
already know
how to graph

↑
shading the half plane
that does not contain
solutions

$$\begin{aligned} (0, -5) \quad 5 \cdot 0 - 3y &= 15 \\ -3y &= 15 \\ y &= -5 \end{aligned}$$

$$\begin{aligned} (3, 0) \quad 5x - 0 &= 15 \\ x &= 3 \end{aligned}$$



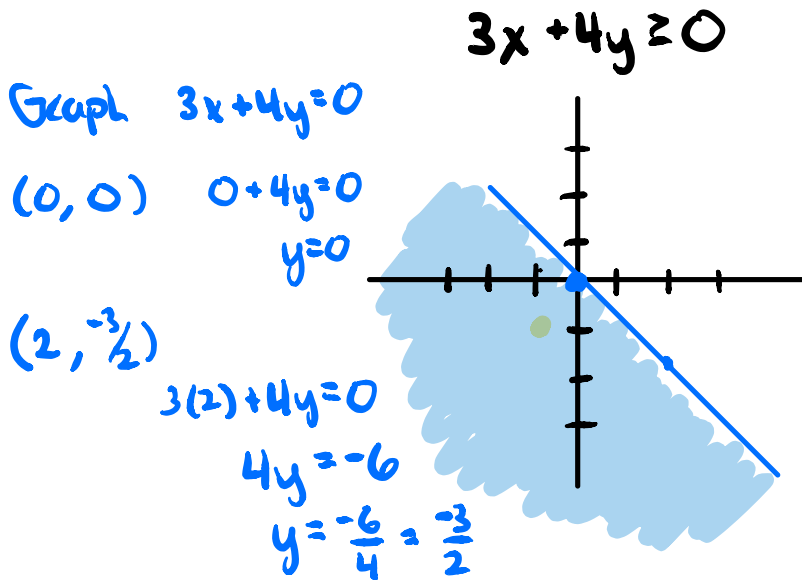
① find point not
on the line
(0, 0)

② 'plug in'
point and see
if inequality
satisfied

$$\text{Is } 5 \cdot 0 - 3 \cdot 0 < 15?$$

* Reminder: We will leave the solution area unshaded

yes; so shade side that does not contain $(0,0)$



Choose point not on line
 $(-1, -1)$

Is
 $3(-1) + 4(-1) \geq 0?$
 $-7 \geq 0?$

NO, so shade side that does contain $(-1, -1)$

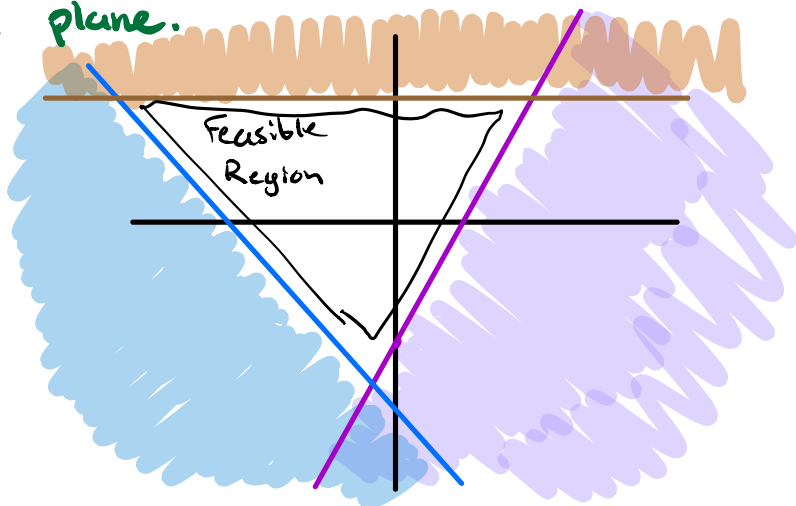
Systems of Inequalities

The set of solutions of a system of inequalities is called the solution set or feasible region and will resemble a region of the plane.

$$3x - 2y \leq 6$$

$$x + y \geq -5$$

$$y \leq 4$$



The above feasible region is an example of a bounded feasible region.

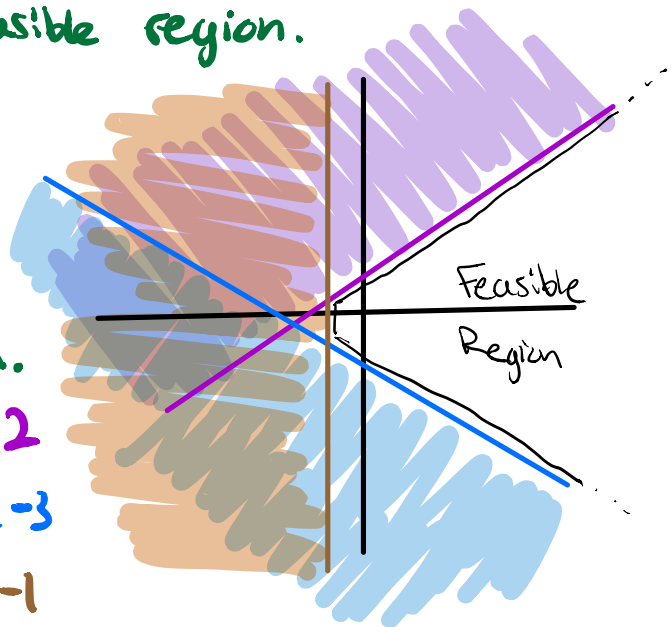
In an unbounded feasible region we can infinitely extend the region in some direction.

To the right is an unbounded feasible region.

$$2y - x \leq 2$$

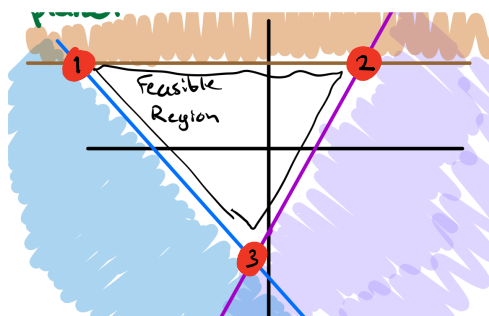
$$2y + x \geq -3$$

$$x \geq -1$$



Corner points & finding them

The edges of the feasible region meet at what we call corner points.



Here each corner point is the intersection of two inequalities.

$$3x - 2y \leq 6$$

$$x + y \geq -5$$

$$y \leq 4$$

Corner 1 is where $x + y = -5$
 $y = 4$

$$x + (4) = -5$$

$$x = -9$$

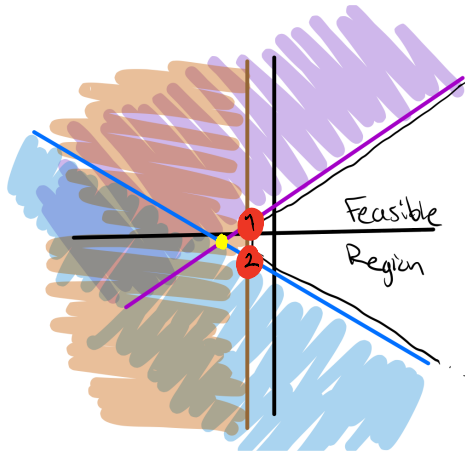
$$(-9, 4)$$

Corner 2 is where $3x - 2y = 6$
 $y = 4$

$$\dots \left(\frac{22}{3}, 4 \right)$$

corner 3 ... $\left(-\frac{4}{5}, -\frac{21}{5} \right)$

* Not all intersections are corner points



$$2y - x \leq 2$$

$$2y + x \geq -3$$

$$x \geq -1$$

The yellow point is

where $2y - x = 2$

$$2y + x = -3$$

which can be found
to be $(-14/4, -1/4)$

which does not satisfy

$$x \geq -1$$

so $(-14/4, -1/4)$ is not
a corner