5.2. Systems of linear Inequalities in 2 variables

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Goals: ① Solve systems of linear Inequalities by graphing.

② Solve some applications.

E.g.

$$\begin{cases} x + y > 6 \\ 2x - y > 0 \end{cases}$$

Solve by graphing.

$x + y = 6$

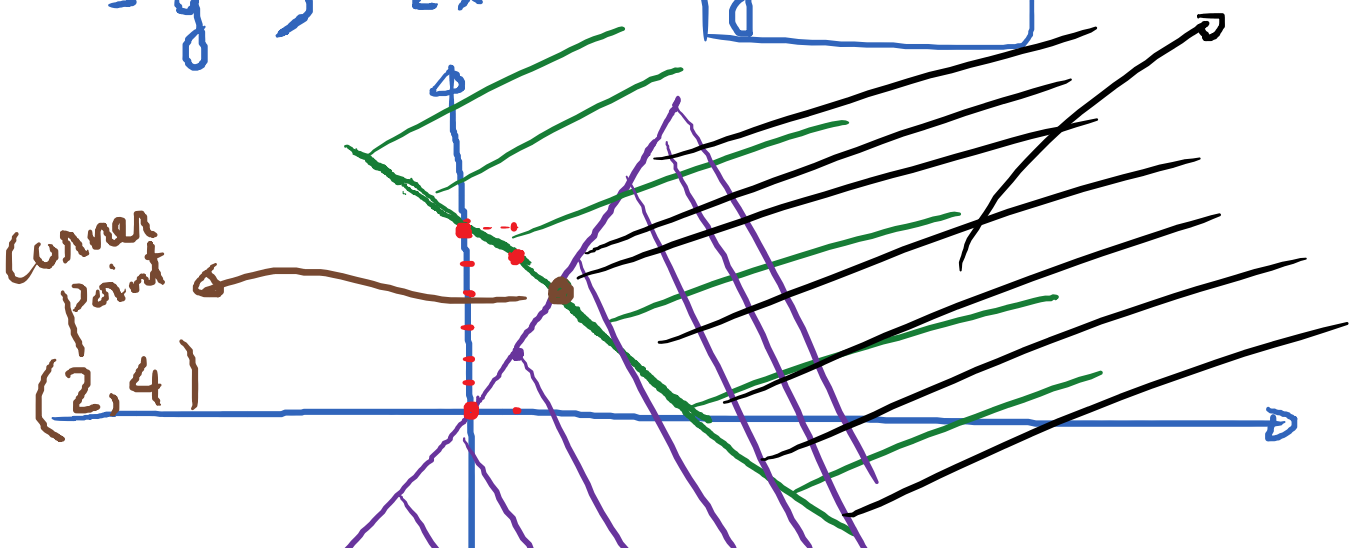
$2x - y = 0$

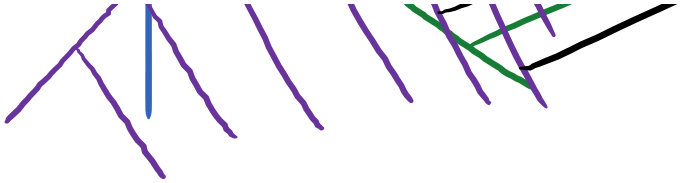
$$\begin{pmatrix} 1 & 1 \\ 2 & -1 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 6 \\ 0 \end{pmatrix}$$

$y > -x + 6$

$-y > -2x \longrightarrow y < 2x$

Region of points that satisfy both inequalities





The solution region for the system is called the feasible region.

A corner point is the intersection of 2 boundary lines of the feasible region.

A manufacturer produces 2 kinds of product

A: 8 hours to design, 4 hours to finish

B: 8 hours to design, 12 hours to finish.

Total # of hours for product design is at most 160.

Total # of hours for finishing product is at most 180

The # of product A is no more than 15.

x: # of product A; y: # of product B.

Q: Write down a system of inequalities that describe these constraints. Find feasible region & corner points.

$$\begin{cases} 8x + 8y \leq 160 \\ 4x + 12y \leq 180 \\ x \leq 15 \\ x \geq 0 \;;\; y \geq 0 \end{cases}$$

$8y \leq -8x + 160$

$y \leq -x + 20$

$12y \leq -4x + 180$

$y \leq -\frac{1}{3}x + 15$

$$\begin{pmatrix} 8 & 8 \\ 4 & 12 \end{pmatrix}\begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 160 \\ 180 \end{pmatrix}$$