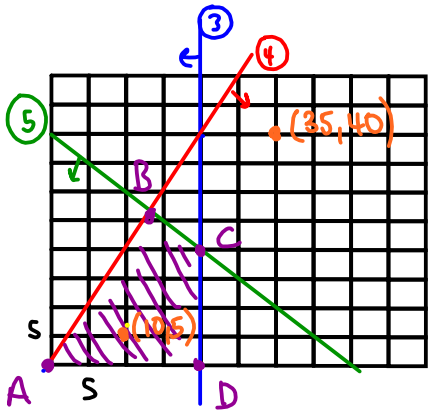
Vertices of Polygon of Constraints

Goal:

- to be able to determine the coordinates of vertices mathematically

Using question 4a from page 21, what are the coordinates of the vertices of the polygon of constraints?

① $x \geq 0$
② $y \geq 0$
③ $x \leq 20$
④ $y \leq 2x$
⑤ $x+y \leq 40$



The shaded region is called the POLYGON OF CONSTRAINTS.
The vertices of this polygon represent max and min optimization solutions.

Coord. of vertices

A(0,0) C(20,20)

B(?,?) D(20,0)

For point B, we must solve a system of equations:

③ $y = 2x$ ④ $x+y=40$

use substitution ③ into ④:

$x + (2x) = 40$

$3x = 40$

$x = \frac{40}{3} = 13.\overline{3}$

into ③ $y = 2\left(\frac{40}{3}\right)$

$= \frac{80}{3} = 26.\overline{6}$

$B\left(\frac{40}{3}, \frac{80}{3}\right)$

In order to find the vertices of a polygon of constraints you must solve a system of equations.

Each line is represented by an equation and each vertex is at the intersection of two lines.

By solving these equations you will find the coordinates of the vertex.

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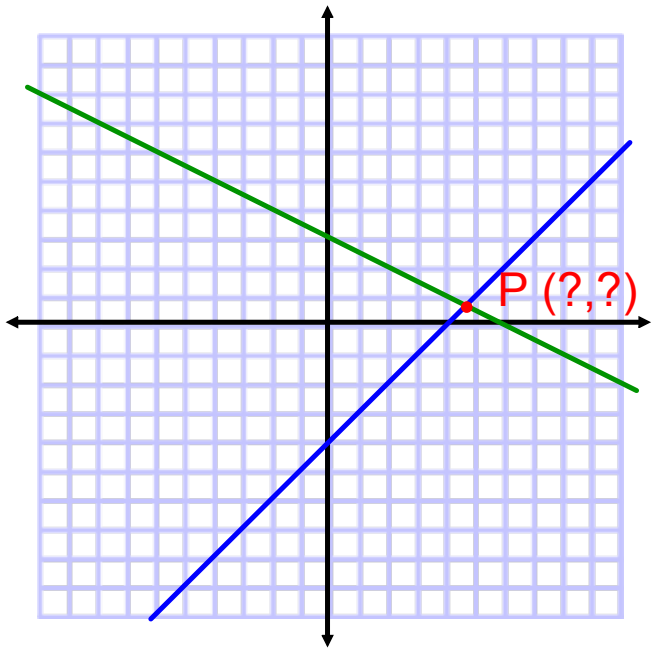
Ex: Find the coordinates of the point of intersection of the following system:

$y=x-4$ ①

$x+2y-6=0$ ②



substitution ① into ②:

$x+2(x-4)-6=0$

$x+2x-8-6=0$

$3x-14=0$

$3x=14$

$x=\frac{14}{3}$

$y=\left(\frac{14}{3}\right)-4$

$y=\frac{14}{3}-\frac{12}{3}$

$y=\frac{2}{3}$

$P\left(\frac{14}{3},\frac{2}{3}\right)$