Math 200 Notes 11/6/2023. Please be sure to put away all phones and computers and take very detailed notes.

1. Graph the system $\begin{cases} x+y\le 2 \\ 2x+y\le 3 \\ x\ge 0 \\ y\ge 0 \end{cases}$

$\xrightarrow{1 \text{ make equation}} x+y=2$

$\xrightarrow{2} x=0,\ y=2$

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

(4) $(0,2),(2,0)$

(5) $\le$ has = , so solid line

(6) check with (0,0):

$0+0\le 2?$

$0\le 2$ true!

(7) shade where (0,0) is located

(1) $2x+y=3$

x=0: $y=3$, $(0,3)$

$y=0:\ 2x=3\to x=3/2,\left(\frac{3}{2},0\right)$

(4) $\le$, so by = part, solid line

(5) check with (0,0):

$2\cdot 0+0\le 3?$

$0\le 3$ true

(6) shade where (0,0) is located

$x\ge 0$ becomes $x=0$

by the = part, draw solid line through x=0

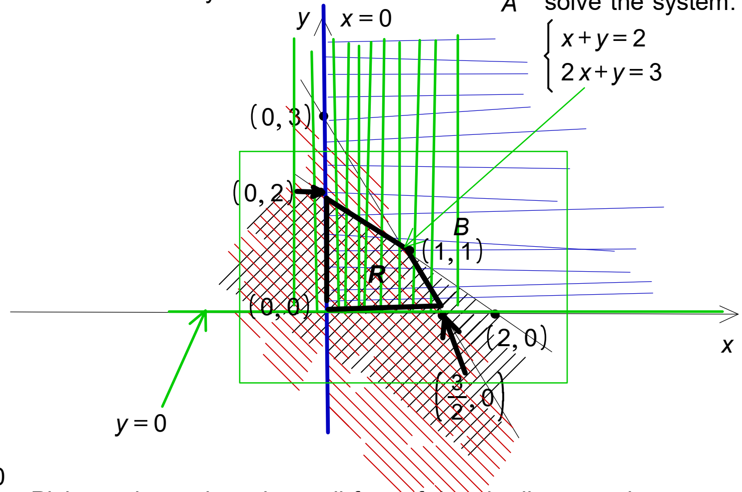
by the > part, shade to the right

$y\ge 0$ becomes y=0 for boundary

by the = part, draw a solid line through y=0

by the > part, shade above this line

A solve the system: $\begin{cases} x+y=2 \\ 2x+y=3 \end{cases}$



Pick out the region where all four of the shadings overlap.

The region R is bounded. We can put inside a rectangle of definite size.

Solve system A: $\begin{cases} x+y=2 \\ 2x+y=3 \end{cases} \xrightarrow{\text{solve top for y}} \begin{cases} y=2-x \\ 2x+y=3 \end{cases} \xrightarrow{\text{plug into bottom}} 2x+2-x=3\to x+2=3\to x=1$

intersection point of boundary lines (=) $\quad y=2-x\to y=2-1=1\ \ point(1,1)(B)$

The region **R** is called the feasible region because it makes every inequality in the system true.

Example 11/Page 184: Nutt's nuts has 75 pounds of cashews and 120 pounds of peanuts. These are to be mixed in 1-pound packages as follow a low-grade mixture that contains 4 ounces of cashews and 12 ounces of peanuts and a high-grade mixture that contains 8 ounces of cashews and 8 ounces of peanuts.

(a) Use x to denote the number of packages of the low-grade mixture and use y to denote the number of packages of the high-grade mixture. Write a system of linear inequalities that describes the possible number of each kind of package.

x ≥ 0, y ≥ 0 (each is positive...number packages..can't have -4 packages)

(ounces of cashews required for low-grade mixture) · (number of packages of low-grade mixture) + (ounces of cashews required for high-grade mixture) · (number of packages of high grade mixture) ≤ 75 pounds of cashews

ounces..not pounds..75lbs $\cdot\left(\frac{16\,oz}{1\text{ lb}}\right)$ = 1200 oz (convert to ounces) $4\cdot x+8\cdot y\le 1200$ (all in ounces..no pounds)

(ounces of peanuts for low-grade) · (number of packages of low-grade mixture) + (ounces of peanutes for high-grade mixture) · (number of packages of high-grade mixture) ≤ 120 pounds of peanutes

ounces conversion: 120 lbs $\cdot\left(\frac{16\,oz}{1\ l\ b}\right)=120\cdot 16\,oz=1920$ oz $\xrightarrow{\text{inequality becomes}} 12x+8y\le 1920$ (all in ounces..no pounds)

system: $\begin{cases} 4x+8y\le 1200 \\ 12x+8y\le 1920 \\ x\ge 0 \\ y\ge 0 \end{cases} \xrightarrow[\text{divide second by 4}]{\text{divide 1st by 4}} \begin{cases} 1x+2y\le 300 \\ 3x+2y\le 480 \\ x\ge 0 \\ y\ge 0 \end{cases}$

$x+2y\le 300$ $\quad (300,0)$

$x+2y=300$ (boundary)

$x=0,\ 2y=300\to y=150$, point: (0,150)

$\le$ has = so solid line

check with (0,0): $0+2\cdot 0\le$ 300?

$0\le 300$ true

shade where (0,0) is located

$3x+2y\le 480$

$3x+2y=480$

$x=0:\ 2y=480\to y=240\ \ (0,240)$

$y=0:$ 3x=480$\to x=160\ \ (160,0)$

$\le$..part is =, so solid line

check with (0,0): $3\cdot 0+2\cdot 0\le$ 480? T

shade where (0,0) is located

$x\ge 0,\ y\ge 0$ (represents already first quadrant)

solve $x+2y=300$ and $3x+2y=480$

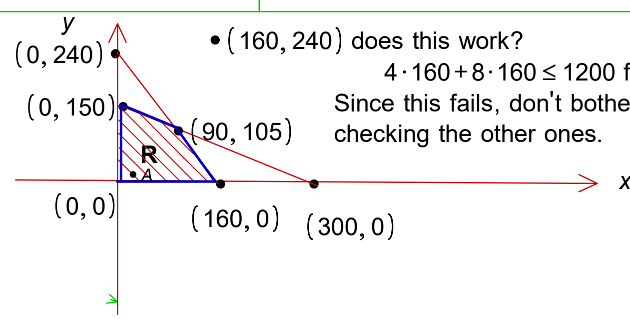
$x=300-2y \xrightarrow{\text{plug in 3x+2y.}} 3(300-2y)+2y=480$

$900-6y+2y=480 \qquad x=300-2\cdot 105$

$-4y=-420 \qquad x=300-210$

$y=105 \qquad x=90$

lines meet at $(90,105)$



• $(160,240)$ does this work?

$4\cdot 160+8\cdot 160\le 1200$ false

Since this fails, don't bother checking the other ones.

R is the feasible region. Any combination of (x,y) from this region or from the boundaries makes the sytstem true.

Let's say we choose $x=20,\ y=10:$ (no reason except they belong to **R**)

point A

check system: $\begin{cases} 4\cdot 20+8\cdot 10\le ?\ 1200\text{TRUE} \\ 12\cdot 20+8\cdot 10\le 1920\text{ TRUE} \\ 20\ge 0\text{ true} \\ 10\ge 0\ \text{ true} \end{cases}$

the point (20,10), for example, makes all the inequalities true!

We have enough ounces of peanuts and cashews to make 20 bags of the low-grade and 10 bags of the high-grade.