Unit 3 : Graphing the Polygon of Constraint and Finding its Vertices (x,y)

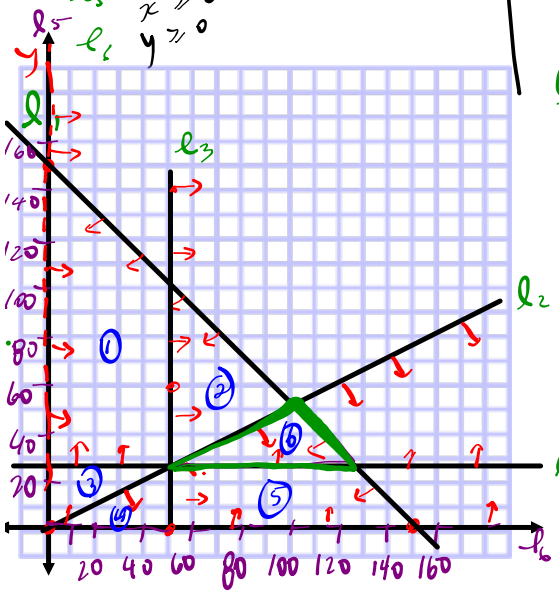
1. A sport boutique sells two types of golf balls: standard quality balls at $2.00 each and high quality balls at $3.50 each. The shopkeeper notices that, monthly, he sells at least 2 times more standard quality balls than the high quality ones. However, to answer his client's needs, the shopkeeper must have at least 50 standard quality balls and at least 25 high quality balls in his shop at all times. Also the shopkeeper never has more than 150 balls total in the store per month.

How many balls of each type must he sell to maximize his revenues?

① x = # of standard balls
y = # of high-quality balls

② $P = 2x + 3.5y$

③ l_1 $x + y \leq 150$
l_2 $x \geq 2y$
l_3 $x \geq 50$
l_4 $y \geq 25$
l_5 $x \geq 0$
l_6 $y \geq 0$



④ Graph inequalities

step i graph the corresponding equations.

l_1 $x + y = 150$

x	y
0	150
150	0

when $x = 0$, what's y?
$0 + y = 150$
$y = 150$

when $y = 0$, what's x?
$x + 0 = 150$
$x = 150$

l_2 $x = 2y$

x	y
0	0
100	50

when $x = 0$, $y = ?$
$\frac{0}{2} = \frac{2y}{2}$
$y = 0$

when $x = 100$, sub it in
$\frac{100}{2} = \frac{2y}{2}$
$y = 50$

step ii. To see what side of line to shade, sub in a test point not on line into original inequality.

l_1 $x + y \leq 150$ sub (0,0)
$0 + 0 \leq 150$
$0 \leq 150$ → True, so arrows towards test point.

l_3 $x = 50$ vertical — no y? special line!
$x \geq 50$
test (0,0) $0 \geq 50$ False, so away

$x \geq 2y$ (120, 20)
$120 \geq 2(20)$
$120 \geq 40$ → True, so arrow toward test point

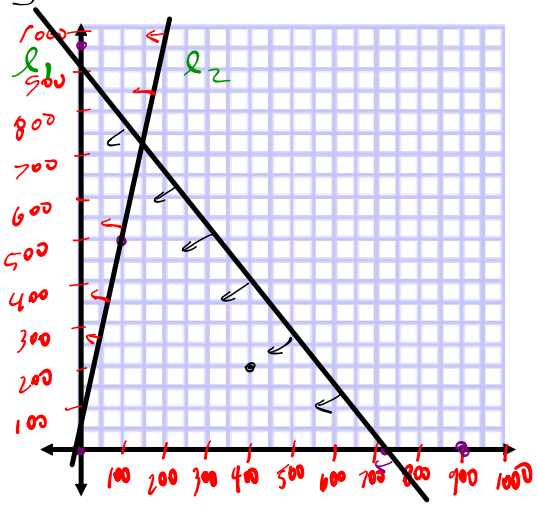
graph l_4 $y = 25$ horizontal!
$y \geq 25$

Note: The singular polygon of constraints is the shape with all arrows pointing towards it.

graph

$20x + 15y \leq 14\,400$

$y \geq 5x$



l_1 $20x + 15y \leq 14\,400$

sub (0,0)

$20(0) + 15(0) \leq 14\,400$

$0 \leq 14\,400$ T

sub (900, 0)

x y

$20(900) + 15(0) \leq 14\,400$

$18\,000 \leq 14\,400$ False

arrows away from test point.

$y \geq 5x$ (400, 200)

x y

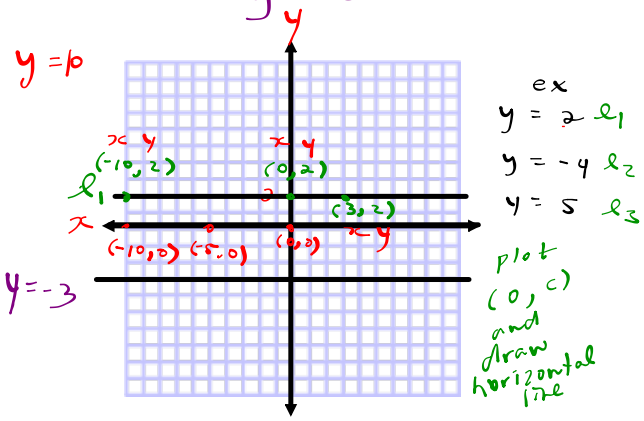
$200 \geq 5(400)$

$200 \geq 2000$

False, arrows away

Graphing Horizontal and Vertical Lines
(Special Lines)

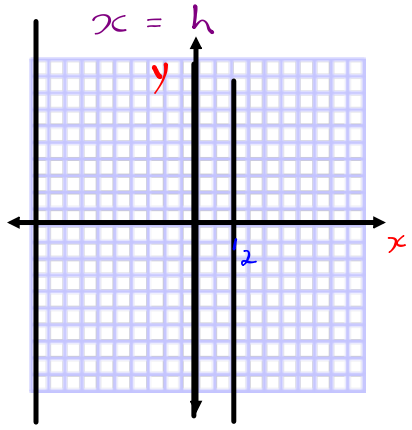
Horizontal Line
$y = c$



ex
$y = 2$ ℓ_1
$y = -4$ ℓ_2
$y = 5$ ℓ_3

plot $(0, c)$ and draw horizontal line

Vertical Line
$x = h$



ex
graph
$x = h$
$x = 2$

plot $(h, 0)$ and draw vertical line

P 3.20

Hg. graph the constraints and find the POC

① $x \geq 0$

② $y \geq 0$

③ $y \geq 10$

④ $x + y \leq 30$

⑤ $6x + 5y \leq 160$

⑥ $x \geq y + 1$

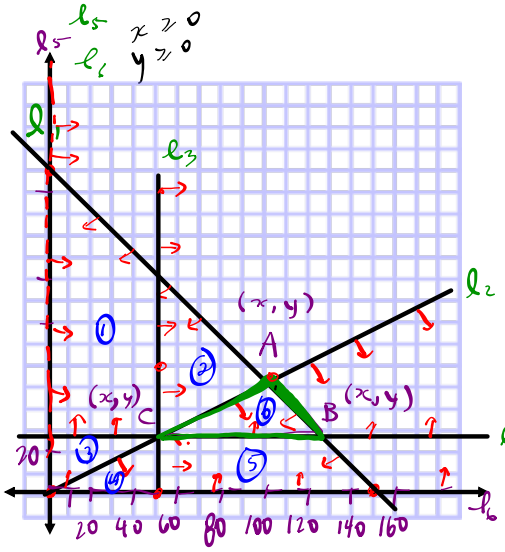
Finding the coordinates (x,y) of the Vertices of POC

① x = # of standard balls
y = # of high-quality balls

② $P = 2x + 3.5y$

③ l_1 $x + y \leq 150$
l_2 $x \geq 2y$
l_3 $x \geq 50$
l_4 $y \geq 25$
l_5 $x \geq 0$
l_6 $y \geq 0$

④ Graph inequalities



⑤ Determine (x,y) of vertices of POC

Vertex	Common Line
A	$l_2 + l_1$

l_1 $x + y = 150$
l_2 $x = 2y$

step i take 2 equations and one equation in substitution elimination or comparison

step ii isolate one unknown in one equation

① $x + y = 150$
② $x = 2y$

step iii sub that unknown into other equation

$2y + y = 150$ ← add, isolate

$\frac{3y}{3} = \frac{150}{3}$

$y = 50$

step iv sub in y into one of equations $y = 50$ into $x = 2y$

$x = 2(50)$
$x = 100$

A (100, 50)

Vertex	Common Lines	(x, y)
A	$l_1 + l_2$	(100, 50)
B	$l_1 + l_4$	
C	$l_2 + l_3$	

B

l_1	$x + y = 150$
l_4	$y = 25$

C

l_2	$x = 2y$
l_3	$x = 50$

After, find coordinates of POC on pg 3.20 - 3.21

HMWK:
p 3.22 - 3.25
#4/5 (steps ④-⑤)

p 3.27 - 3.29
(steps ①-⑤)