Your Name: **Narek Bayramyan**

CSC 4512, Optimization Approaches in CS: Algorithms and Applications

Instructor: Evangelos Triantaphyllou, Ph.D.
Louisiana State University
School of Electrical Engineering and Computer Science
Division of Computer Science and Engineering

Spring 2022 Semester

SUBMIT ALL HOMEWORKS Electronically via Moodle

MAIN GOALS for HW #1:
Gain experience with some basic model formulations of LP (linear programming) and the 2-D graphical solution approach.

Today's date: **Monday,** **January 31, 2022**
Due date: **Wednesday,** **February 9, 2022. By 10:00 PM of that day via MOODLE**
Maximum grade points = 100
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ANNOUNCEMENT: Our TA is Augustine Orgah. His E-mail is: aorgah1@lsu.edu
CLEARLY EXPLAIN AND ORGANIZE YOUR ASNWERS! The TA may take points off otherwise. Your answers must be presented sequentially.

NOTE: Always observe the Policy Statement for this course regarding Cheating / Academic Misconduct as it is stated on page 4 of the syllabus and described in the first day of classes.

See the following pages the exact descriptions.
From Problem Set 2.2A solve the following problems:
Problem #3. Do the first three parts.
Problem #4: Do parts (a) and (b), only.

When you solve a problem graphically do as we did in our Zoom meetings. That is, do the following:
1. Prepare a table with all the corner points of the FR, their coordinates, and the value of the objective function at each corner point.
2. Show the objective function and the way it improves. Also, show the objective function at optimality.
3. Clearly describe what the optimal solution is.

Solve even more problems on your own so you can gain a deep understanding of the ideas.

Attach this form on front of your solutions with your name filled in

Baghramyan Narek

HW #1

2.2 A Ex. 3

a) demand for exterior $\le 2,5$

1) $6x_1 + 4x_2 \le 24$

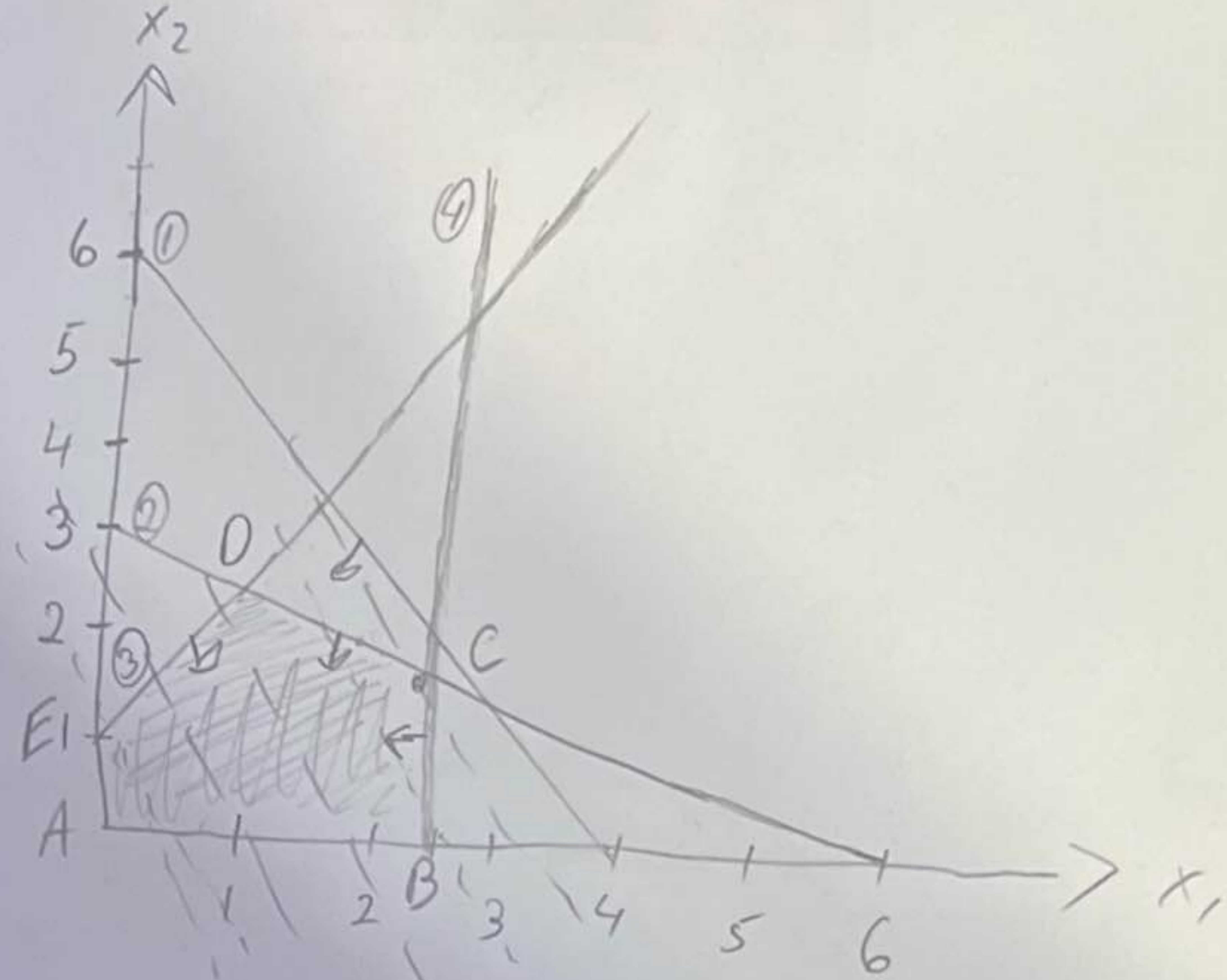
2) $x_1 + 2x_2 \le 6$

3) $x_2 - x_1 \le 1$

4) $x_1 \le 2,5$

5) $x_1, x_2 \ge 0$

$z = 5x_1 + 4x_2$



1) $x_2 = 6 - \frac{6}{4}x_1$

$x_1 = 0 \quad x_2 = 6$

$x_1 = 4 \quad x_2 = 0$

2) $x_2 = 3 - \frac{x_1}{2}$

$x_1 = 0 \quad x_2 = 3$

$x_1 = 6 \quad x_2 = 0$

3) $x_2 = 1 + x_1$

$x_1 = 0 \quad x_2 = 1$

$x_1 = 5 \quad x_2 = 6$

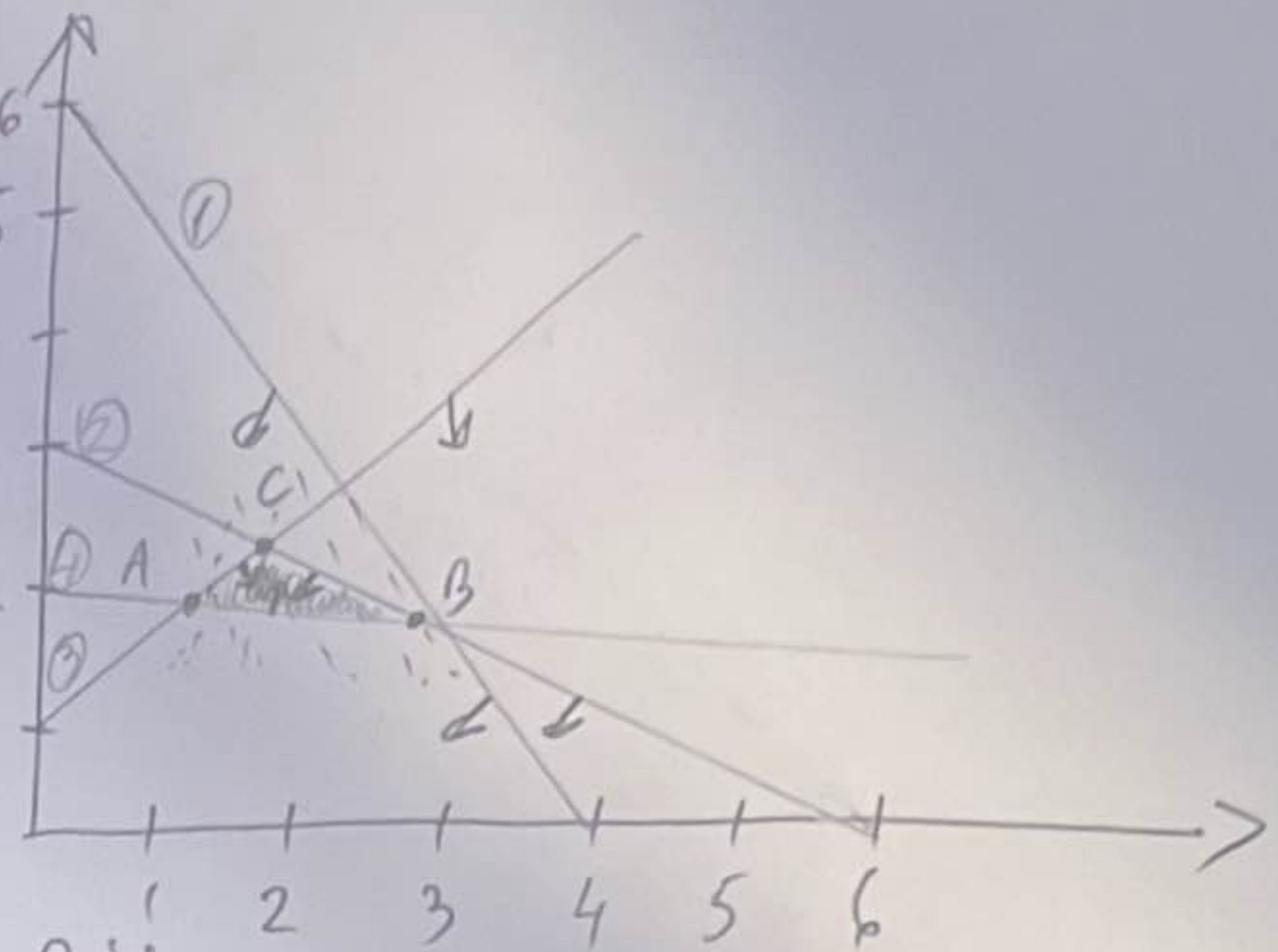
$x_1 = 2,5$
$x_2 = 1,75$ $\Rightarrow$ $z = 12,5 + 7 = 19,5$ is the optimal solution

Corner Points	x_1	x_2	Constraints	$z = 5x_1 + 4x_2$
A	0	0	0, 0	0
B	2,5	0	$x_1 \le 2,5$, $x_1 + 2x_2 \le 6$	12,5
C	2,5	1,75	$x_1 \le 2,5$, $x_1 + 2x_2 \le 6$	19,5
D	1,33	2,33	$x_2 - x_1 \le 1$, $x_1 + 2x_2 \le 6$	$\approx 15,97$
E	0	1	$x_2 - x_1 \le 1$,	4

19,500\$ is the maximum profit that satisfies all conditions with 2,5 tons exterior and 1,75 interior paint

b) $X_2 \geq 2$

1) $6x_1 + 4X_2 \leq 24$
2) $X_1 + 2X_2 \leq 6$
3) $X_2 - X_1 \leq 1$
4) $X_2 \geq 2$
5) $X_1, X_2 \geq 0$

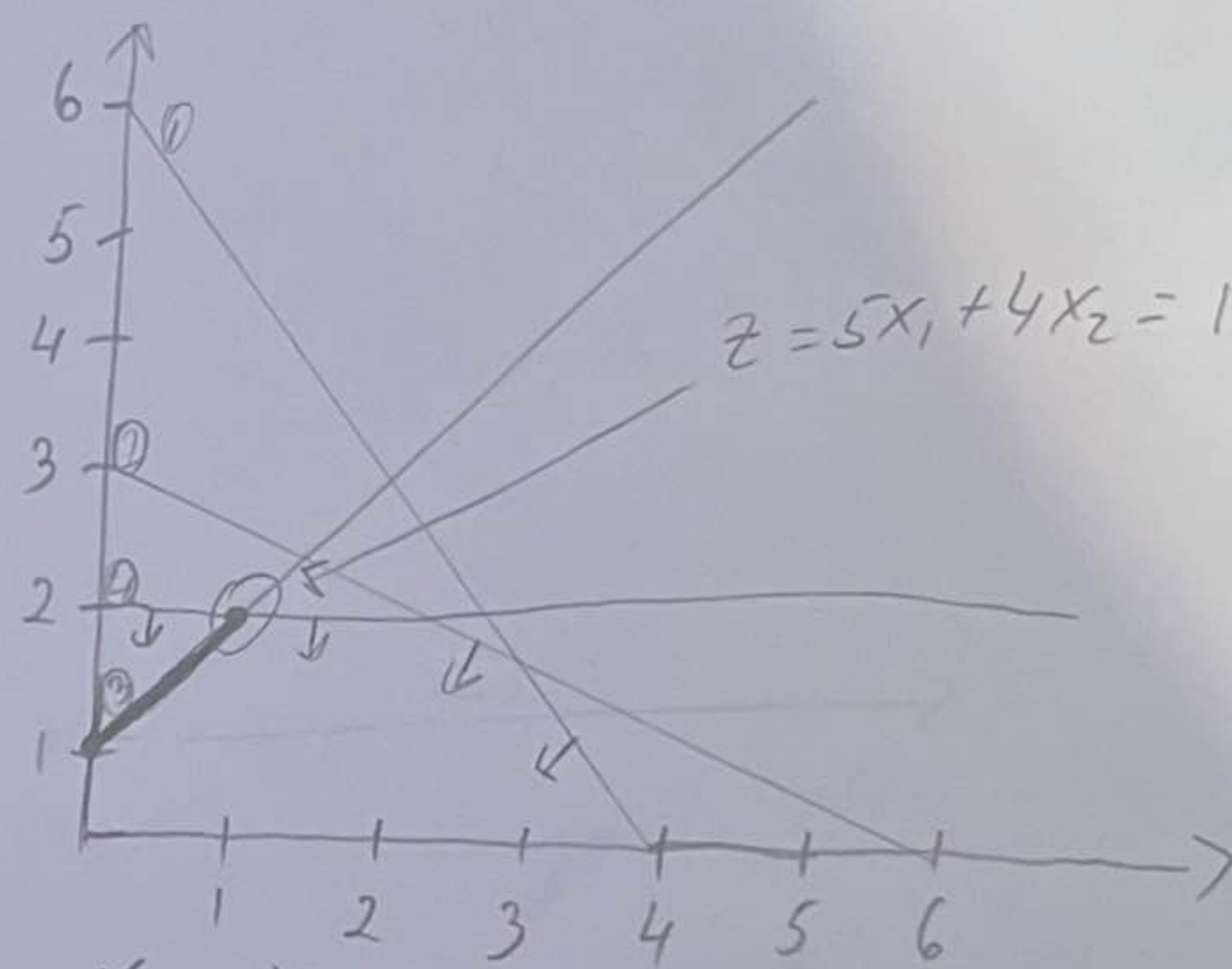


Corner Point	X_1	X_2	Constraints	$Z = 5X_1 + 4X_2$
A	1	2	$X_2 - X_1 \leq 1, X_2 \geq 2$	13
B	2	2	$X_1 + 2X_2 \leq 6, X_2 \geq 2$	18 ←
C	1,33	2,33	$X_1 + 2X_2 \leq 6, X_2 - X_1 \leq 1$	≈15.97

$Z = 5 \cdot 2 + 4 \cdot 2 = 18$ is the optimal solution
18 000\$ Profit with 2 tons of int and ext. paint

c) $X_2 - X_1 = 1$

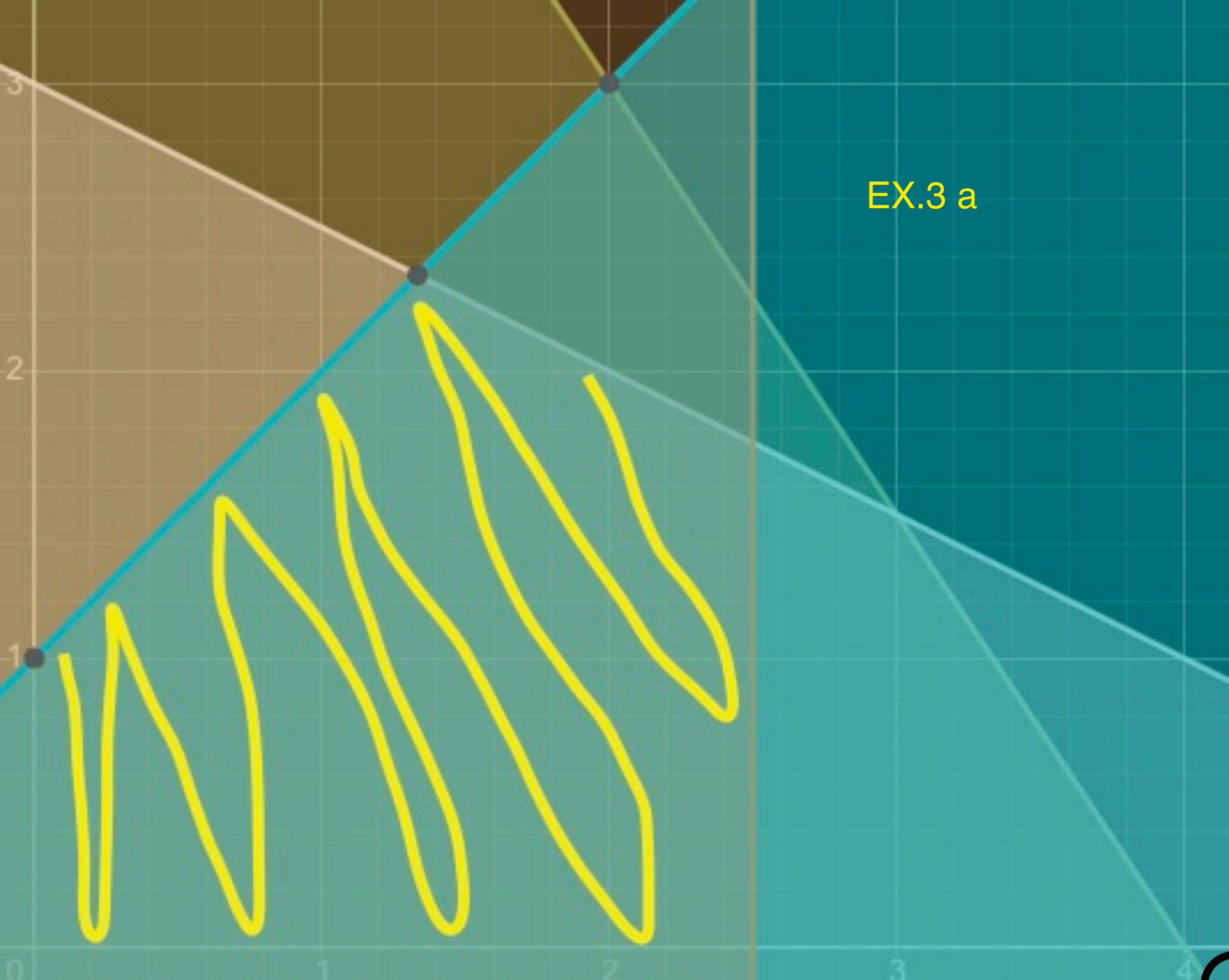
1) $6X_1 + 4X_2 \leq 24$
2) $X_1 + 2X_2 \leq 6$
3) $X_2 - X_1 = 1$
4) $X_2 \leq 2$
5) $X_1, X_2 \geq 0$

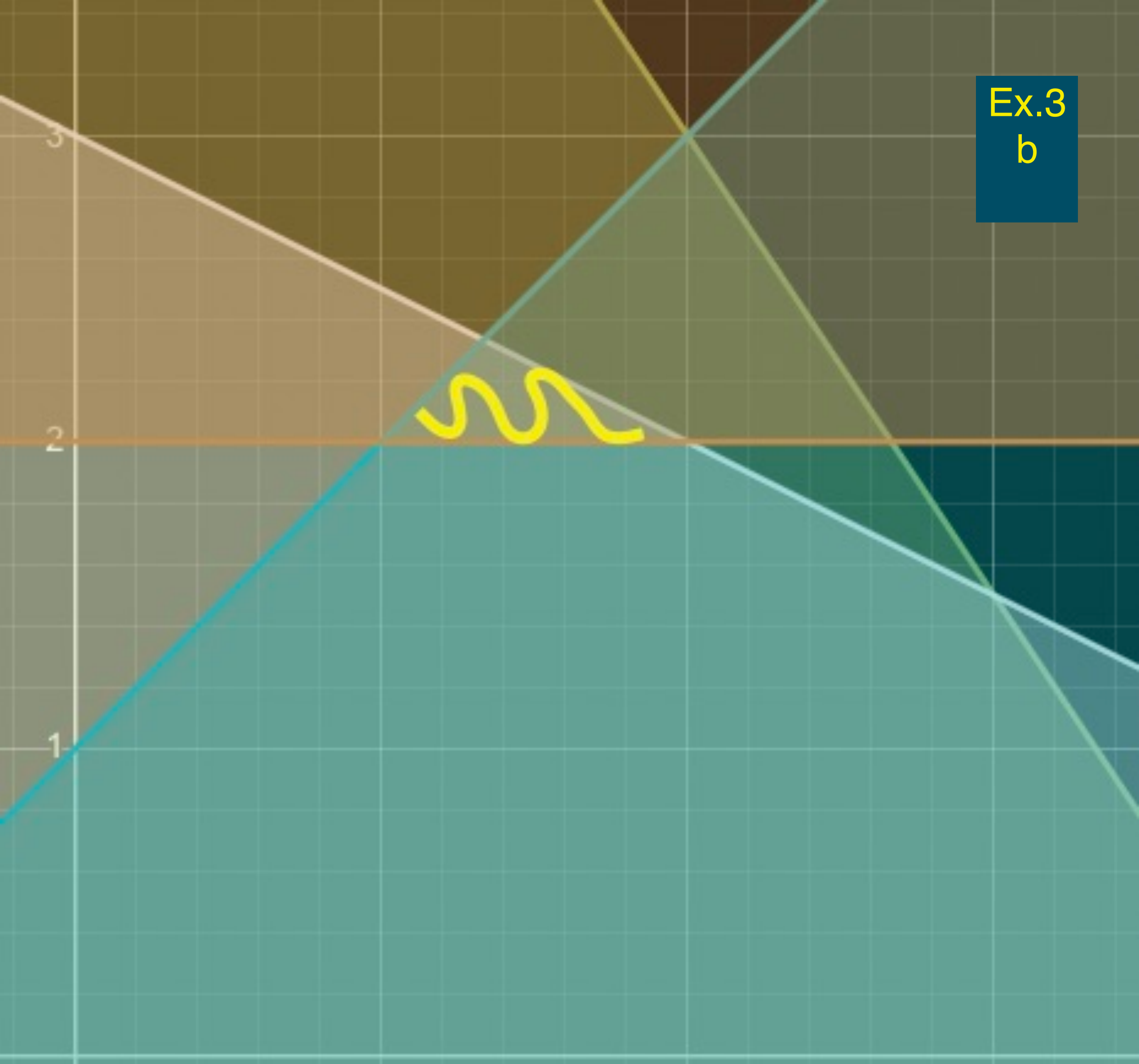


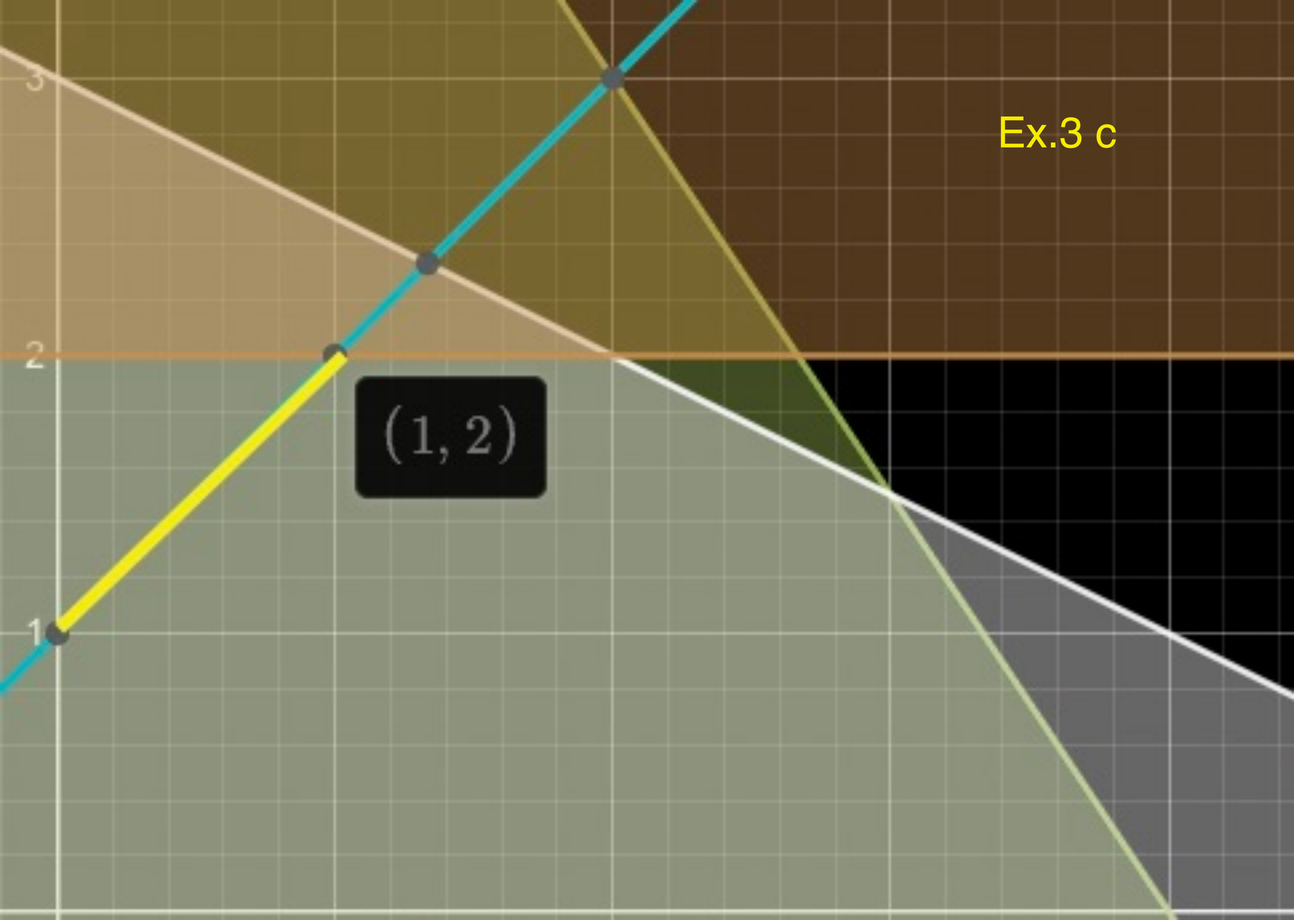
As $X_2 - X_1 = 1 \Rightarrow$

A	0	1	$X_2 - X_1 = 1$	4
B	1	2	$X_2 - X_1 = 1, X_2 \leq 2$	13 ←

13,000\$ with 1 ton exterior and 2 tons of interior paint


EX.3 a


Ex.3
b
3
2
1


Ex.3 c
3
2
1
$(1,2)$

Ex. 4

a) $z = 3x_1 + x_2$

b) $z = x_1 + 3x_2$

c) $z = 6x_1 + 4x_2$

1) $6x_1 + 4x_2 \leq 24$

2) $x_1 + 2x_2 \leq 6$

3) $-x_1 + x_2 \leq 1$

4) $x_2 \leq 2$

5) $x_1, x_2 \geq 0$

Corner P.	x_1	x_2	Constraints	$z = 3x_1 + x_2$	$z = x_1 + 3x_2$	$z = 6x_1 + 4x_2$
A	0	0	$x_1 = 0,\ x_2 = 0$	0	0	0
B	4	0	$6x_1 + 4x_2 \leq 24$	12	4	24
C	3	1,5	$6x_1 + 4x_2 \leq 24$ $x_1 + 2x_2 \leq 6$	10,5	7,5	22
D	2	2	$x_2 \leq 2,\ x_1 + 2x_2 \leq 6$	8	8	20
E	1	2	$x_2 \leq 2,\ -x_1 + x_2 \leq 1$	5	7	14
F	0	1	$-x_1 + x_2 \leq 1$	1	3	4

The difference between c and a, b is that
z is the same as ①-st constraint. which is the max.

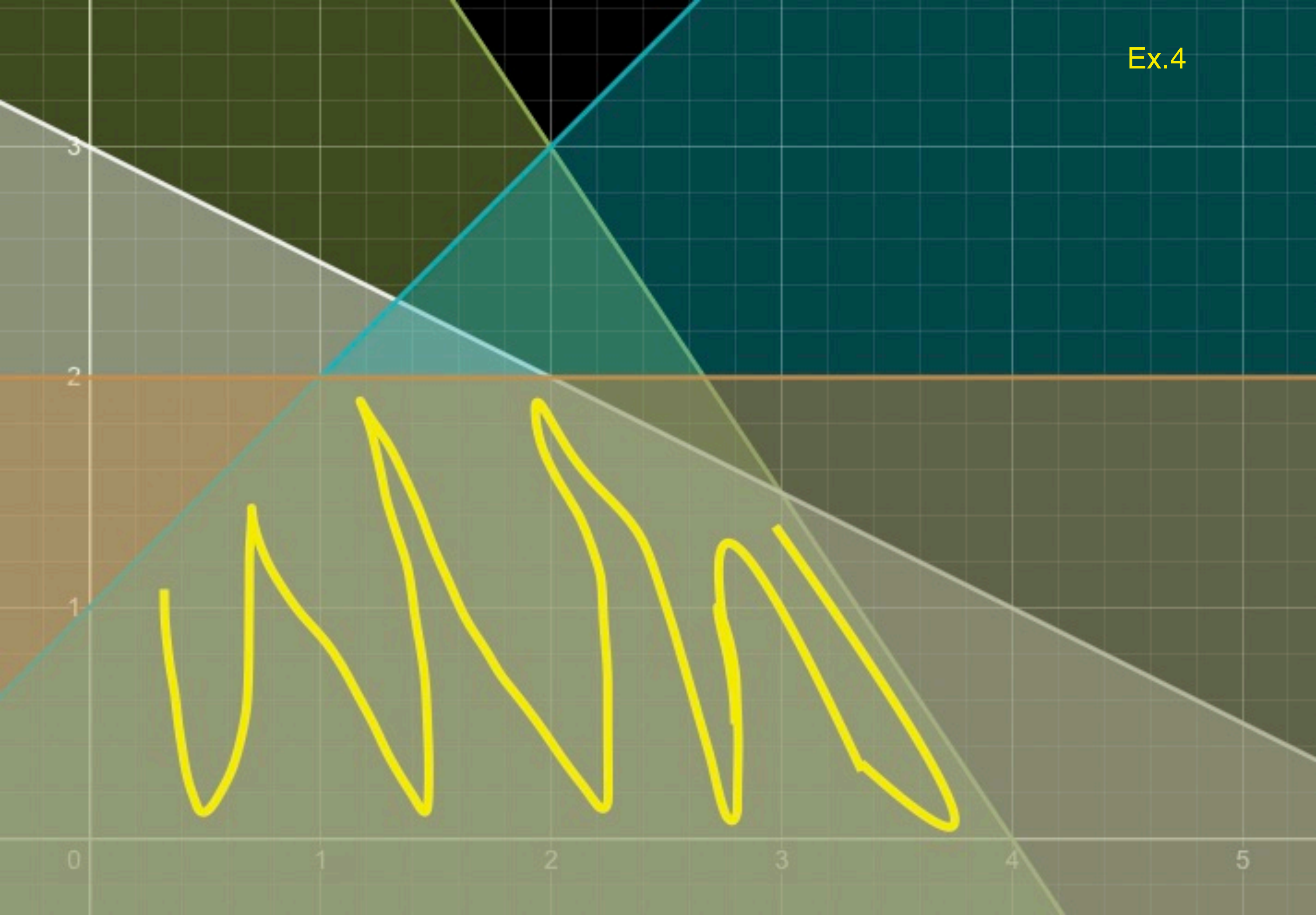
a) $x_1 = 4$; $x_2 = 0$ b) $x_1 = 2$ $x_2 = 2$ c) $x_1 = 4$ $x_2 = 0$

$z = 12$ $z = 8$ $z = 24$

To translate it, the best mix of interior and exterior paints that maximizes the total daily profit is a) 4 tons exterior and 0 tons interior will profit 12 000 $

b) 2 tons ext. and 2 tons int. will profit 8 000 $

c) 4 tons ext. and 0 tons int will profit 24 000 $



Ex.4
3
2
1
0
1
2
3
4
5