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20K-1044

SE-4A

ASSIGNMENT #1

OPERATION RESEARCH

1. A PRODUCTION PROBLEM

let:

x_1 = number of quart of fine made

x_2 = number of quart of extra fine made

let 'Z' be the profit

Maximize:

$$Z = 8x_1 + 10x_2$$

Subject to:

$$2x_1 + x_2 \leq 50$$

$$x_1 + 2x_2 \leq 70$$

$$x_1, x_2 \geq 0$$

Graphical Method:

From eq 1)

Put $x_1 = 0$

$2(0) + x_2 = 50$

$(0, 50)$

Put $x_2 = 0$

$2x_1 = 50$

$x_1 = 25$

$(25, 0)$

From eq 2)

Put $x_1 = 0$

$2x_2 = 70$

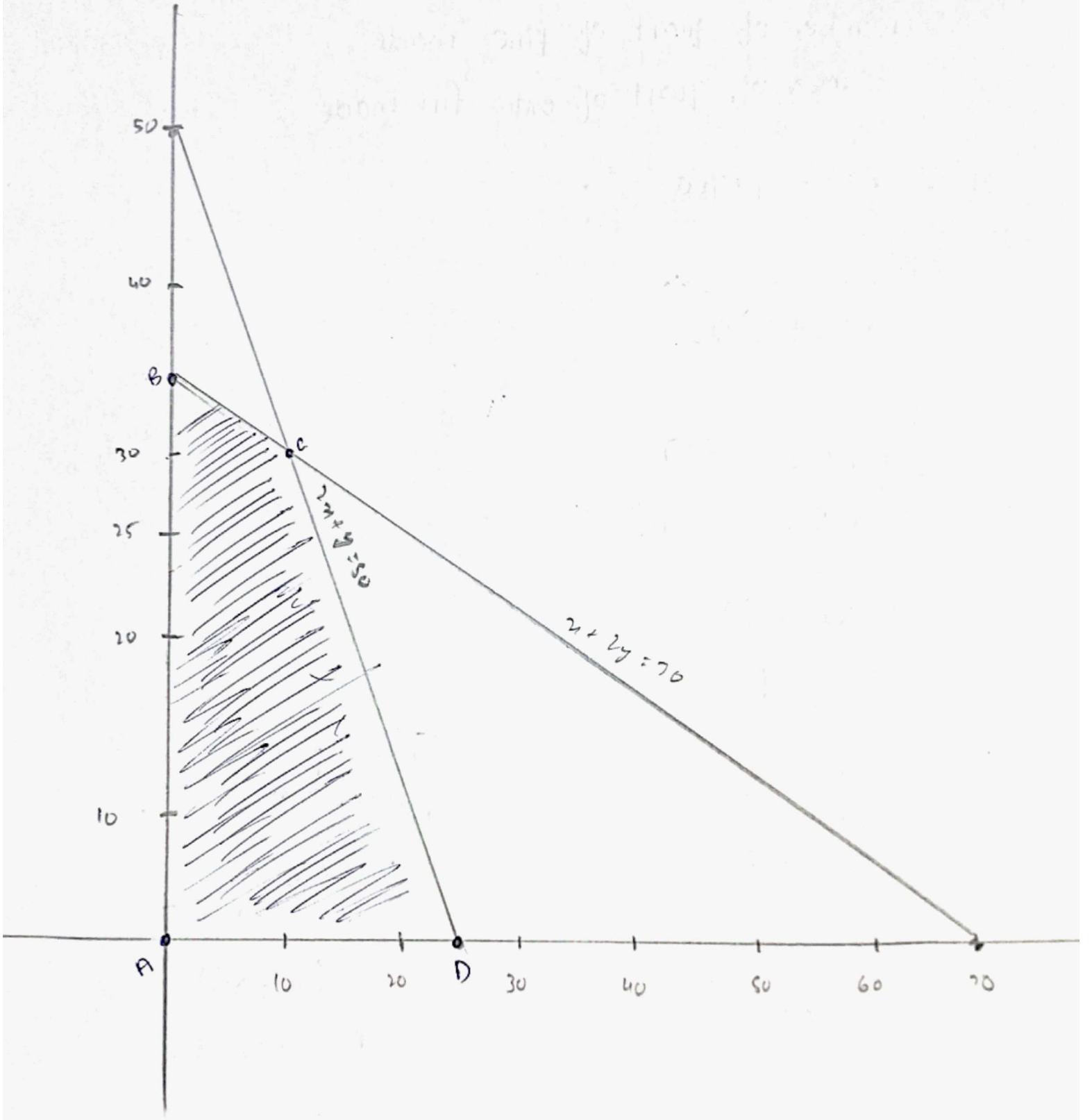
$x_2 = 35$

$(0, 35)$

Put $x_2 = 0$

$x_1 = 70$

$(70, 0)$



Points	Profit $Z = 8x_1 + 10x_2$
A (0,0)	0
B (0,35)	350
C (10,30)	380
D (25,0)	200

Result:

10 quarts of fine and 30 quarts of extra fine give maximum profit.

2) THE POLLUTION PROBLEM:

let

x_1 = number of tons of product made in Plant X

x_2 = number of tons of product made in Plant Y

Minimize:

$$Z = 20x_1 + 30x_2$$

Subject to:

$$x_1 \leq 30$$

$$x_2 \leq 40$$

$$x_1 + x_2 \geq 50$$

$$x_1, x_2 \geq 0$$

Graphical Method:

From eq 1)

(30,0)

From eq 2)

(0,40)

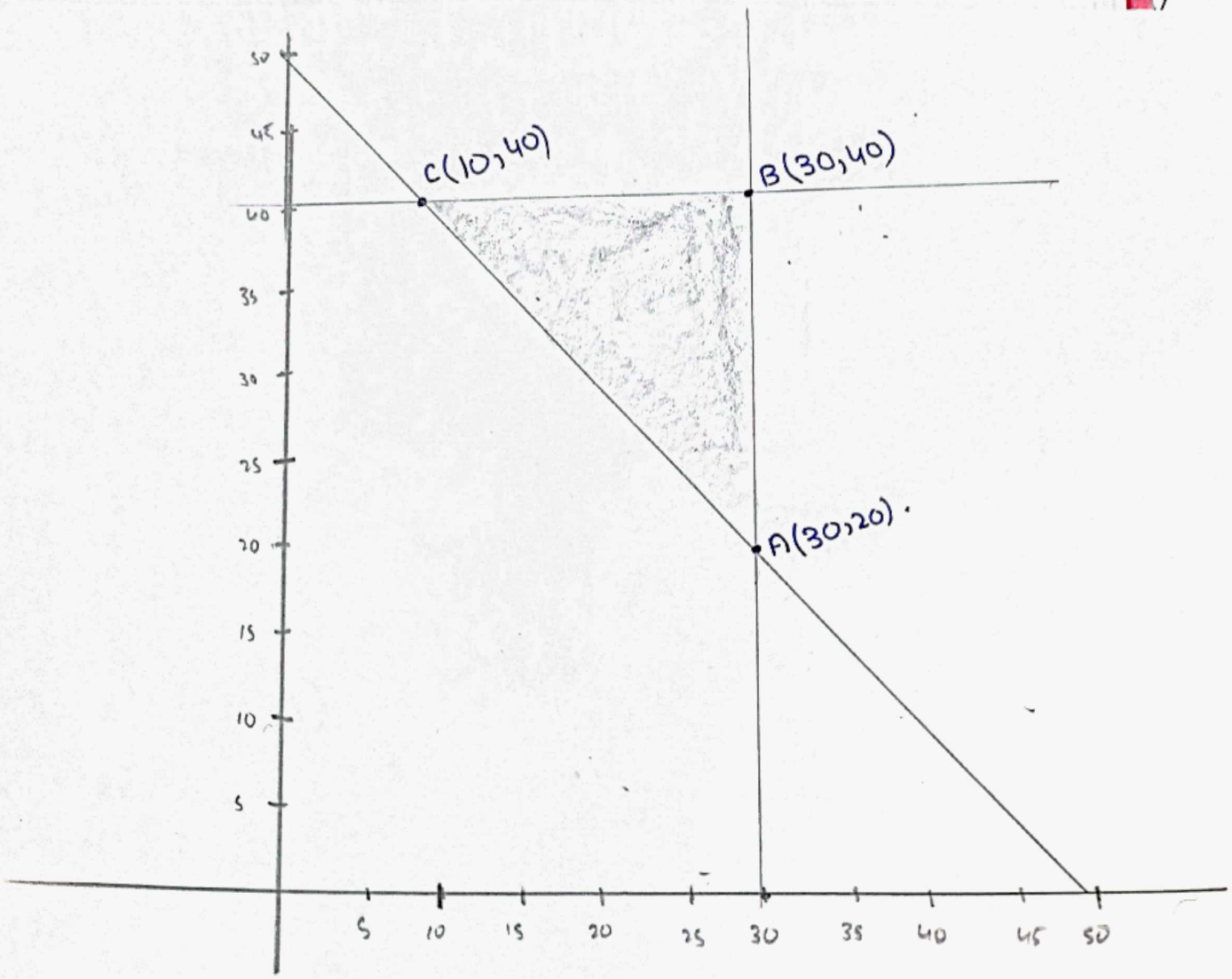
From eq 3)

put $x_1 = 0$

$x_2 = 50$ (0,50)

put $x_2 = 0$

$x_1 = 50$ (50,0)



Point	Minimze $Z = 20x_1 + 30x_2$
A (30,20)	1200
B (30,40)	1800
C (10,40)	1400

Result:

30 tons of produd should be made in plant X and 20 tons of product should be made in plant Y to minimize the total amount of particulate in atmosphere.

3. THE DIET PROBLEM

let

x_1 = food A

x_2 = food B

Minimize:

$$Z = 30x_1 + 40x_2$$

Subject to:

$$2x_1 + x_2 \geq 12$$

$$x_1 + x_2 \geq 9$$

$$x_1 + 3x_2 \geq 15$$

$$x_1, x_2 \geq 0$$

Graphical Method:

from eq 1)

put $x_1 = 0$

$x_2 = 12$ (0,12)

put $x_2 = 0$

$x_1 = 6$ (6,0)

from eq 2)

put $x_1 = 0$

$x_2 = 9$ (0,9)

put $x_2 = 0$

$x_1 = 9$ (9,0)

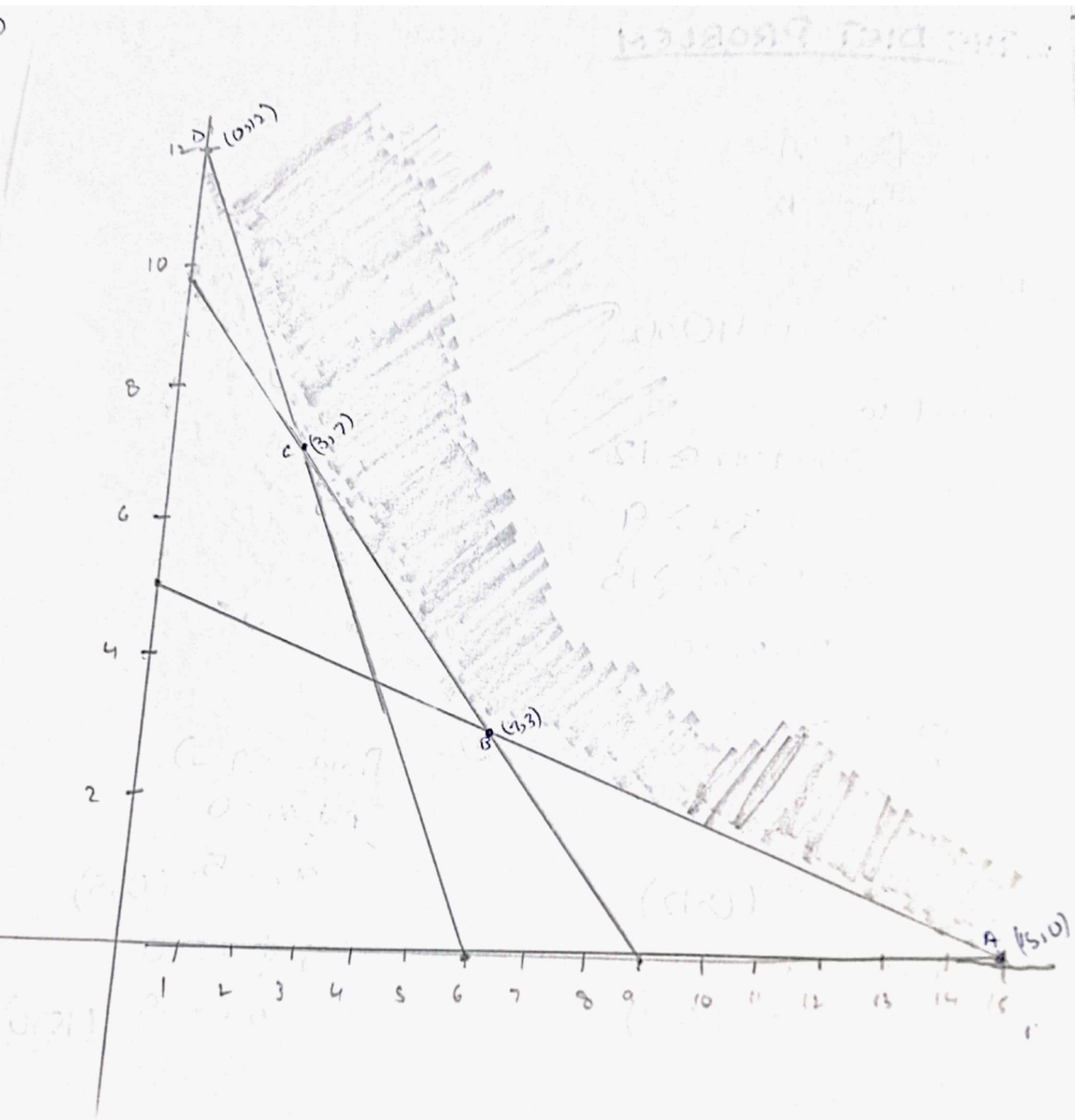
from eq 3)

put $x_1 = 0$

$x_2 = 5$ (0,5)

put $x_2 = 0$

$x_1 = 15$ (15,0)



Points	Minimize $z = 30x_1 + 40x_2$
A (15, 0)	450
B (7, 3)	330
C (3, 7)	370
D (0, 12)	480

Result :

7 ounces of food A & 3 ounces of food B minimize the cost of meal.

4- TELEVISION

let

x_1 = no of minutes of advertising

x_2 = no of minutes of comedy program

Maximize:

$$Z = 40000x_1 + 45000x_2$$

Subject to:

$$x_1 \geq 2$$

$$x_1 \leq 4$$

$$x_2 \geq 24$$

$$x_1 + x_2 \leq 30$$

Graphical Method:

From eq 1)

(2,0)

From eq 2)

(4,0)

From eq 3) (0,24)

From eq 4)

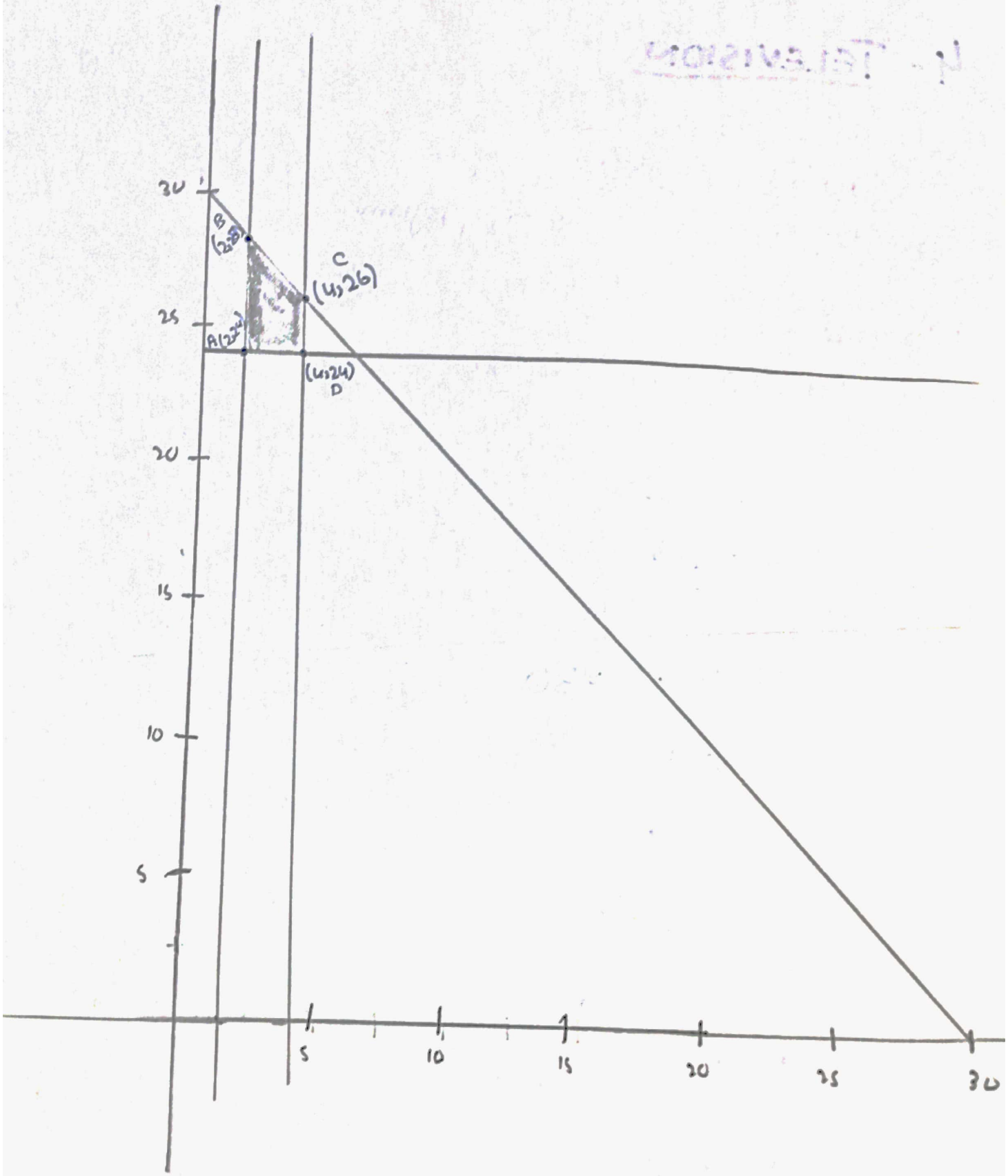
put $x_1 = 0$

$x_2 = 30$ (0,30)

put $x_2 = 0$

$x_1 = 30$

(30,0)



Points	Maximize $Z = 40000x_1 + 45000x_2$
A (2, 24)	1160000
B (2, 28)	1340000
C (4, 26)	1330000
D (4, 24)	1240000

Result :

Time divide between advertising and program should be 2 minute for advertising & 28 minute for program to maximize the viewer-minutes.

5-PROTEIN DIET CLUB

Let

x_1 = dish A

x_2 = dish B

Maximize:

Subject to

$$1x_1 + 2x_2 \leq 10$$

$$1x_1 + 1x_2$$

$$4x_1 + 6x_2$$

No maximize equation

6- GENERATOR

let

x_1 = low sulfur fuel (L)

x_2 = high sulfur fuel (H)

Minimize:

$$Z = 60x_1 + 50x_2$$

Subject to:

$$3x_1 + 5x_2 \leq 15$$

$$4x_1 + 4x_2 \geq 16$$

$$x_1, x_2 \geq 0$$

Graphical Method:

From eq 1)

put $x_1 = 0$

$x_2 = 3$ (0, 3)

put $x_2 = 0$

$x_1 = 5$ (5, 0)

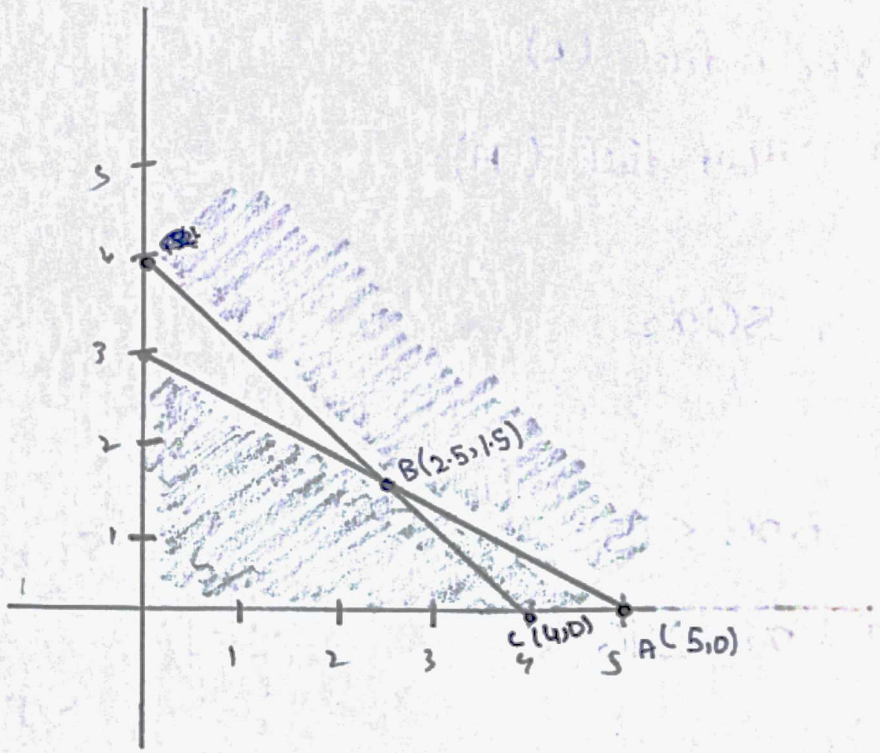
From eq 2)

put $x_1 = 0$

$x_2 = 4$ (0, 4)

Put $x_2 = 0$

$x_1 = 4$ (4, 0)



Point	Minimize $Z = 60x_1 + 50x_2$
A (5,0)	300
B (2.5, 1.5)	225
C (4,0)	240

Result:

2.5 gallons of L & 1.5 gallons of H should be used hourly to minimize the cost of the fuel used.

7- TRANSPORTATION SYSTEM:

let

x_1 = type A bus

x_2 = type B bus

Minimize:

$$Z = 20000x_1 + 25000x_2$$

Subject to:

$$40x_1 + 60x_2 \geq 300$$

$$2x_1 + 3x_2 \leq 12$$

$$x_1, x_2 \geq 0$$

Graphical Method:

From eq 1)

put $x_1 = 0$

$x_2 = 5$ (0,5)

put $x_2 = 0$

$x_1 = 7.5$ (7.5,0)

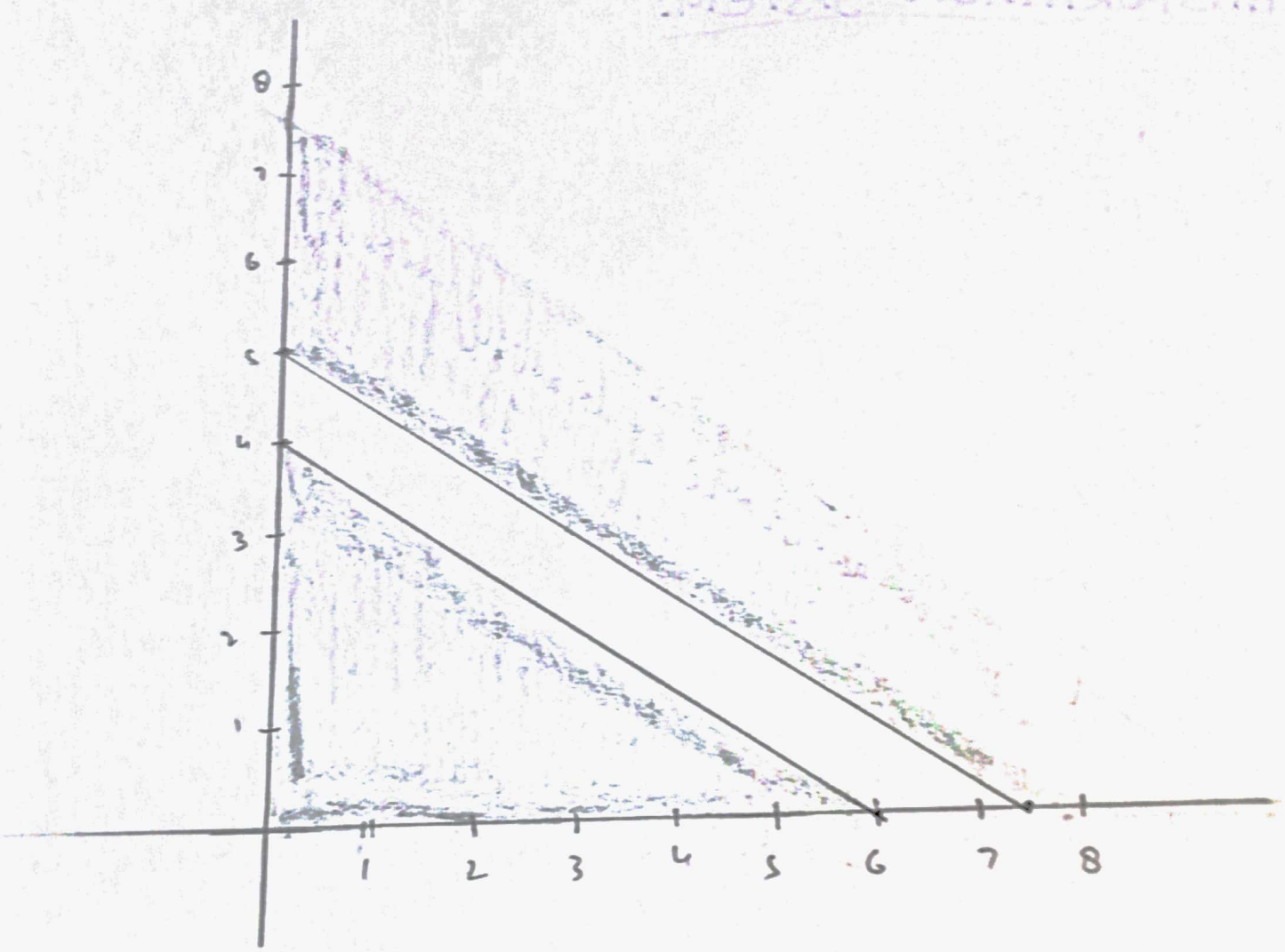
From eq 2)

Put $x_1 = 0$

$x_2 = 4$ (0,4)

Put $x_2 = 0$

$x_1 = 6$ (6,0)



Solution not possible.

8. Animal Feed Producer:

let

x_1 = gain A

x_2 = gain B

Minimize:

$$Z = 10x_1 + 12x_2$$

subject to:

$$2x_1 + 3x_2 \geq 18$$

$$1x_1 + 3x_2 \geq 12$$

$$80x_1 + 60x_2 \geq 480$$

Graphical Method:

From eq 1)

Put $x_1 = 0$

$x_2 = 6$ (0,6)

Put $x_2 = 0$

$x_1 = 9$ (9,0)

From eq 2).

Put $x_1 = 0$

$x_2 = 4$ (0,4)

Put $x_2 = 0$

$x_1 = 12$ (12,0)

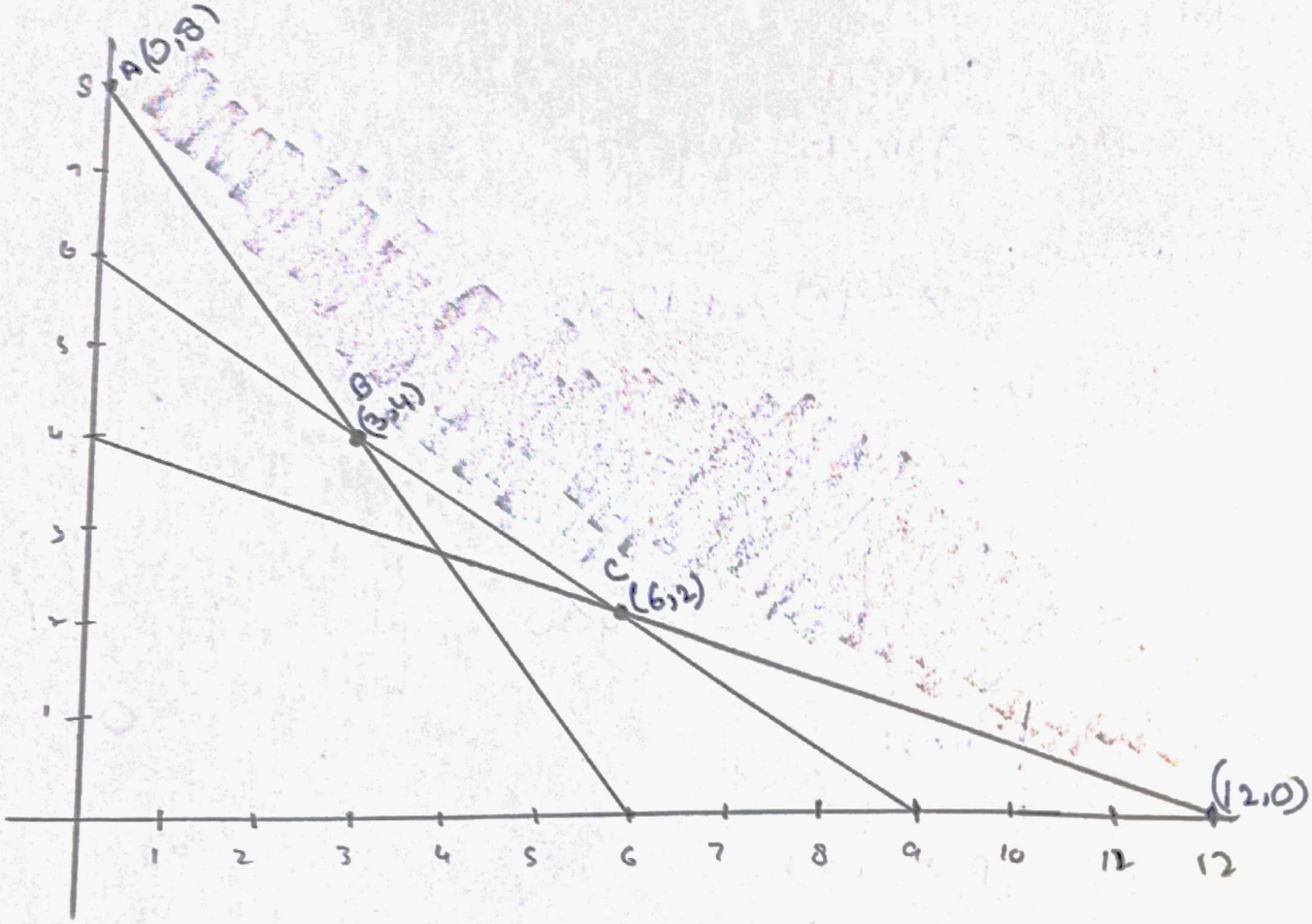
From eq 3)

Put $x_1 = 0$

$x_2 = 8$ (0,8)

Put $x_2 = 0$

$x_1 = 6$ (6,0)



Point	Minimize $Z = 10x_1 + 12x_2$
A (0,8)	96
B (3,4)	78
C (6,2)	84
D (12,0)	120

3 unit of grain A and 4 unit of grain B should be produced to minimize the cost

9- STEEL

Let

x_1 = Regular steel

x_2 = Special steel

Maximize:

$$Z = 120x_1 + 100x_2$$

Subject to:

$$2x_1 + 2x_2 \leq 8$$

$$5x_1 + 3x_2 \leq 15$$

$$x_1, x_2 \geq 0$$

Graphical Method:

From eq 1)

Put $x_1 = 0$

$x_2 = 4$ (0,4)

Put $x_2 = 0$

$x_1 = 4$ (4,0)

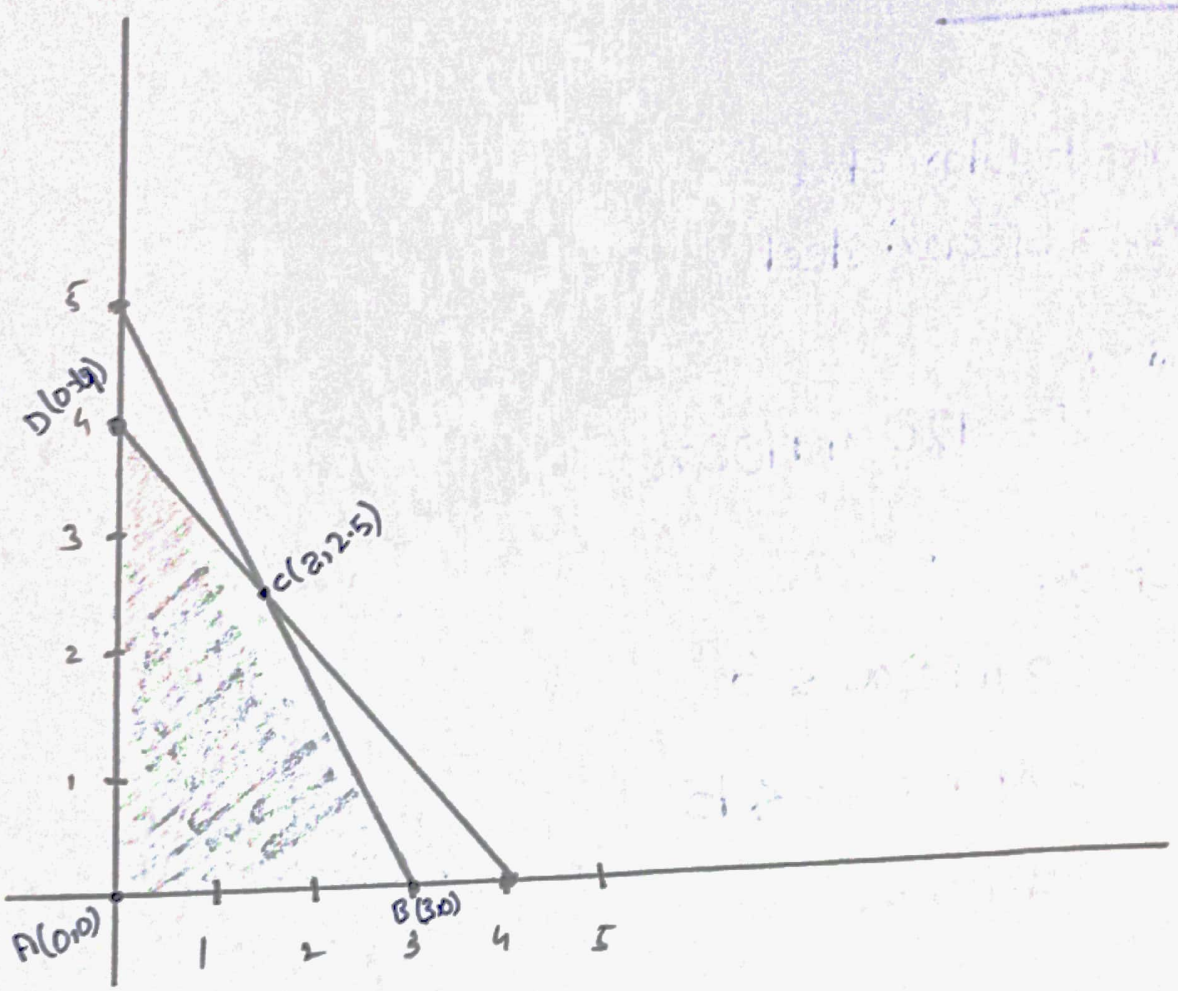
From eq 2)

Put $x_1 = 0$

$x_2 = 5$ (0,5)

Put $x_2 = 0$

$x_1 = 3$ (3,0)



Point	Maximize $Z = 120m_1 + 100m_2$
A(0,0)	0
B(3,0)	360
C(2,2.5)	490
D(0,4)	400

Result :-

2 tons of regular steel and 2.5 ton of special steel should be made to maximize the profit.

10- TRASH COMPANY

let

x_1 = container from Smith corporation

x_2 = container from Johnson corporation

Maximize:

$$Z = 30x_1 + 60x_2$$

Subject to:

$$6x_1 + 12x_2 \leq 18000$$

$$3x_1 + x_2 \leq 1800$$

$$x_1, x_2 \geq 0$$

Graphical Method !

From eq 1)

put $x_1 = 0$

$x_2 = 1500$ (0, 1500)

put $x_2 = 0$

$x_1 = 3000$

(3000, 0)

From eq 2)

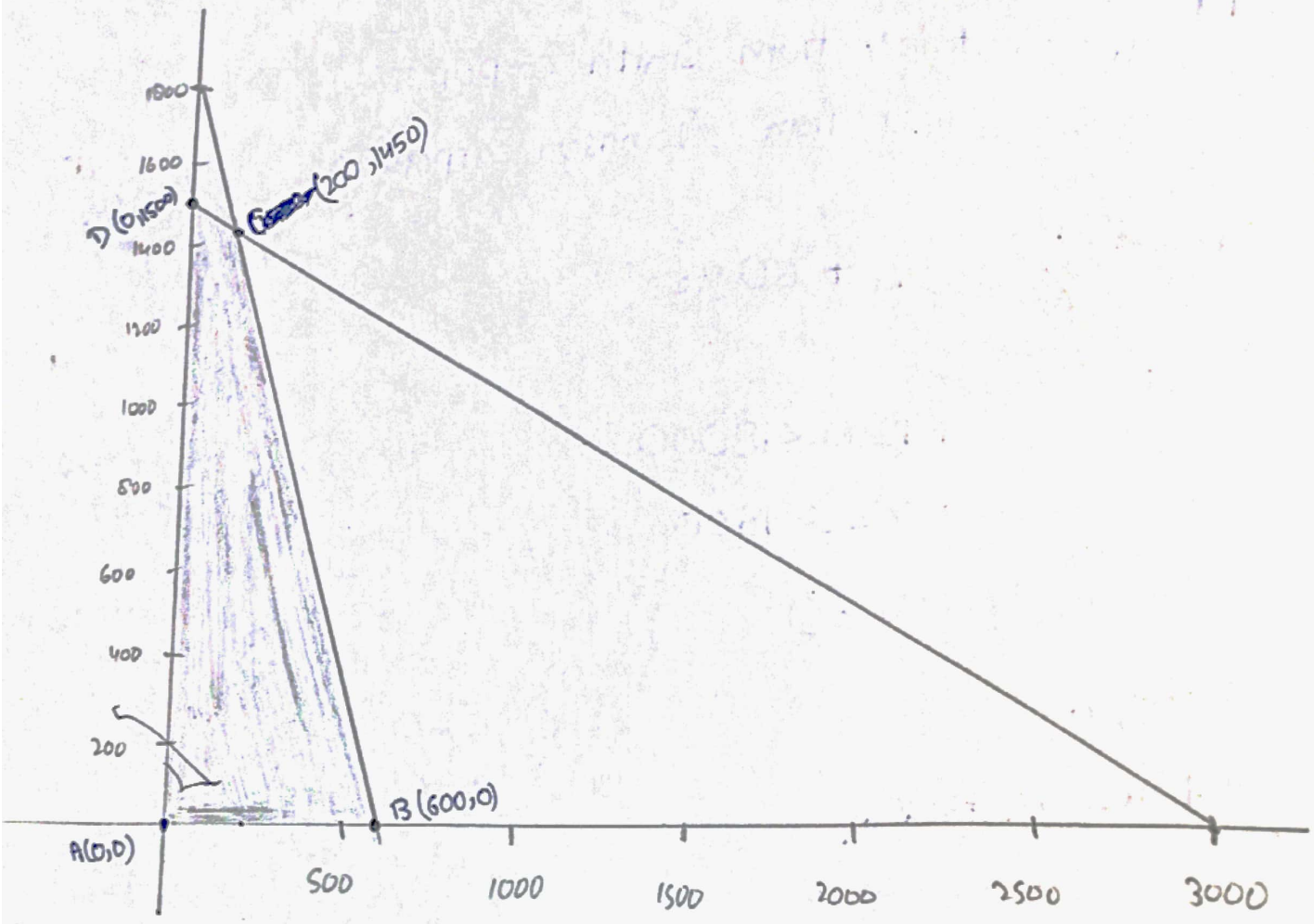
put $x_1 = 0$

$x_2 = 1800$ (0, 1800)

put $x_2 = 0$

$x_1 = 600$

(600, 0)



Point	Maximize $Z = 30x_1 + 60x_2$
A (0,0)	0
B (600,0)	18000
C (200,1450)	93000
D (0,1500)	90000

RESULT :

200 container from Smith corporation & 1450 from Johnson corporation should be carry to maximize revenue.

Maximize =

11.12 TRUST FUND

let

x_1 = Bond A investment

x_2 = Bond B investment

Maximize:

$$Z = 8x_1 + 10x_2$$

Subject to:

$$x_1 + x_2 \leq 6000 \quad -1)$$

$$x_1 \geq 1500 \quad -2)$$

$$x_2 \leq 4000 \quad -3)$$

$$x_1, x_2 \geq 0$$

$$x_2 \leq \frac{1}{2}x_1 \quad -4)$$

Graphical Method:

From eq 1)

Put $x_1 = 0$

$x_2 = 6000$

(0, 6000)

Put $x_2 = 0$

$x_1 = 6000$

(6000, 0)

From eq 2)

(1500, 0)

From eq 3)

(0, 4000)

From eq 4)

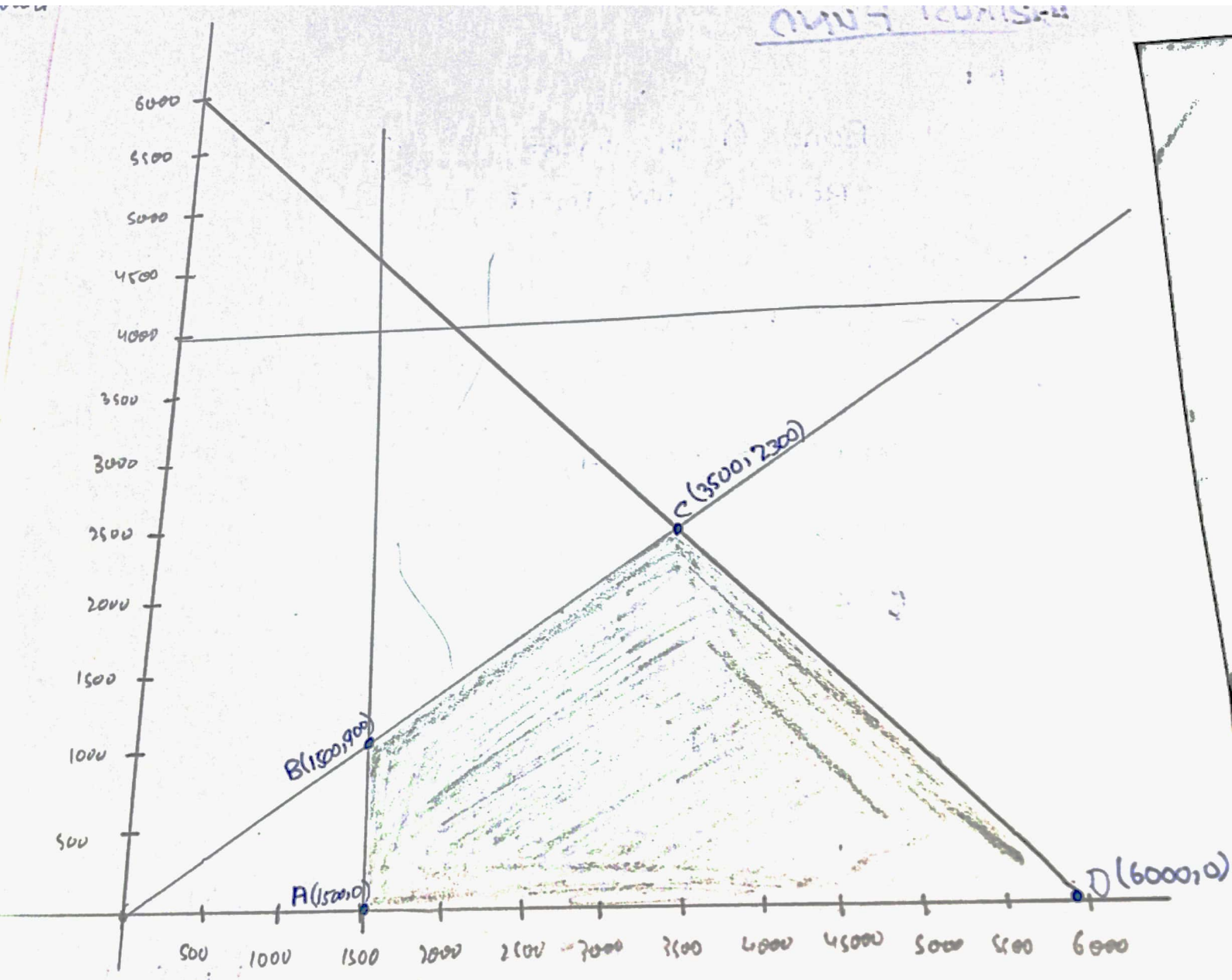
Put $x_1 = 0$

$x_2 = 0$

(0, 0)

Put $x_2 = 0$

(0, 0)



Points	Maximize $Z = 8x_1 + 10x_2$
A(1500,0)	12000
B (1500,900)	21000
C (3500,2300)	51000
D (6000,0)	48000

Result :-

3500 in Bond A and 2300 in Bond B should be invested to maximize the fund return.