∴ coordinate of A (12, 3) ; z = ...
" B (30, 0) ; z = 120
" C (3, 18) ; z = 12 + 36 = 48
" ~~B~~ D (~~30~~ 0, 27) ; z = 54

Since, it is a problem of minimization, we move the objective line over the region towards origin and lastly it touches at D(3,18) in the feasible region

∴ min z = 48, optimal soln is x = 3, y = 18 Ans.

(7.) Minimize. $z = 3x_1 + x_2$
S.t $2x_1 + 3x_2 \le 6$
$x_1 + x_2 \ge 1$
$x_1, x_2 \ge 0$

$2x_1 + 3x_2 = 6$
$\frac{x_1}{3} + \frac{x_2}{2} = 1$ ——— (1)
$\frac{x_1}{1} + \frac{x_2}{1} = 1$ ——— (2)

Considering the constrains as equation, we draw the graph. Now, giving the direction of inequalities and non negativity restriction we get the common region ABCDA shaded i.e called feasible region. Coordinate of A (1, 0), B(3, 0) C(0, 2), D (0, 1)

Now we draw the objective line by suitable z here z = 12 over the region
Since the problem is of minimization, we move it towards the origin and it touches lastly D(0,1) in the feasible region

∴ At A ; z = 3
B ; z = 9
C ; z = 2
D ; z = 1

∴ Min z = 1
optimal soln. is
$x_1 = 0$
$x_2 = 1$

✓

coordinate of C is (3,18)

$\therefore$ coordinate of A (12, 9) ; $z = 48 + 18 = 66$

" B (30,0) ; $z = 120$

" C (3,18) ; $z = 12 + 36 = 48$

" D (0,27) ; $z = 54$

Since it is a problem of minimization, we move the objective line over the region towards origin and lastly it touch at C (3,18) in the feasible region

$\therefore$ Min $z = 48$, optimal soln is $x = 3$, $y = 18$ Ans.

(7.) Minimize. $z = 3x_1 + x_2$

S.t $2x_1 + 3x_2 \le 6$

$x_1 + x_2 \ge 1$

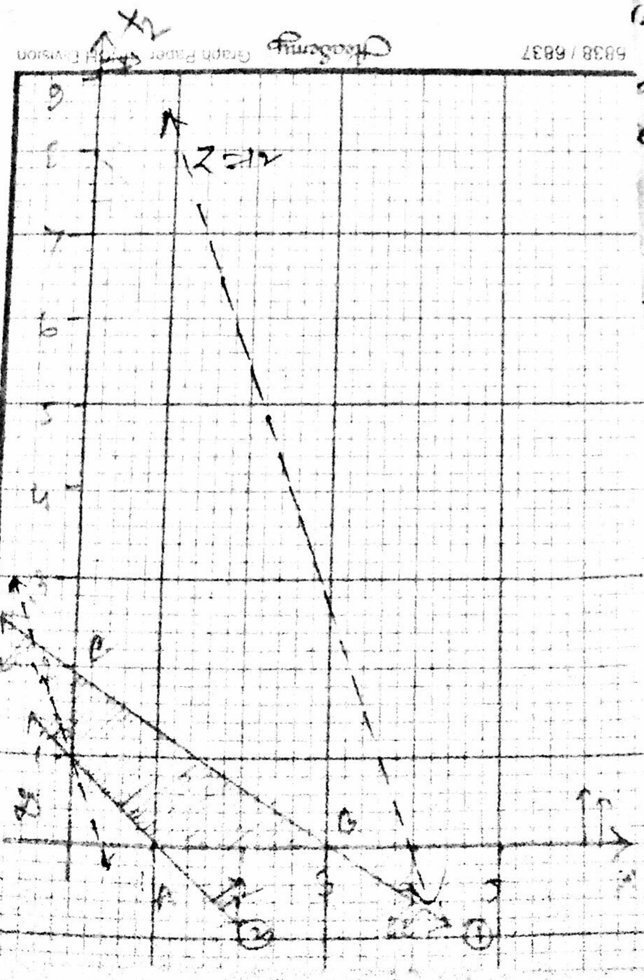
$x_1, x_2 \ge 0$

$2x_1 + 3x_2 = 6$

$\frac{x_1}{3} + \frac{x_2}{2} = 1$ —— (1)

$\frac{x_1}{1} + \frac{x_2}{1} = 1$ —— (2)

... equation, we draw the ...ection of inequalities and ...t the common region ABCDA ...egion. coordinate of A (1,0),



... line by suitable z over the region

...nization, we move it towards ...tly D (0,1) in the feasible region.

Min $z = 1$

...ptimal soln. is

$x_1 = 0$

$x_2 = 1$

Since, it is a problem of maximization we move the objective line far away from origin over the region and it touches lastly the point C is the feasible region

$\therefore$ At O, $z=0$

At A, $z=8$

At B, $z=18$

At C, $z=21$

At D, $z=15$

$\therefore$ Max $z=21$

and the feasible soln. is soln. is

$x=3,\ y=3.$

(8) Minimize $z=4x+2y$

subject to $3x+y\geq 27$

$-x-y\leq -21$

$x+2y\geq 30$

$x, y\geq 0$

$3x+y=27$

or $\frac{x}{9}+\frac{y}{27}=1$ ... (A)

$x+y\geq 21$

or $\frac{x}{21}+\frac{y}{21}=1$ ... (B)

$x+2y=30$

or $\frac{x}{30}+\frac{y}{15}=1$ ... (C)

Considering the constrains as equations we draw the graph. Now giving the direction of inequalities and non-negativity restriction of decision variable, we see that the common region is unbounded and i.e. ABCD

let, us draw the objective line by suitable z

here $z=144$

$\therefore 4x+2y=144$

$\therefore \frac{x}{36}+\frac{y}{72}=1$

solving (B), (C)

$x+y=21$

$x+2y=30$

$(-)\ (-)\ (-)$

$-y=-9 \quad \therefore y=9 \quad \therefore x=21-9$

$=12$

$\therefore$ coordinate of A is (12, 9)

solving (A), (B)

$x+y=21$

$3x+y=27$

$(-)\ (-)\ (-)$

$-2x=-6 \quad \therefore x=3$

$\therefore y=21-3$

$=18$

Since, it is a maximizing problem we draw the objective line far from origin and lastly it touch point B and passout from feasible region.

$\therefore$ At O, $Z = 0$

At A, $Z = \frac{15}{2} = 7.5$

At B, $Z = \frac{15}{2} + \frac{7}{2} = 11$

At C, $Z = \frac{20}{5} + \frac{42}{5} = \frac{62}{5} = 12\frac{2}{5}$

At D, $Z = \frac{21}{2} = 10.5$

Hence $Max\ Z = \frac{62}{5}$ and the optimal soln is $x_1 = 4/5$, $x_2 = \frac{6}{5}$

(a)

1) Max $Z = 2x + 5y$

Subject to $0 \le x \le 4$
$0 \le y \le 3$
$x + y \le 6.$

$x + y = 6$
$x = 4, x = 0$
$y = 3, y = 0$

(a)

Considering the constraints as equations, we draw the graphs of the lines. Now giving the direction of inequalities and nonnegativity restrictions of decision variables, we have a common region OABCDO (shaded) called feasible region with extreme points O, A, B, C, D

$x + y = 6$ —— ①
$x = 4$ —— ②
$y = 2$

$x + y = 6$ —— ①
$y = 3$
$\therefore x = 3$

$\therefore$ coordinate of O is (0,0)
" " A is (4,0)
" " B is (4,2)
" " C is (3,3)
" " D is (0,3)

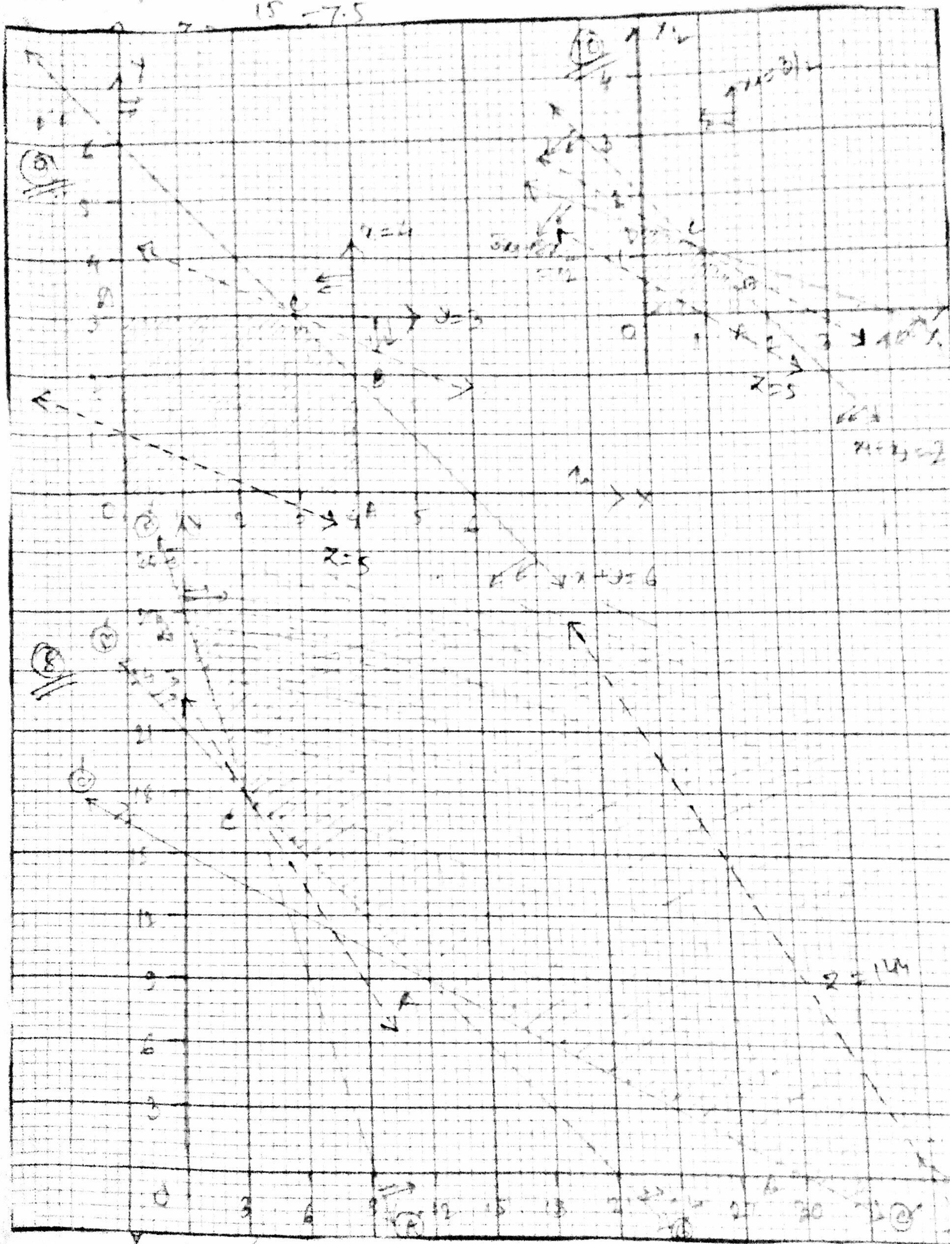
Now we draw the objective line by suitable Z, here $Z = 5$

$\therefore 2x + 5y = 5$

or, $\frac{x}{2.5} + \frac{y}{1} = 1$

Since, it is a maximizing problem we draw the objective line far from origin and lastly it touch point B and passout from feasible region.

$\therefore$ At O, $Z = 0$



$\therefore$ here $Z = 5$

$\therefore 2x + 5y = 5$

or, $\frac{x}{2.5} + \frac{y}{1} = 1$

(10). Maximize $z = 5x_1 + 7x_2$

Subject to $3x_1 + 8x_2 \le 12$

$x_1 + x_2 \le 2$

$2x_1 \le 3$

$x_1, x_2 \geq 0$

$3x_1 + 8x_2 = 12$

or, $\frac{x_1}{4} + \frac{x_2}{1.5} = 1$

$\frac{x_1}{2} + \frac{x_2}{2} = 1$

$x_1 = 3/2$

Considering the constraints as equations, we draw the graph. Now, giving the directions of inequalities and non-negativity restriction of decision variable, we have a common region with region OABCDO (shaded) called feasible region

extreme point ~~of~~ O, A, B, C, D

$x_1 + x_2 = 2$ —①

$2x_1 = 3$ —②

$2x_1 + 2x_2 = 4$

or $3 + 2x_2 = 4$

$\therefore x_2 = \frac{1}{2}$

$\therefore$ Coordinate of

B $(3/2, 1/2)$

$3x_1 + 3x_2 = 6$

$3x_1 + 8x_2 = 12$

(-) (-) (-)

$-5x_2 = -6$

$\therefore x_2 = \frac{6}{5}$, $\therefore x_1 = 2 - x_2$

$= 2 - \frac{6}{5} = \frac{4}{5}$

coordinate of C $\left(\frac{4}{5}, \frac{6}{5}\right)$

$\therefore$ coordinate of O is (0,0)

" " A is $(3/2, 0)$

" " B is $(3/2, 1/2)$

" " C is $(4/5, 6/5)$

" " D is $(0, 3/2)$

Now we draw the objective line by suitable Z,

here $Z = 5$ $\therefore 5x_1 + 7x_2 = 5$

$7)5.0(.7$
$\underline{49}$

$\therefore \frac{x_1}{1} + \frac{x_2}{5/7} = 1$

or, $\frac{x_1}{1} + \frac{x_2}{0.71} = 1$

(17) Maximize

$Z = 9x + 8y$

Subject to $4x + 3y \le 30$

$2x + 3y \le 18$

$2x + y \le 10$

$x, y \geq 0$

$4x + 3y = 30$

or $\frac{x}{7.5} + \frac{y}{10} = 1$

$2x + 3y = 18$

or $\frac{x}{9} + \frac{y}{6} = 1$

$2x + y = 10$

or $\frac{x}{5} + \frac{y}{10} = 1$

$2x + 3y = 18$ ——— (1)

$2x + y = 10$ ——— (2)

Solving (1) and (2), $2y = 8$

$\therefore y = 4 \quad \therefore x = 3$

$\therefore (x, y) = (3, 4)$

Considering the constrains as equations, we draw the graphs of the lines. Now giving the directions of inequalities & non-negativity restrictions of the decision variable, we see that the feasible region is OABCO (shaded region) with the extreme points $O(0,0)$; $A(5,0)$; $B(3,4)$; $C(0,6)$.

Now, we draw the objective line by suitable Z

here $Z = 36$

$\therefore 9x + 8y = 36$

or $\frac{x}{4} + \frac{y}{4.5} = 1$

Since it is a maximising problem, we move the objective line far away from origin and we have

at O, $Z = 0$

At A, $Z = 45$

At B, $Z = 59$

At C, $Z = 48$

Hence Max $Z = 59$

and the optimal soln is

$x = 3$

$y = 4$ Ans.

(1) Maximize $Z = 9x + 8y$

subject to $4x + 3y \le 30$

$2x + 3y \le 18$

$x, y \geq 0$

Let $4x + 3y = 30$

or, $\frac{x}{7.5} + \frac{y}{10} = 1$

$\frac{x}{9} + \frac{y}{6} = 1$

Considering the constrains as equations, we draw the graphs of the lines. Now giving the direction of inequalities and non-negativity restriction of the decision variable, we see that feasible solⁿ is at OABCO (shaded region).

with extreme points

$O(0,0)$, $A(7.5,0)$, $B(6,2)$, $C(0,6)$

$$\begin{array}{r} 4x+3y=30 \\ 4x+6y=36 \\ (-)\quad(-)\quad(-) \\ \hline -3y=-6 \end{array}$$

$\therefore y = 2$

$\therefore 2x = 18 - 6$
$= 12$
$\therefore x = 6.$

$$\begin{array}{r} 4x+3y=30 \\ 2x+3y=18 \\ (-)\quad(-)\quad(-) \\ \hline 2x=12 \end{array}$$

$x = 6$

$\therefore y = \frac{30-24}{3}$
$= 2$

$Z = 9x + 8y$

Now, we draw the objective line by suitable Z

here $Z = 45$

$\therefore 9x + 8y = 45$

or, $\frac{x}{5} + \frac{y}{\frac{45}{8}} = 1$,

~~or, $\frac{x}{6} + \frac{y}{6.75} = 1$~~

or, $\frac{x}{5} + \frac{y}{5.625} = 1$

Since it is a problem of maximization, we move it far away from origin over the region and it lastly touch and B and left the feasible region.

$\therefore$ At O, $Z = 0$

At A, $Z = 67.5$

At $B(6,2)$, $Z = 54 + 16$
$= 70$

Hence Max $Z = 70$

The optimal solⁿ is $x = 6$, $y = 2$

(17) Maximize

$Z = 9x + 8y$

Subject to $4x + 3y \le 30$

$2x + 3y \le 18$

$2x + y \le 10$

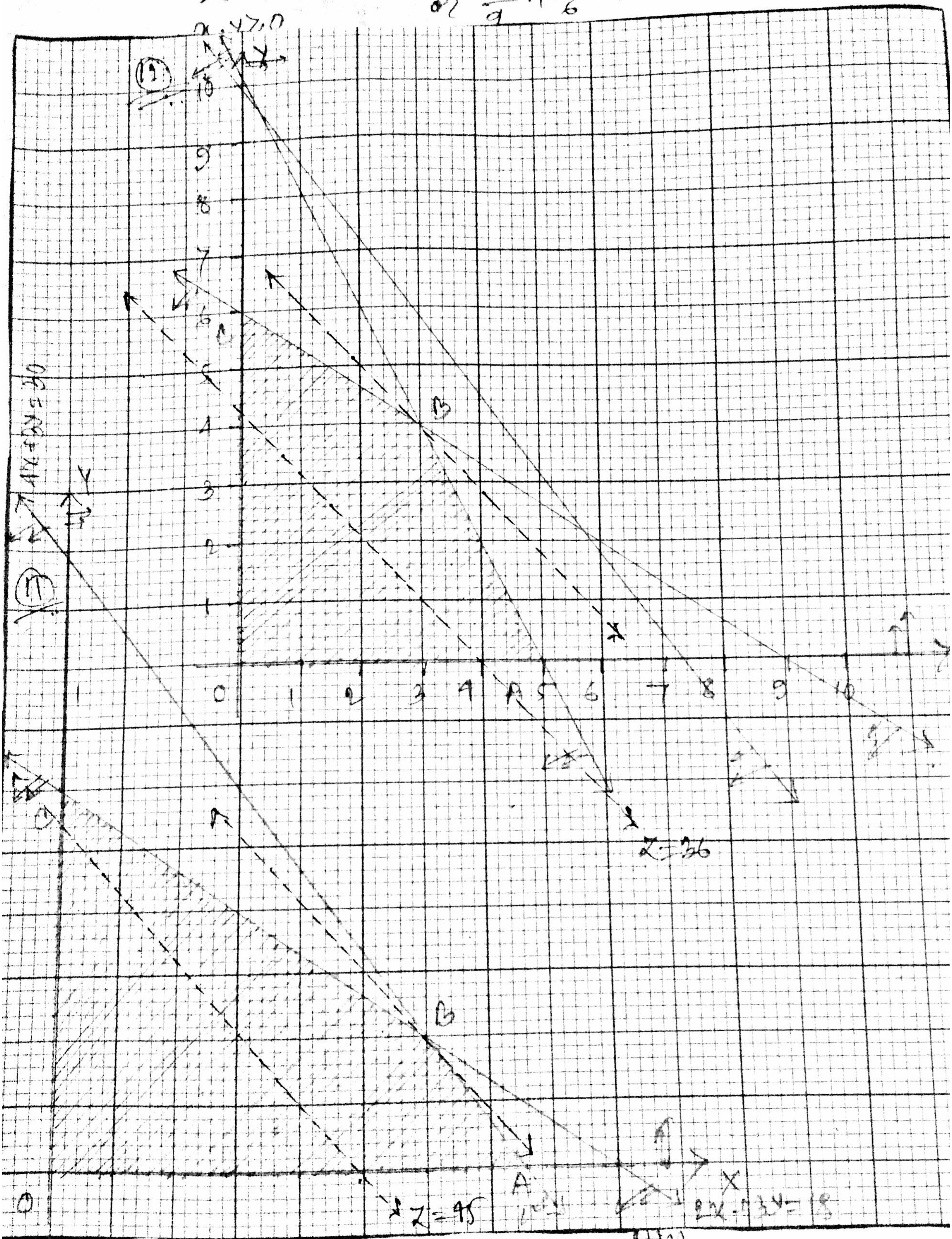
$x, y \ge 0$

$4x + 3y = 30$

or $\frac{x}{7.5} + \frac{y}{10} = 1$

$2x + 3y = 18$

or $\frac{x}{9} + \frac{y}{6} = 1$



$Z = 48$ $y = 4$ ANS.