Question 4 :(10 Points)

A manufacturer of a certain product sells all that is produced. If the product is sold \$16 per unit, fixed cost is \$10,000 and variable cost \$8 per unit. Then

a) Determine the break-even point (6 Points)

The price = \$16/unit , F.C. = \$10,000 , V.C. = \$8/unit.

Let q be the number of units

At the break-even point $\Rightarrow$ Total revenue = Total cost. 1

$\Rightarrow$ 1 $16q = 10{,}000 + 8q \Rightarrow 8q = 10{,}000 \Rightarrow q = 1250$. 2

T.R. = 16(1250) = \$20,000 $\Rightarrow$ The break-even point (1250, \$20,000) } 2

b) Find the level of production at the break-even point if the total cost increases by 5%. (4 Points)

The new T.C. = $(10{,}000 + 8q) + .05\,(10{,}000 + 8q) = 10{,}500 + 8.4q$. 2

At the break-even point T.R = T.C

$\Rightarrow$ 1 $16q = 10{,}500 + 8.4q \Rightarrow 7.6q = 10{,}500 \Rightarrow q = \frac{10{,}500}{7.6} = 1381.58$

≈ 1382 1

The level of production $\approx$ 1382 units.

Question 5 :(10 Points)

Solve the following linear programming problem **geometrically**:

Minimize:

$$Z = 2x + 1.25y$$

Subject to :

$3x + y \geq 9 \Rightarrow Y_1 = -3x + 9$

x	0	3
y	9	0

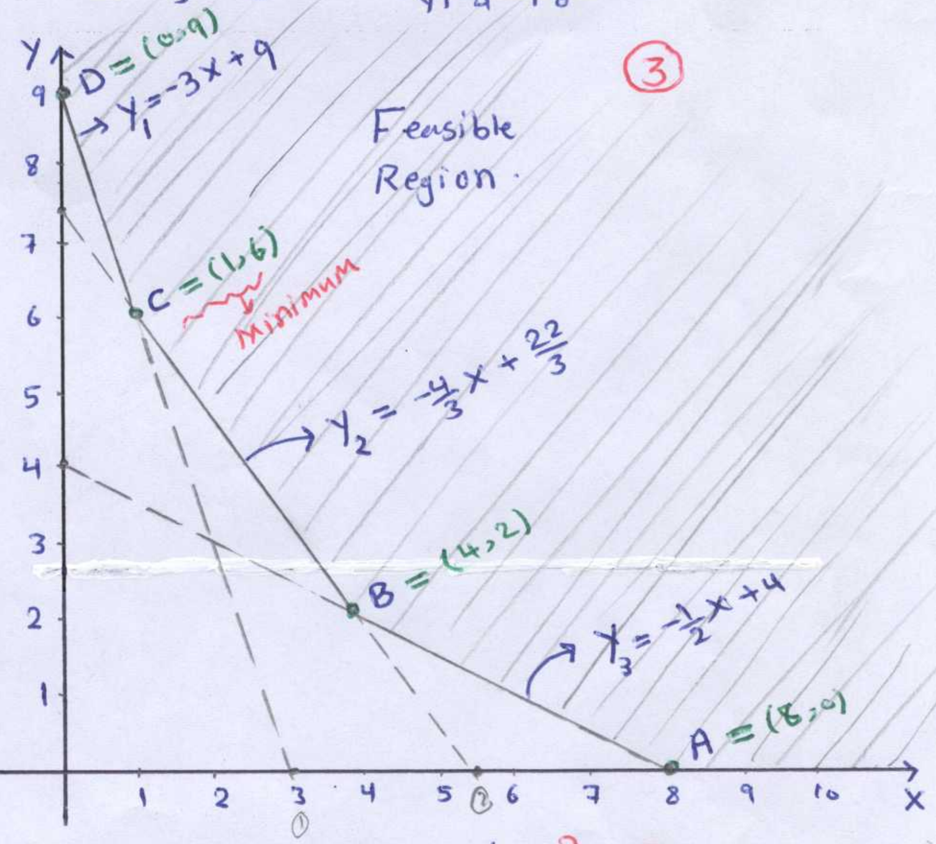
$4x + 3y \geq 22 \Rightarrow Y_2 = -\frac{4}{3}x + \frac{22}{3}$

x	0	11/2
y	22/3	0

$x + 2y \geq 8 \Rightarrow Y_3 = -\frac{1}{2}x + 4$

x	0	8
y	4	0

$x, y \geq 0$



1 $A = (8, 0)$

1 $D = (0, 9)$

B : The intersection point between : Y_2 & Y_3

$-\frac{4}{3}x + \frac{22}{3} = -\frac{1}{2}x + 4$

$-\frac{4}{3}x + \frac{1}{2}x = 4 - \frac{22}{3}$

$-\frac{5}{6}x = -\frac{10}{3}$

$\Rightarrow -15x = -60 \Rightarrow x = 4$

$y = -\frac{1}{2}(4) + 4 = -2 + 4 = 2$

1 $\therefore B = (4, 2)$

C : The intersection between Y_1 & Y_2

$-3x + 9 = -\frac{4}{3}x + \frac{22}{3}$

$-\frac{5}{3}x = -\frac{5}{3} \Rightarrow x = 1, y = 6$

1 $\therefore C = (1, 6)$ $\Rightarrow$

$Z(A) = 2(8) + 1.25(0) = 16 + 0 = 16$

$Z(B) = 2(4) + 1.25(2) = 8 + 2.5 = 10.5$

$Z(C) = 2(1) + 1.25(6) = 2 + 7.5 = 9.5 \to$ minimum

$Z(D) = 2(0) + 1.25(9) = 0 + 11.25 = 11.25$ } 2

$\therefore$ The minimum value of Z is 9.5 at $C = (1, 6)$ } 1