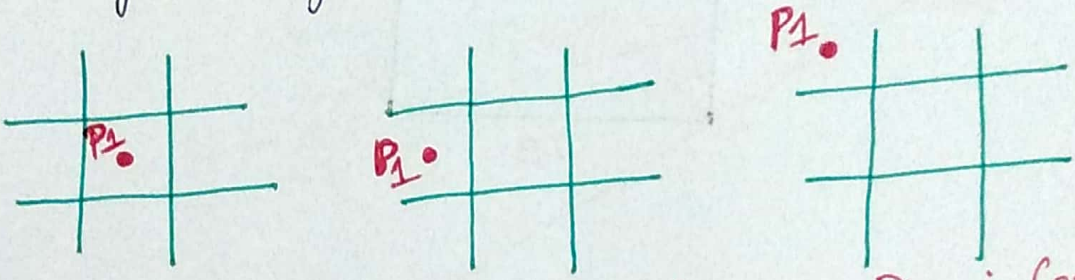
Nicholl - Lee - Nicholl Line clipping Algorithm

⇒ For a line with endpoints P1 and P2, we first determine the position of point P1 for the nine possible regions relative to the clipping rectangle.

⇒ Only 3 regions need to be considered.

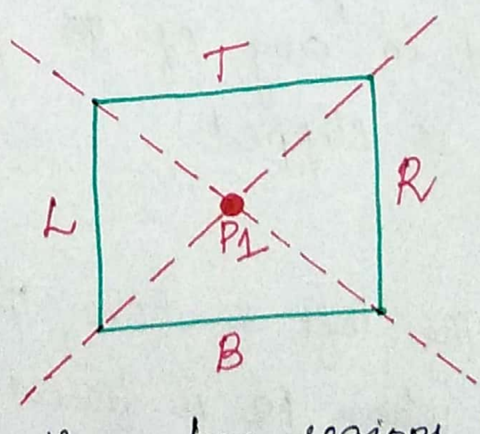


$P_1 \rightarrow$ in window $P_1 \rightarrow$ in Edge Region $P_1 \rightarrow$ in Corner Region

⇒ If P1 lies in any one of the other 6 regions, we can move it to one of the three regions using a symmetry transformation. (Reflection, Rotation)

Case 1 :-

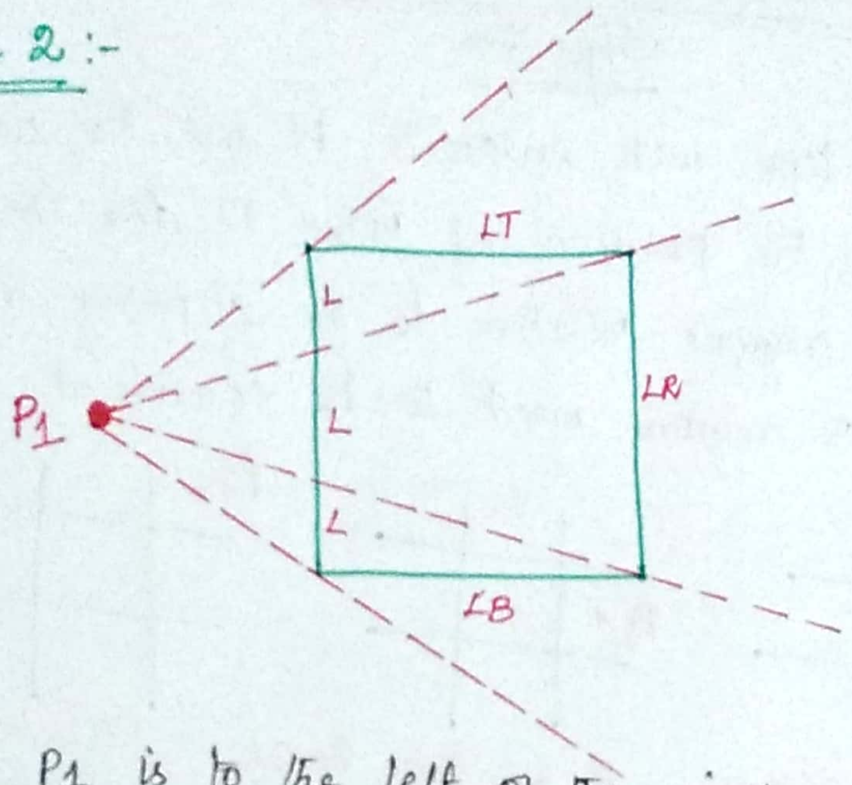
P1 is inside the clip window & P2 is outside.



If any of these four regions (L, T, R, B) has P2, then find the intersection point & save the portion that is inside the window.

→ If both P1 & P2 lies inside, then save them. (2)

Case 2 :-



⇒ If P1 is to the left of the window, set up four regions, L, LT, LR, LB.

⇒ For eg. if P2 is in region L, then clip the line at the left boundary & save the line segment from this intersection point to P2.

⇒ If P2 is in LT, then save the line segment from left window boundary to the top boundary.

⇒ If P2 is not in any of the four regions, then the entire line is clipped.

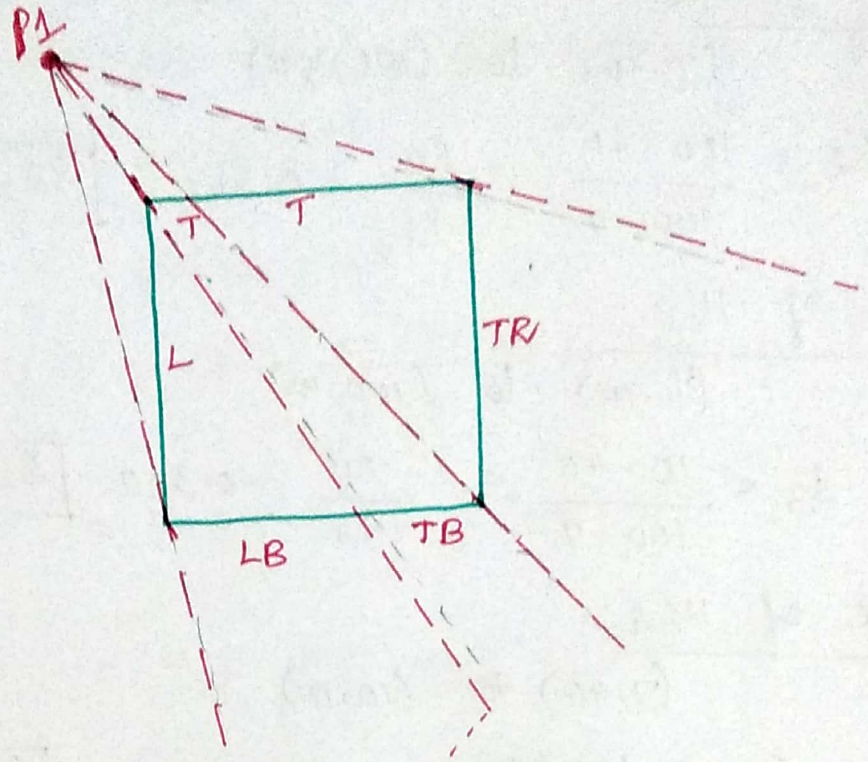
Case 3 :-

⇒ P1 is to the left & above the clip window.

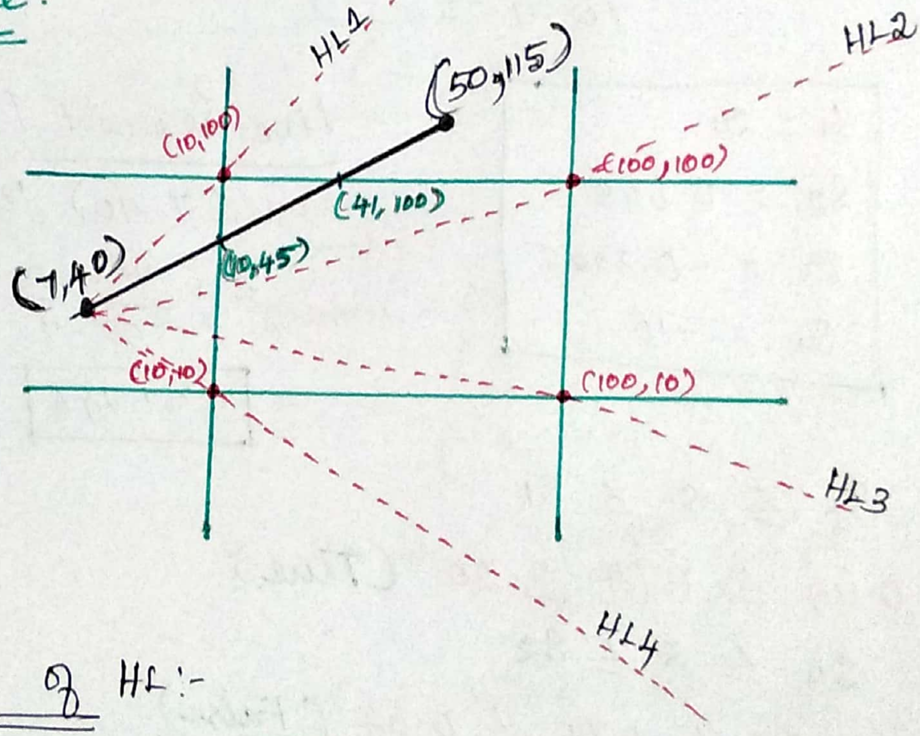
⇒ Look for where P2 is found, based on it, find the intersection point and clip it.

⇒ To determine the region in which P2 is located, we compare the slopes of lines to the slope of boundaries of the clip regions.

Case 3



Example:



Slope of HL :-

$$\boxed{S = \frac{y_2 - y_1}{x_2 - x_1}}$$

HL → Half Infinite Line

Slope of HL1 :

(7, 40) to (10, 100)

$$S_1 = \frac{100 - 40}{10 - 7} = \frac{60}{3} = 20$$

$\boxed{S1 = 20}$

Slope of HL2:-

(7, 40) to (100, 100)

$$S_2 = \frac{100-40}{100-7} = \frac{60}{93} = 0.645 \qquad \boxed{S_2 = 0.645}$$

Slope of HL3:-

(7, 40) to (100, 10)

$$S_3 = \frac{10-40}{100-7} = \frac{-30}{93} = -0.322 \qquad \boxed{S_3 = -0.322}$$

Slope of HL4:-

(7, 40) to (10, 10)

$$S_4 = \frac{10-40}{10-7} = \frac{-30}{3} = -10 \qquad \boxed{S_4 = -10}$$

$$\boxed{\begin{aligned} S_1 &= 20 \\ S_2 &= 0.645 \\ S_3 &= -0.3225 \\ S_4 &= -10 \end{aligned}}$$

Line Segment (slope):

(7, 40) to (50, 115)

$$S = \frac{115-40}{50-7} = \frac{75}{43} = 1.744$$

$$\boxed{S = 1.744}$$

$S_2 \le S \le S_1$

$0.64 \le 1.74 \le 20$ (True)

$S_3 \le S \le S_2$

$-0.32 \le 1.74 \le 0.64$ (False)

$S_4 \le S \le S_3$

$-10 \le 1.74 \le -0.32$ (False)

$\boxed{\therefore \text{ The line lies between HL1 \& HL2}}$

Scanned with CamScanner

Intersection Point:

(7, 40) to (50, 115)
x_1 y_1 x_2 y_2

① **Horizontal Boundary:**

$$y = y_{wmax} = 100$$

$$x = x_1 + \left(\frac{x_2 - x_1}{y_2 - y_1}\right)(y - y_1)$$

$$= 7 + \left(\frac{50 - 7}{115 - 40}\right)(100 - 40)$$

$$= 7 + \left(\frac{43}{75}\right)(60)$$

$$= 41.399 \simeq 41.4$$

$$\boxed{\therefore (x, y) = (41, 100)}$$

② **Vertical Boundary:**

$$x = x_{wmin} = 10$$

$$y = y_1 + \left(\frac{y_2 - y_1}{x_2 - x_1}\right)(x - x_1)$$

$$= 40 + \left(\frac{115 - 40}{50 - 7}\right)(10 - 7)$$

$$= 40 + 1.744\,(3)$$

$$= 45.23 \simeq 45$$

$$\boxed{\therefore (x, y) = (10, 45)}$$