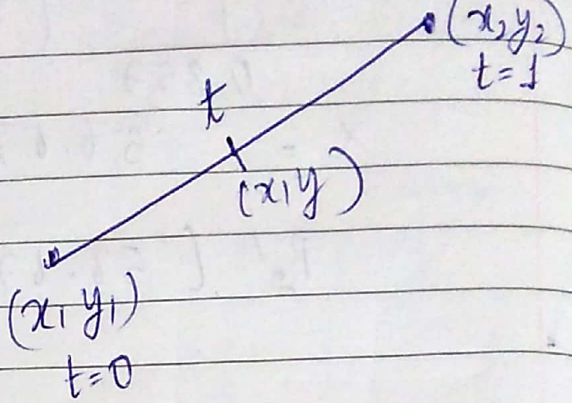
Solving Simultaneous Equation using Parametric form of a line:

$x = tx_2 + (1-t)x_1$

$x = t.x_2 + x_1 - x_1 t$

$x = x_1 + t(x_2 - x_1)$



$\boxed{x = x_1 + t.\Delta x}$

$0 < t < 1$

$\boxed{y = y_1 + t.\Delta y}$

$0 < t < 1$

$x_{w_{min}} \le x \le x_{w_{max}}$

$y_{w_{min}} \le y \le y_{w_{max}}$.

$x_{w_{min}} \le x_1 + t\Delta x \le x_{w_{max}}$

$y_{w_{min}} \le y_1 + t\Delta y \le y_{w_{max}}$

$x_1 + t\Delta x \geq x_{w_{min}}$

$x_1 + t\Delta x \le x_{w_{max}}$

$y_1 + t\Delta y \geq y_{w_{min}}$

$y_1 + t\Delta y \le y_{w_{max}}$

$t\Delta x \geq x_{w_{min}} - x_1$ —— 1

$t.\Delta x \le x_{w_{max}} - x_1$ —— 2

$t.\Delta y \geq y_{w_{min}} - y_1$ —— 3

$t.\Delta y \le y_{w_{max}} - y_1$ —— 4

These are the two different co-ordinates at particular time $t=0$ & $t=1$.

x, y co-ordinates must lie between window boundaries i.e (x_{min}, x_{max}, y_{min}, Y_{max})

$$\boxed{t \cdot P_K \leq q_K} \qquad K = 1, 2, 3, 4.$$

In order to convert these equations in above form, we need to multiply eqn ① & ③ with -1.

$$\boxed{\begin{aligned} -t\Delta x &\leq x_1 - x_{wmin} \\ t.\Delta x &\leq x_{wmax} - x_1 \\ -t.\Delta y &\leq y_1 - y_{wmin} \\ t.\Delta y &\leq y_{wmax} - y_1 \end{aligned}}$$

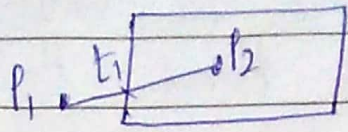
Based upon these 4 conditions we need to find out whether line lies ~~b~~ inside or outside window boundary.

$P_1 = -\Delta x$ $\quad q_1 = x_1 - x_{wmin}$
$P_2 = \Delta x$ $\quad q_2 = x_{wmax} - x_1$
$P_3 = -\Delta y$ $\quad q_3 = y_1 - y_{wmin}$
$P_4 = \Delta y$ $\quad q_4 = y_{wmax} - y_1$

If $P_K = 0$ - Line is parallel to window

$q_K < 0$ - Line outside
$q_K > 0$ - line is inside | partial
$q_K = 0$ - within boundary | partially.

If $P_K < 0 \longrightarrow t_1$

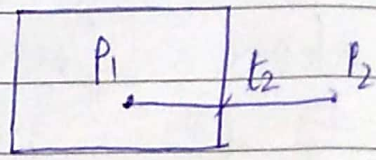


$$t_1 = \max\left(0, \frac{q_K}{P_K}\right)$$

At what interval the point is intersecting with the window boundary

$$x = x_1 + t.\Delta x$$
$$y = y_1 + t.\Delta y$$

If $P_K > 0 \longrightarrow t_2$



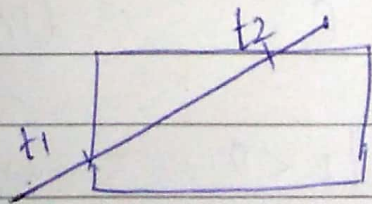
$$t_2 = \min\left(1, \frac{q_K}{P_K}\right)$$

$$x = x_1 + t.\Delta x$$
$$y = y_1 + t.\Delta y$$

If t_1 changes $\rightarrow$ starting position is outside the window

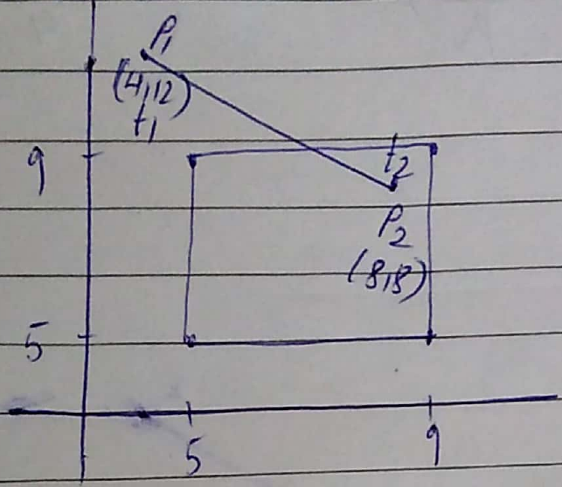
If t_2 changes $\longrightarrow$ end point is outside the window

If both changes $\longrightarrow$ both initial & final point lies outside the window.



Que. $xw_{min} = 5$ $yw_{min} = 5$ Line $P_1(4,12)$

$xw_{max} = 9$ $Yw_{min} = 9$ $P_2(8,8)$



$P_1 = -\Delta x$ $q_1 = x_1 - xw_{min}$

$P_2 = \Delta x$ $q_2 = xw_{max} - x_1$

$P_3 = -\Delta y$ $q_3 = y_1 - yw_{min}$

$P_4 = \Delta y$ $q_4 = yw_{max} - y_1$

$\Delta x = x_2 - x_1 = 8 - 4 = 4$

$\Delta y = y_2 - y_1 = 8 - 12 = -4.$

$P_1 = -4$ $q_1 = -1$

$P_2 = 4$ $q_2 = 5$

$P_3 = 4$ $q_3 = 7$

$P_4 = -4$ $q_4 = -3$

$\underline{P_k < 0}$ (P_1, P_4)

Here, we need to find time interval (t_1)

$$t_1 = \max\left(0, \frac{q_k}{P_k}\right)$$

$$t_1 = \max\left(0, \frac{q_1}{P_1}, \frac{q_4}{P_4}\right) = \max\left(0, \frac{1}{4}, \frac{+3}{+4}\right) = \boxed{t_1 = 3/4}$$

Scanned by CamScanner

$P_k > 0 \ (P_2, P_3)$

$$t_2 = \min\left(1, \frac{q_2}{p_2}, \frac{q_3}{p_3}\right) = \min\left(1, \frac{5}{4}, \frac{7}{4}\right)$$

$$t_2 = 1$$

For $t_1 = 3/4$

$$x = x_1 + t_1 \cdot \Delta x$$
$$= 4 + (3/4) \cdot 4$$
$$= 7$$

$$y = y_1 + t_1 \cdot \Delta y$$
$$= 12 + (3/4) \cdot -4$$
$$= 9$$

$t_1 = 3/4 \quad (7, 9)$

Ques. Window A (20,20) B (90,20) C (90,70) D (20,70)
Line P_1 (10,30) P_2 (80,90)