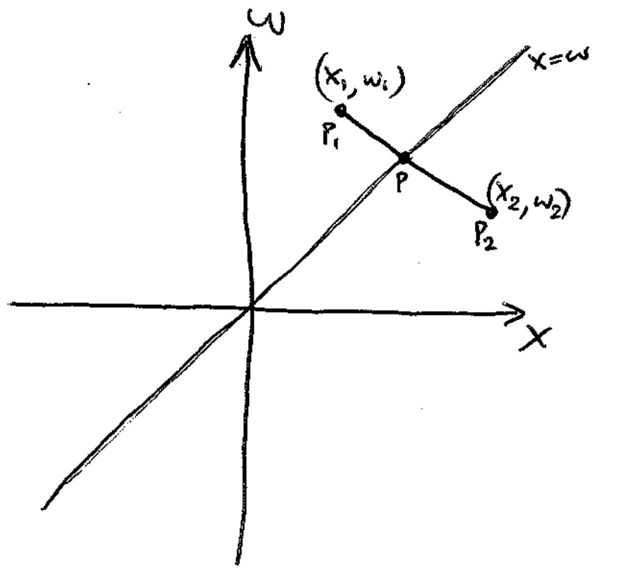
So let's do our clipping <u>before</u> we homogenize the projected coordinates.



Clip against $x=w$:

$$P = P_1 + (P_2 - P_1)t$$ solve for the t that gives us P

$$x = x_1 + (x_2 - x_1)t$$
$$w = w_1 + (w_2 - w_1)t$$
set these two equal because $x=w$

$$x_1 + (x_2 - x_1)t = w_1 + (w_2 - w_1)t$$

$$x_1 - w_1 = [(w_2 - w_1) + (x_1 - x_2)]\,t$$

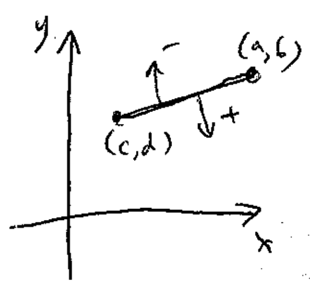
$$t = \frac{x_1 - w_1}{[(w_2 - w_1) + (x_1 - x_2)]}$$

Now plug the t back to get x, w of the clip point:

$$x = x_1 + \frac{(x_2 - x_1)(x_1 - w_1)}{(w_2 - w_1) + (x_1 - x_2)}$$

$$x = \frac{x_1 w_2 - x_2 w_1}{w_2 - w_1 + x_1 - x_2}$$

EFFICIENT LINE EQUATION FROM 2 PTS (IMPLICIT)



$$f_\ell = (a,b,1)\times(c,d,1) = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ a & b & 1 \\ c & d & 1 \end{vmatrix}$$

$$= (b-d)\vec{i} - (a-c)\vec{j} + (ad-cb)\vec{k}$$

implicit line equation:

$$f_\ell = (b-d)x - (a-c)y + (ad-cb)$$

do a dot product to test "sidedness"

$$x \cdot f_\ell \gtrless 0$$

If $f_\ell = 0$ (pts on the line)

$$(b-d)x - (a-c)y + (ad-cb) = 0$$

$$\Downarrow$$

$$y = \underbrace{\frac{b-d}{a-c}}_{\text{slope}}x + \underbrace{\frac{ad-cb}{a-c}}_{\text{intercept}}$$

VIEWPORT TRANSFORMATION

Map $-1 < x' < 1$ to $0 < i <$ screen width

$$i = \left(\frac{x'}{2} + \frac{1}{2}\right) \cdot \text{screen width}$$

$$i = \frac{w}{2} x + \frac{w}{2}$$

$$j = \frac{h}{2} y + \frac{h}{2}$$

$$M_{\text{Viewport}} = \begin{bmatrix} \frac{w}{2} & 0 & 0 & \frac{w}{2} \\ 0 & \frac{h}{2} & 0 & \frac{h}{2} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$