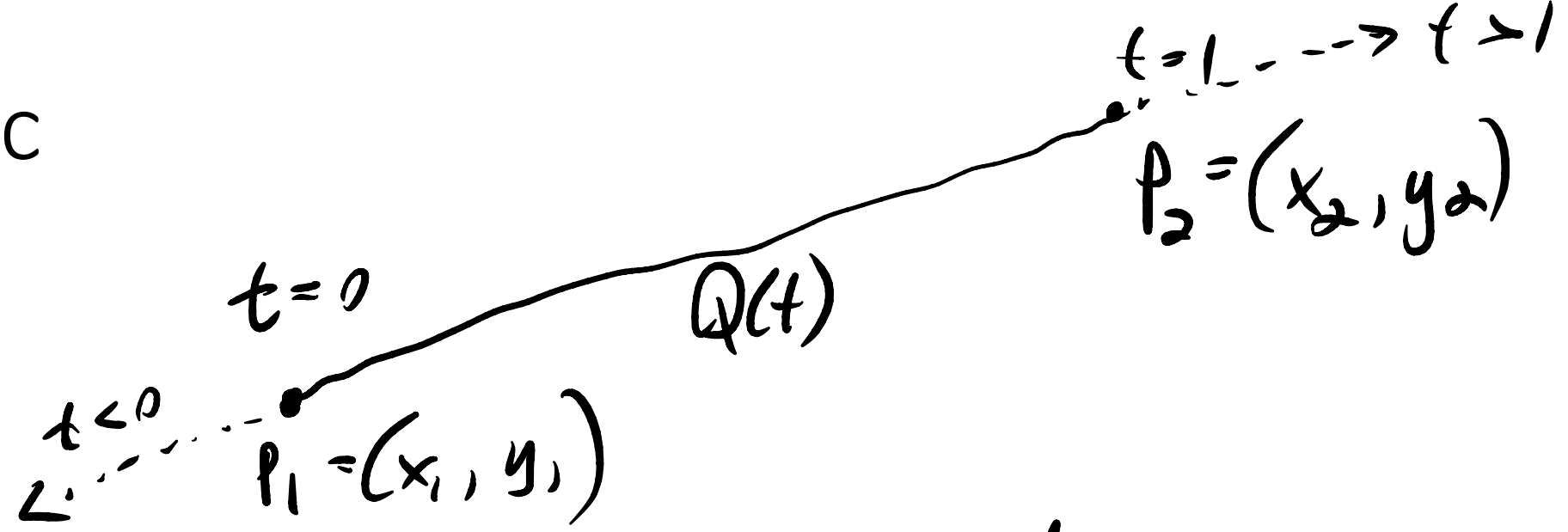
6 – lines

Parametric and Implicit forms of Lines

Rasterizing Lines

And Alb if time!

Parametric



$$x(t) = x_1 + t(x_2 - x_1) = x_1 + t * dx$$
$$y(t) = y_1 + t(y_2 - y_1) = y_1 + t * dy$$
$$\vdots$$
$$Q(t) = P_1 + t(P_2 - P_1) = P_1 + t(V)$$

if |V| = 1
t = distance

↳ vector of the dis

Implicit Line Equation

define function $f(x, y)$

on line $\rightarrow f(x, y) = 0$

off line $\rightarrow f(x, y) \neq 0$

$$y = mx + B$$

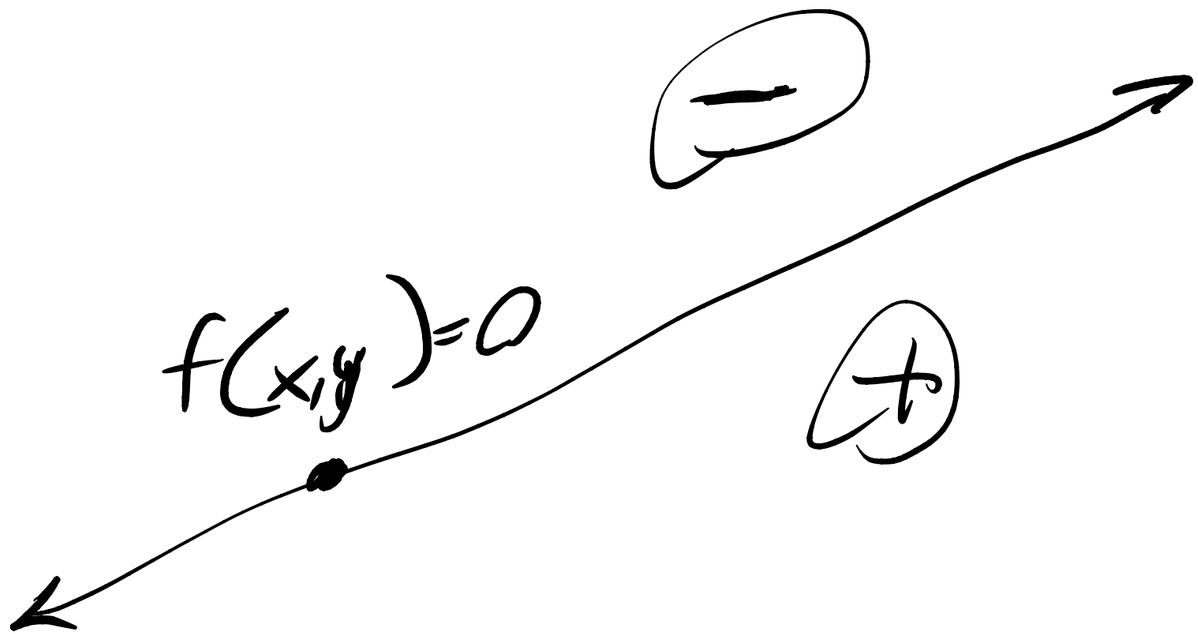
$$f(x, y) = mx + B - y$$

$$f(x,y) = ax + by + c = 0$$

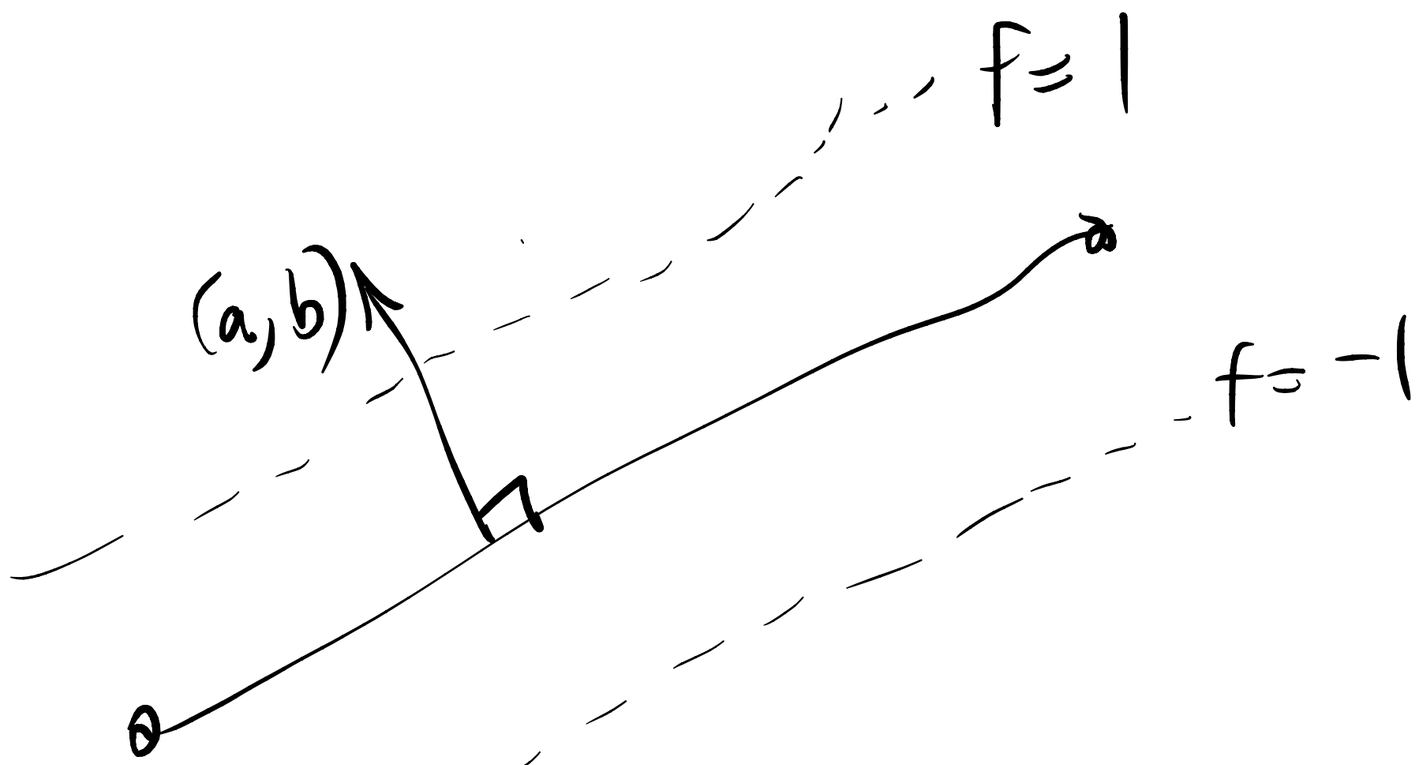
for some a, b, c

for some $\wedge$ $\quad nax + nby + nc = 0$

a, b, c are coefficients of a particular line

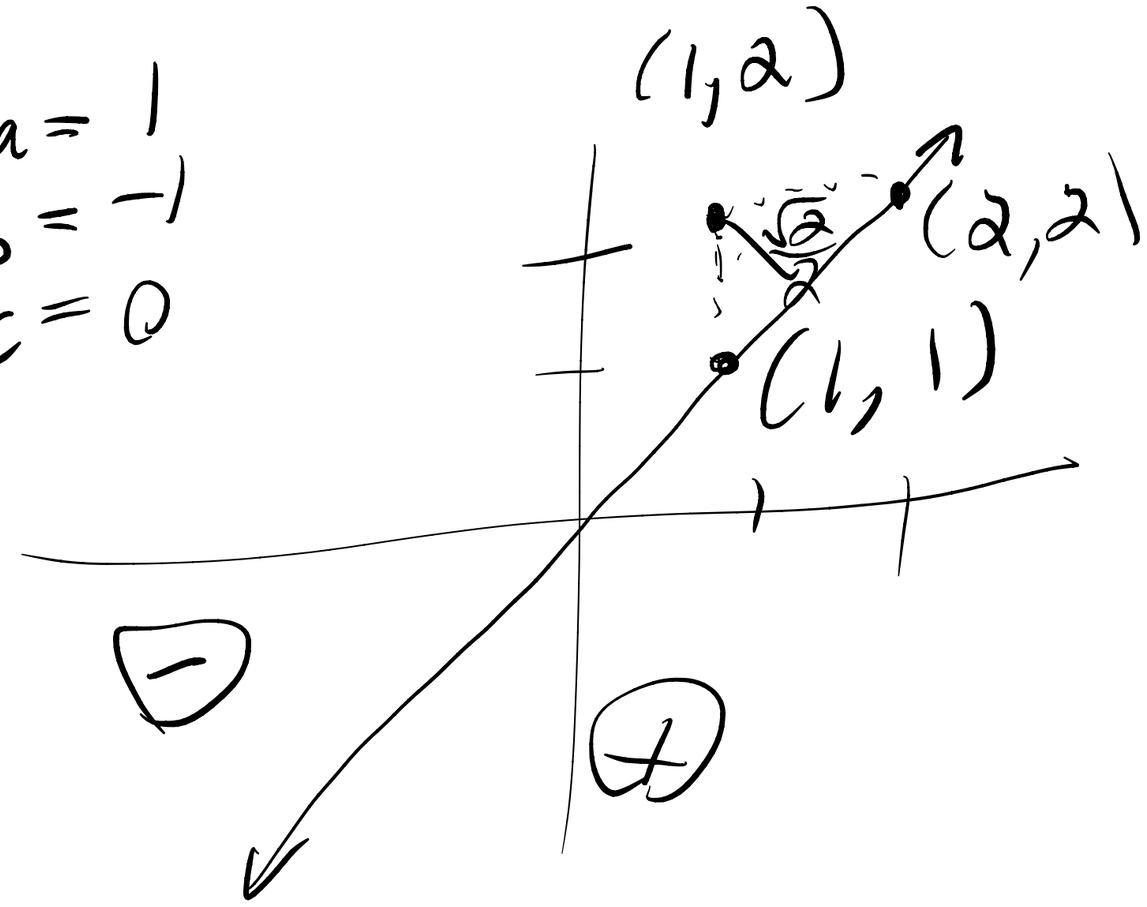


If $a^2 + b^2 = 1$ then $f(x,y)$ gives the distance to line



c is distance of the line to origin

$a = 1$
$b = -1$
$c = 0$

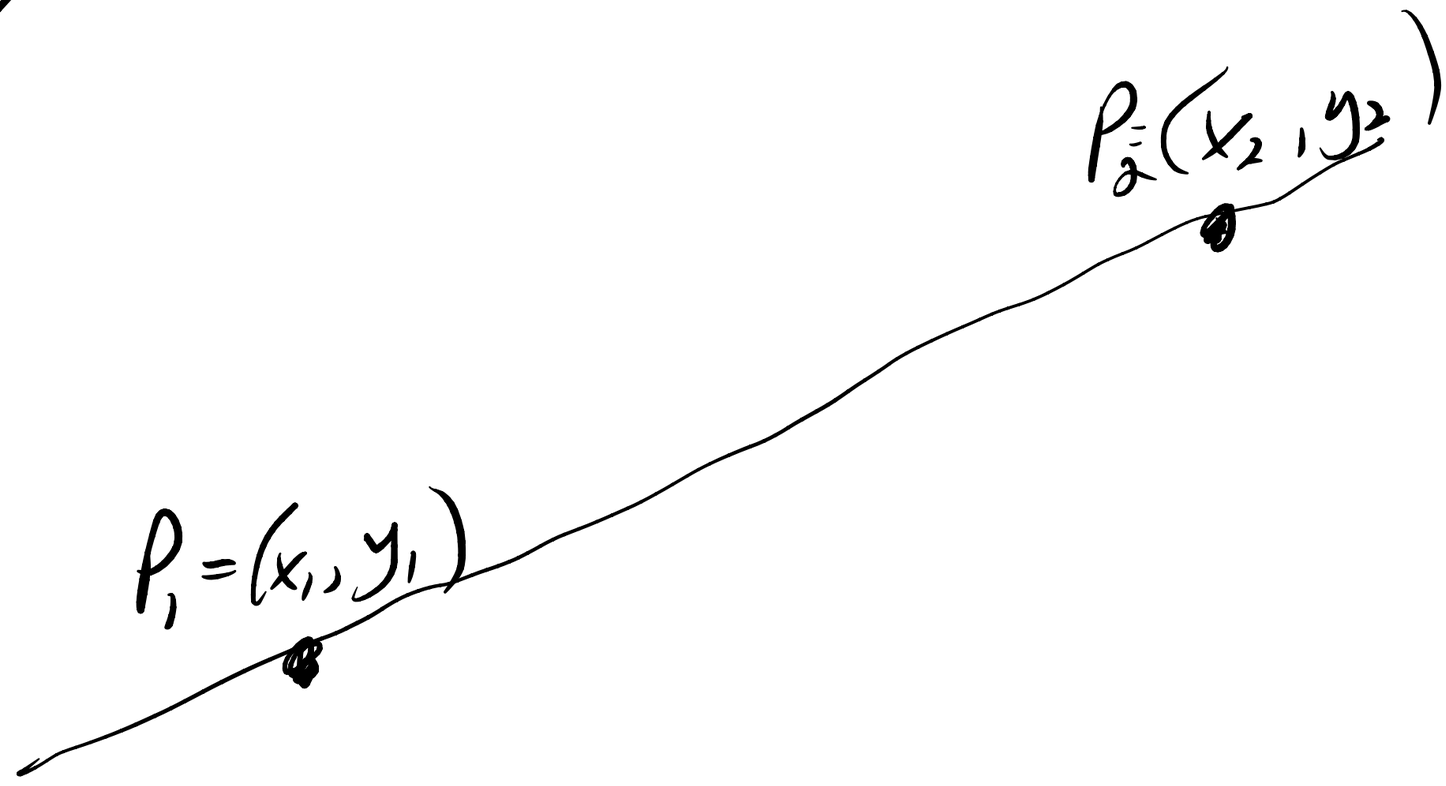


$f(1,2) = 1 - 2 \neq 0$
$= -1$

$\frac{\sqrt{2}}{2} \quad \frac{1.4\ldots}{2} = .707$

Math (2.5.?)
discusses
implicit lines

find a, b, c?



$$f(x, y) = ax + by + c = 0$$

$$ax_1 + by_1 + c = 0$$
$$ax_2 + by_2 + c = 0$$ ⟆ subtract

$$a(x_1 - x_2) + b(y_1 - y_2) = 0$$

(negative b)

$$a = -b\frac{(y_1 - y_2)}{(x_1 - x_2)}$$

let $b = 1$
solve for a
solve for c

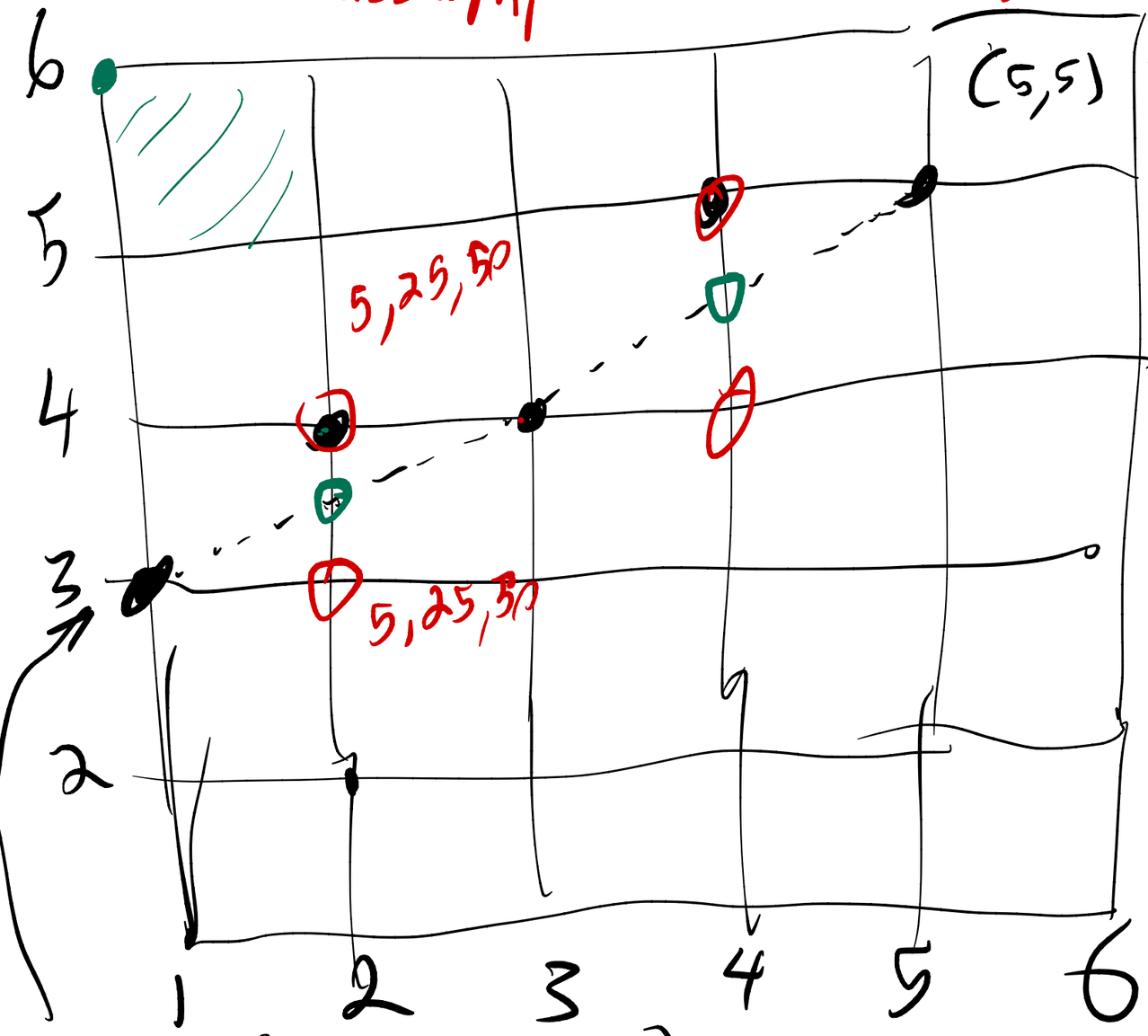
Rasterization

convert shapes to pixels

```
function line (x0, y0, x1, y1) {
    let dx = x1 - x0    // assuming x1 > x0
    let dy = y1 - y0    // ↩
    let length = max (dx, dy)
    let xinc = dx / length
    let yinc = dy / length
    let x = x0
    let y = y0
```

```
for (let i = 0; i <= length; i++) {
    drawPixel(round(x), round(y), 10, 50, 100)
    x += xInc
    y += yInc
}
```

assumption: black background



(1,3) = (x_0, y_0)

"aliasing"

$dx = 5 - 1 = 4$

$dy = 5 - 3 = 2$

length = 4

$x_{inc} = 1$

$y_{inc} = 0.5$

$x = 1$, $y = 3$

x	y
1	3
2	3.5
3	4
4	4.5
5	5