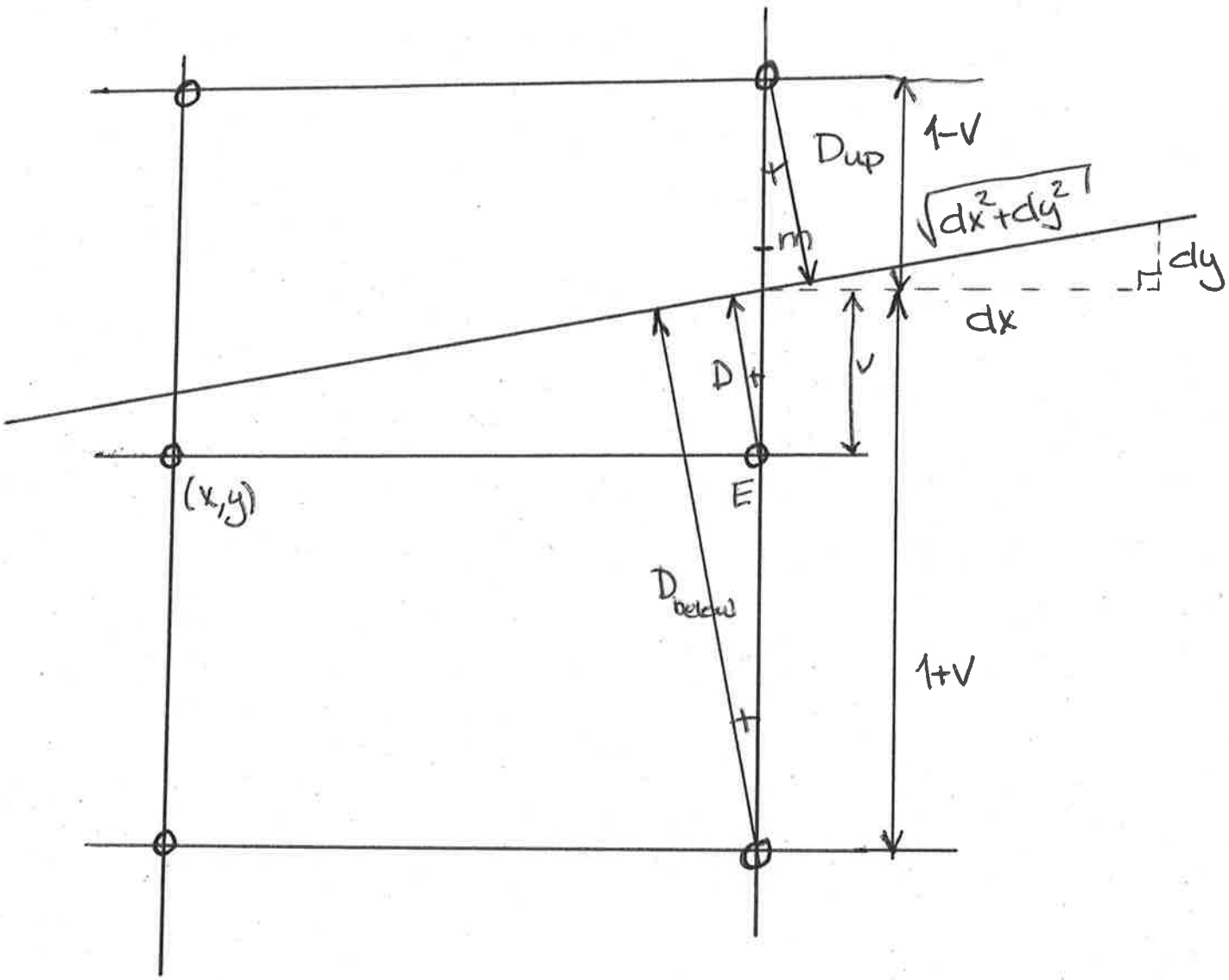
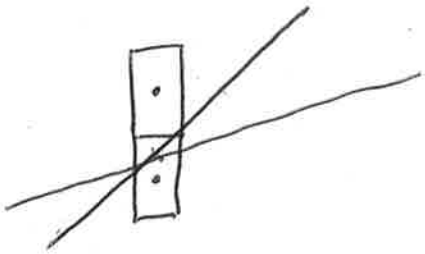

D_{up}
1-V
$\sqrt{dx^2+dy^2}$
dy
dx
D
V
(x,y)
E
D_{below}
1+V

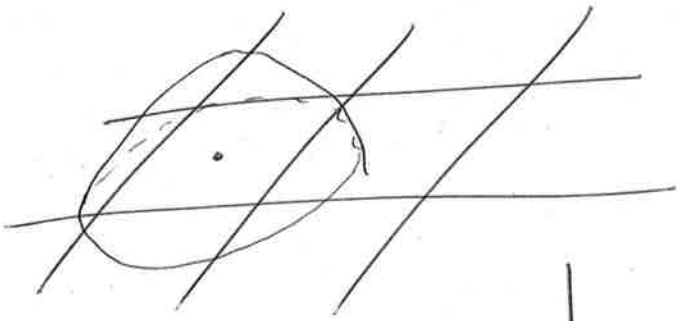
Gupta - Sproull

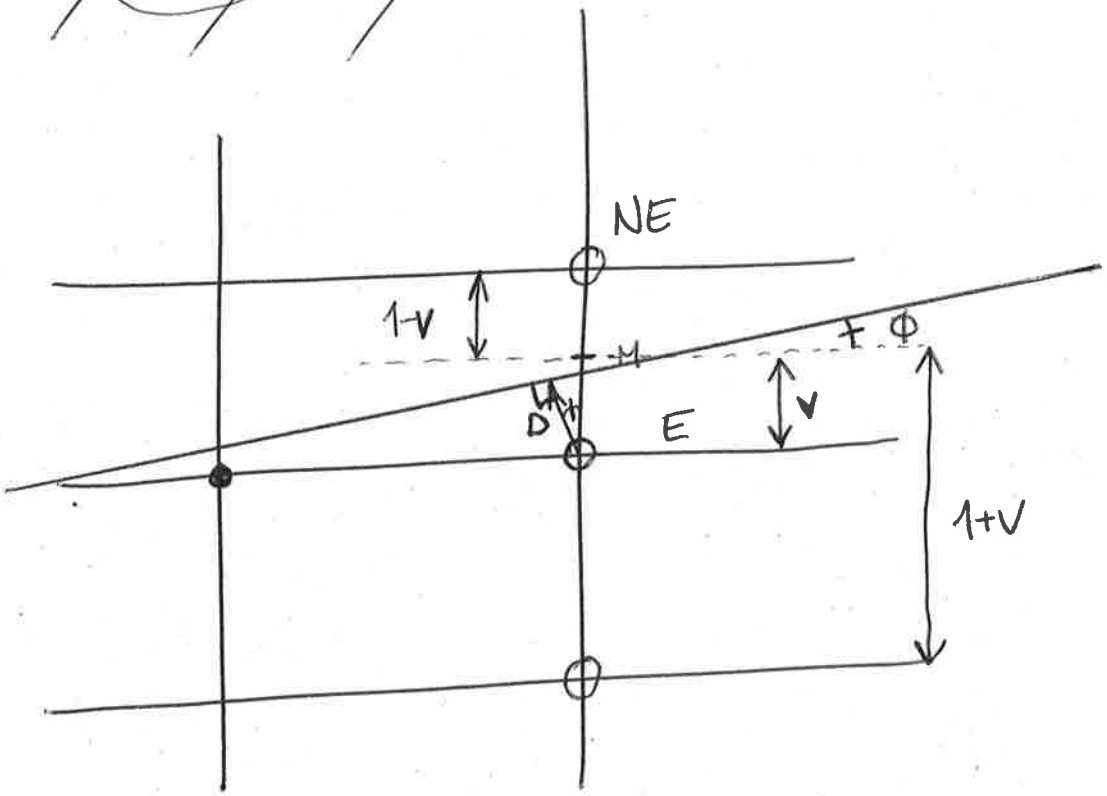
WU - only mid-point matters



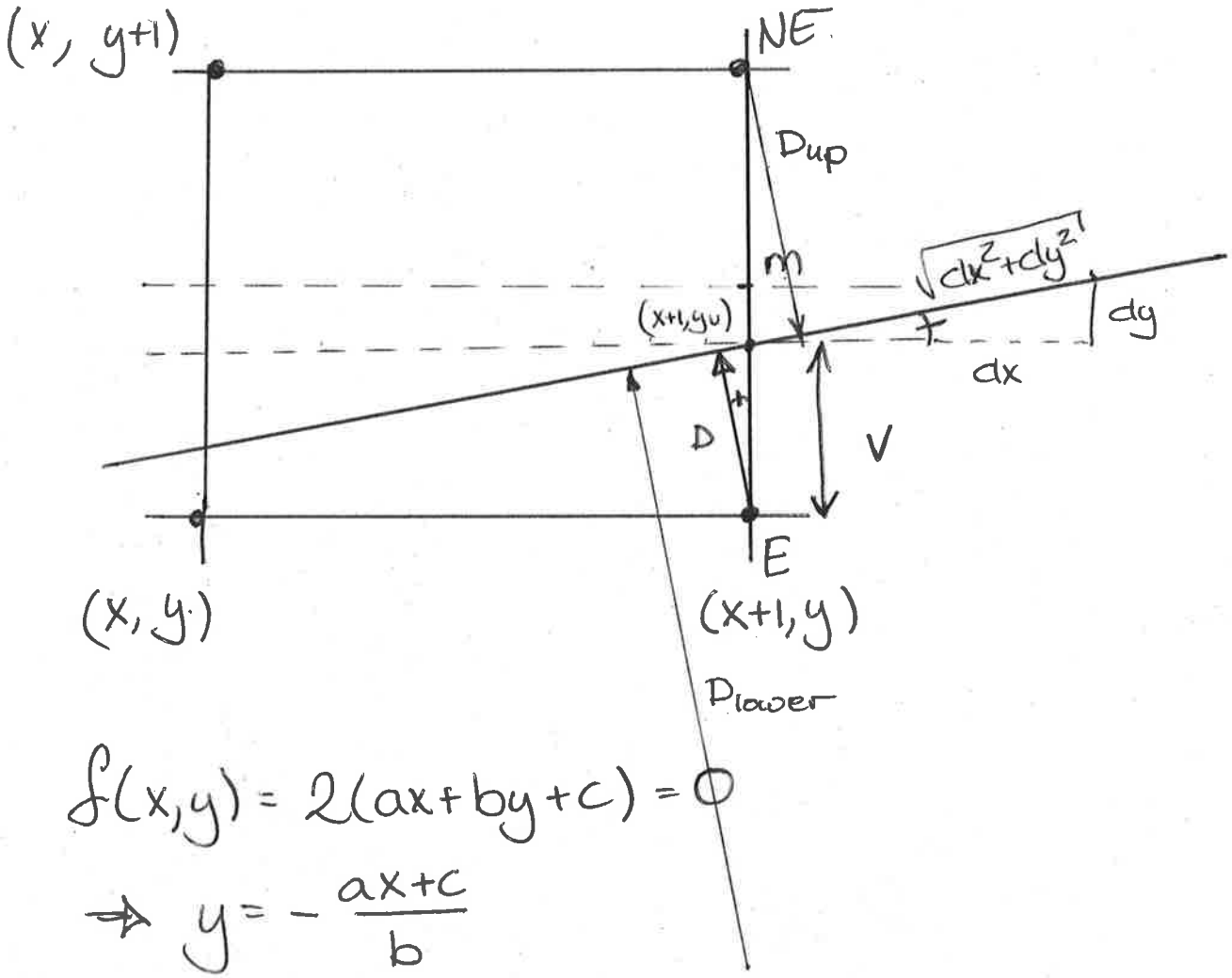
pixel colour will be the same.

Weighted anti-aliasing





1. Mid-point ⇒ choose E or NE
2. Colour pixel and its two vertical neighbours



$$f(x,y) = 2(ax+by+c) = 0$$

$$\Rightarrow y = -\frac{ax+c}{b}$$

$$y_v = -\frac{a(x+1)+c}{b}$$

$$V = y_v - y_p = -\frac{a(x+1)+c}{b} - y$$

$$\Rightarrow -bv = a(x+1) + c + by$$

Bresenham: $b = -dx$

$$\Rightarrow v \cdot dx = \underbrace{a(x+1) + by + c}_{\frac{1}{2} f(x+1, y)} = \frac{1}{2} f(x+1, y) \quad (*)$$

Decision variable

$$d = f(x+1, y+\tfrac{1}{2})$$

$(*) \Rightarrow 2v \cdot dx = f(x+1, y) =$

$$= 2a(x+1) + 2by + 2c =$$

$$= 2a(x+1) + 2b(y+\tfrac{1}{2}) - 2b\tfrac{1}{2} + 2c =$$

$$= \underbrace{2a(x+1) + 2b(y+\tfrac{1}{2}) + 2c}_{f(x+1, y+\frac{1}{2})} - b =$$

$$= f(x+1, y+\tfrac{1}{2}) - b = d - b = \underline{\underline{d + dx}}$$

$$\cos\theta = \frac{dx}{\sqrt{dx^2+dy^2}} = \frac{D}{V}$$

$$\Rightarrow D = \frac{V\cdot dx}{\sqrt{dx^2+dy^2}} = \frac{(d+dx)\frac{1}{2}}{\sqrt{dx^2+dy^2}} =$$

$$2V\cdot dx = d+dx$$

$$= (d+dx)\cdot \frac{1}{2(\sqrt{dx^2+dy^2})} = \underline{A}\cdot(d+dx)$$

$\Rightarrow$ A constant for line so can be precomputed

Shade as a function of D.

$$D_{up} = \cancel{(1-V)dx\cdot A = A(dx-Vdx)}$$

$$= \frac{(1-V)dx}{\sqrt{dx^2+dy^2}} = \frac{dx-Vdx}{\sqrt{dx^2+dy^2}} = \frac{dx}{\sqrt{dx^2+dy^2}} - \frac{Vdx}{\sqrt{dx^2+dy^2}} =$$

$$= B - A(d+dx)$$

$$D_{lower} = \frac{(1+V)dx}{\sqrt{dx^2+dy^2}} = \frac{dx}{\sqrt{dx^2+dy^2}} + \frac{Vdx}{\sqrt{dx^2+dy^2}} = B + A(d+dx)$$