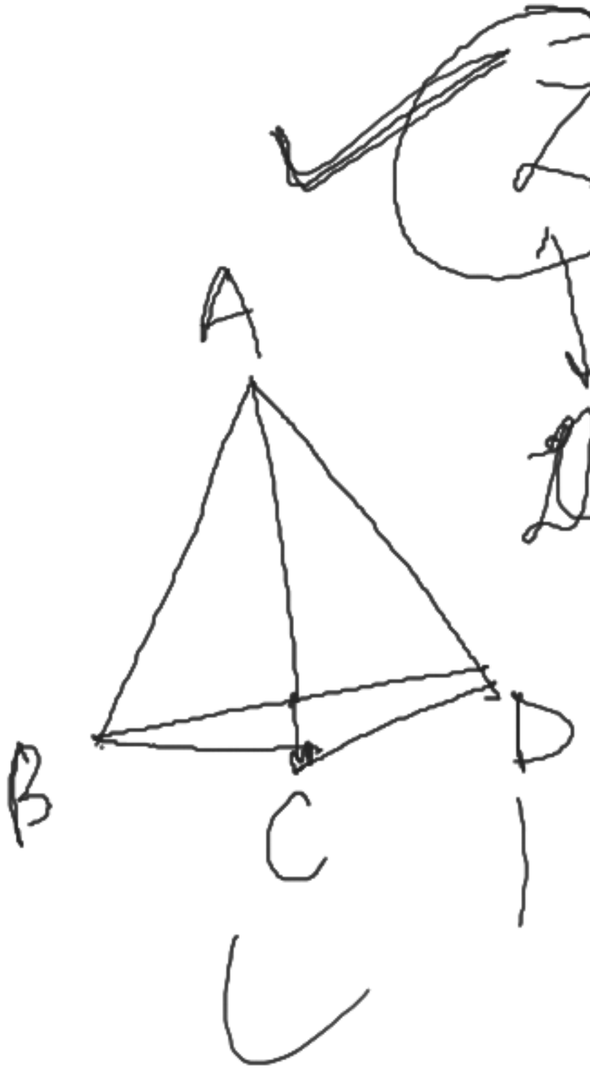
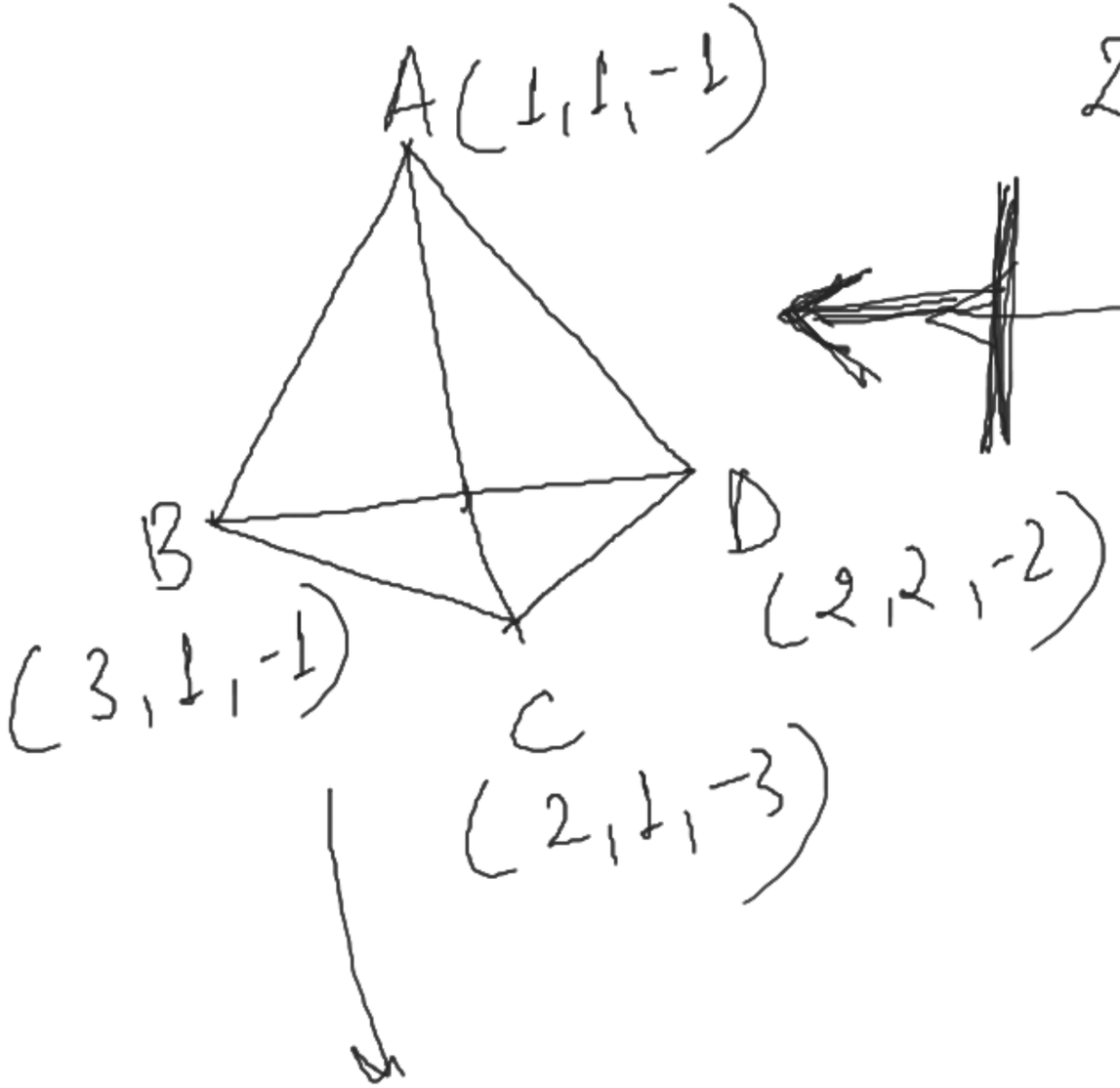
Z-Buffer Algorithm



Depth Value



Z-Buffer Algo to detect visible surfaces.

- BAD : Yellow
  ABC : Red
  ACD :- Blue
  CBD :- Green

- Visible Screen resolution
  4 x 4

Equation of plane $\rightarrow$

$$\begin{vmatrix} y_1-y_2 & z_1-z_2 \\ y_2-y_3 & z_2-z_3 \end{vmatrix} x + \begin{vmatrix} z_1-z_2 & x_1-x_2 \\ z_2-z_3 & x_2-x_3 \end{vmatrix} y + \begin{vmatrix} x_1-x_2 & y_1-y_2 \\ x_2-x_3 & y_2-y_3 \end{vmatrix} z - \begin{vmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{vmatrix} = 0$$

(1) ABC :-

$y = 1$ ✗

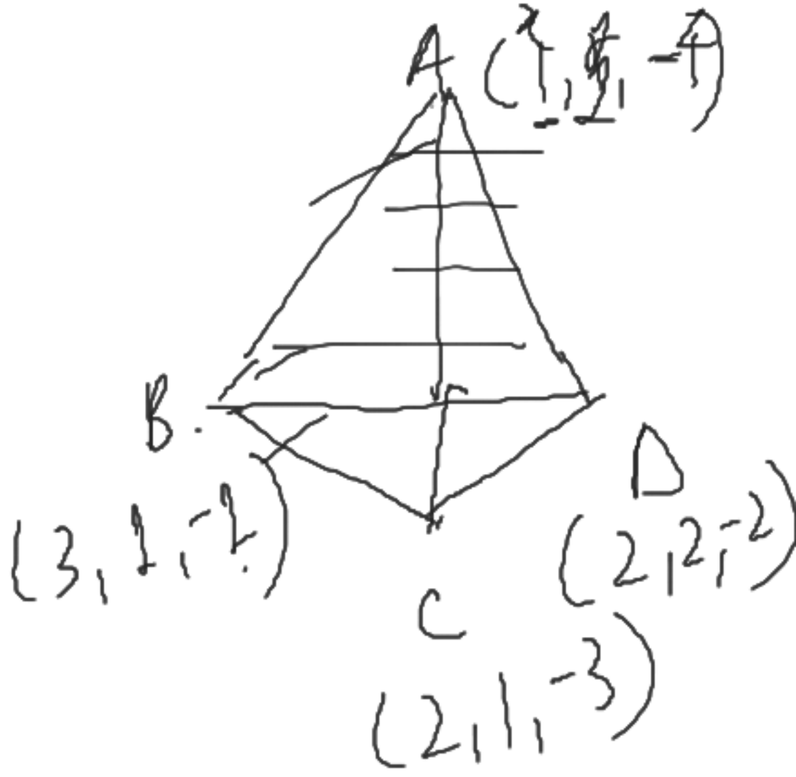
x	y	z
1	1	-1
3	1	-1
2	1	-3

(2) ABD

$y = -z$

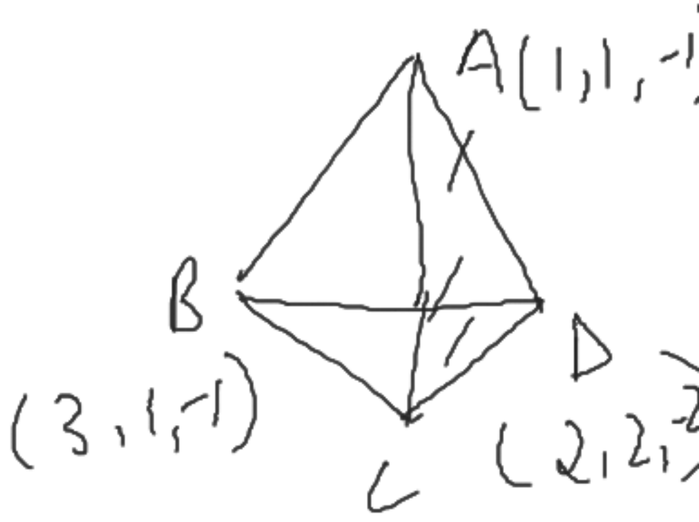
$z = -y$ ✓

x	y	z
1	1	-1
3	1	-1
2	2	-2



(3) ACD

$$\begin{vmatrix} x & y & z \\ 1 & 1 & -1 \\ 2 & 1 & -3 \\ 2 & 2 & -2 \end{vmatrix}$$



$$= \begin{vmatrix} 0 & 2 \\ -1 & -1 \end{vmatrix} x + \begin{vmatrix} 2 & -1 \\ 0 & 1 \end{vmatrix} y + \begin{vmatrix} -1 & 0 \\ 0 & -1 \end{vmatrix} z$$

$$- \begin{vmatrix} 1 & 1 & -1 \\ 2 & 1 & -3 \\ 2 & 2 & -2 \end{vmatrix} = 0$$

$$= 2x - y + z - (0) = 0$$

$$= 2x - y + z - 0 = 0$$

$$= 2x - y + z = 0$$

$$\boxed{z = y - 2x}$$

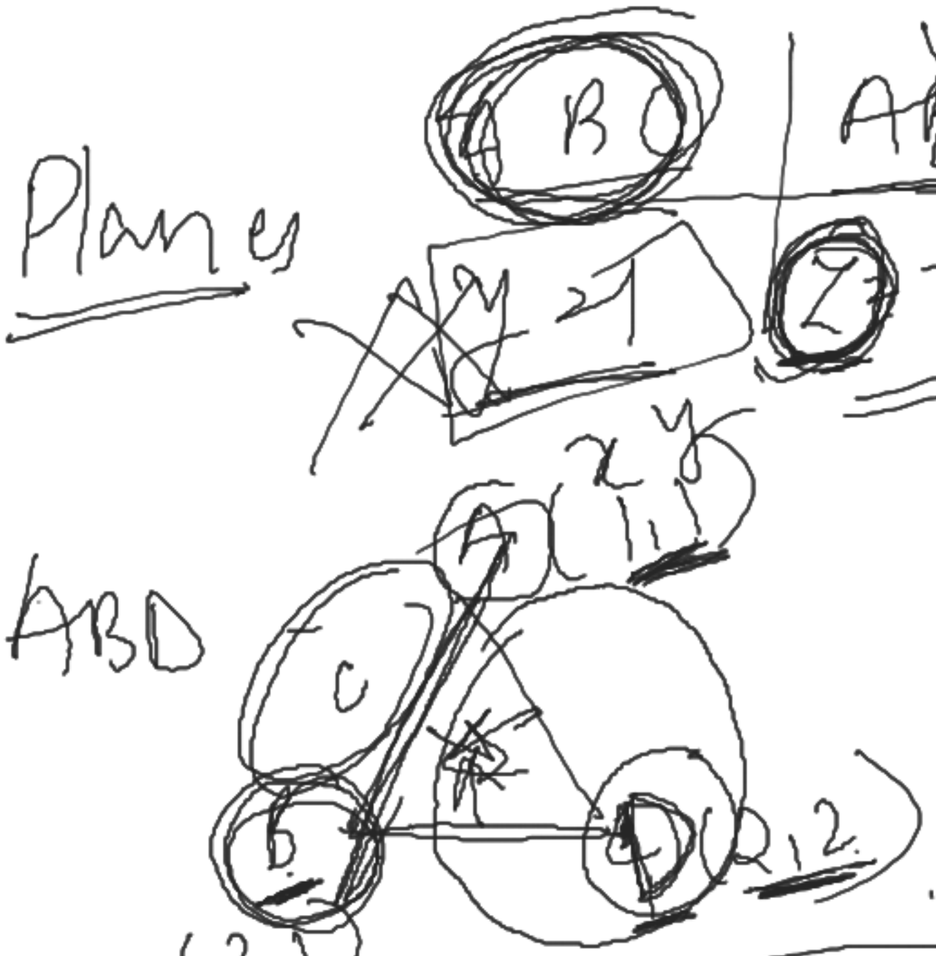
(4) RD $\begin{vmatrix} 3 & 1 & -1 \\ 2 & 1 & -3 \\ 2 & 2 & -2 \end{vmatrix}$

$= 2x + y - z - 12 = 0$

$\boxed{z = 2x + y - 8}$

Planes | ABC | ABD | ACD | BCD

$z = 1$ | $z = -y$ | $z = -2x + y$ | $z = 2x + y - 8$



ABD

$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$

Inside Test :-

x, y

AB :- $y = 1$

$f(x,y) = y - 1 \geq 0$

BD $= f(x,y)$ $= 4 - x - y \geq 0$

AD $x > y$ $f(x,y) = x - y \geq 0$

Projection (xy)

$z = 0$

01 ≥ 0

Plane :- ACD

Inside Test

1, 1

AC $y = 1$ $f(x,y) = y - 1 \geq 0$

CD $x = 2$ $f(x,y) = 2 - x \geq 0$

AD $x = y$ $f(x,y) = x - y \geq 0$

Plane :- BCD

BC $y = y - 1$ $f(x,y) = y - 1 \geq 0$

CD $x = x \geq 2$ $f(x,y) = \underline{x - 2} \geq 0$ 1-2 X

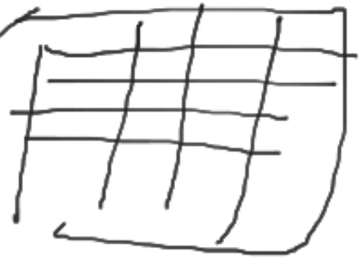
BD $x + y = 4$ $f(x,y) = 4 - x - y \geq 0$

Resolution → 4X4 6X6

1,4	Background
1,1	

Z = Buffer

I =



(1 - 3)

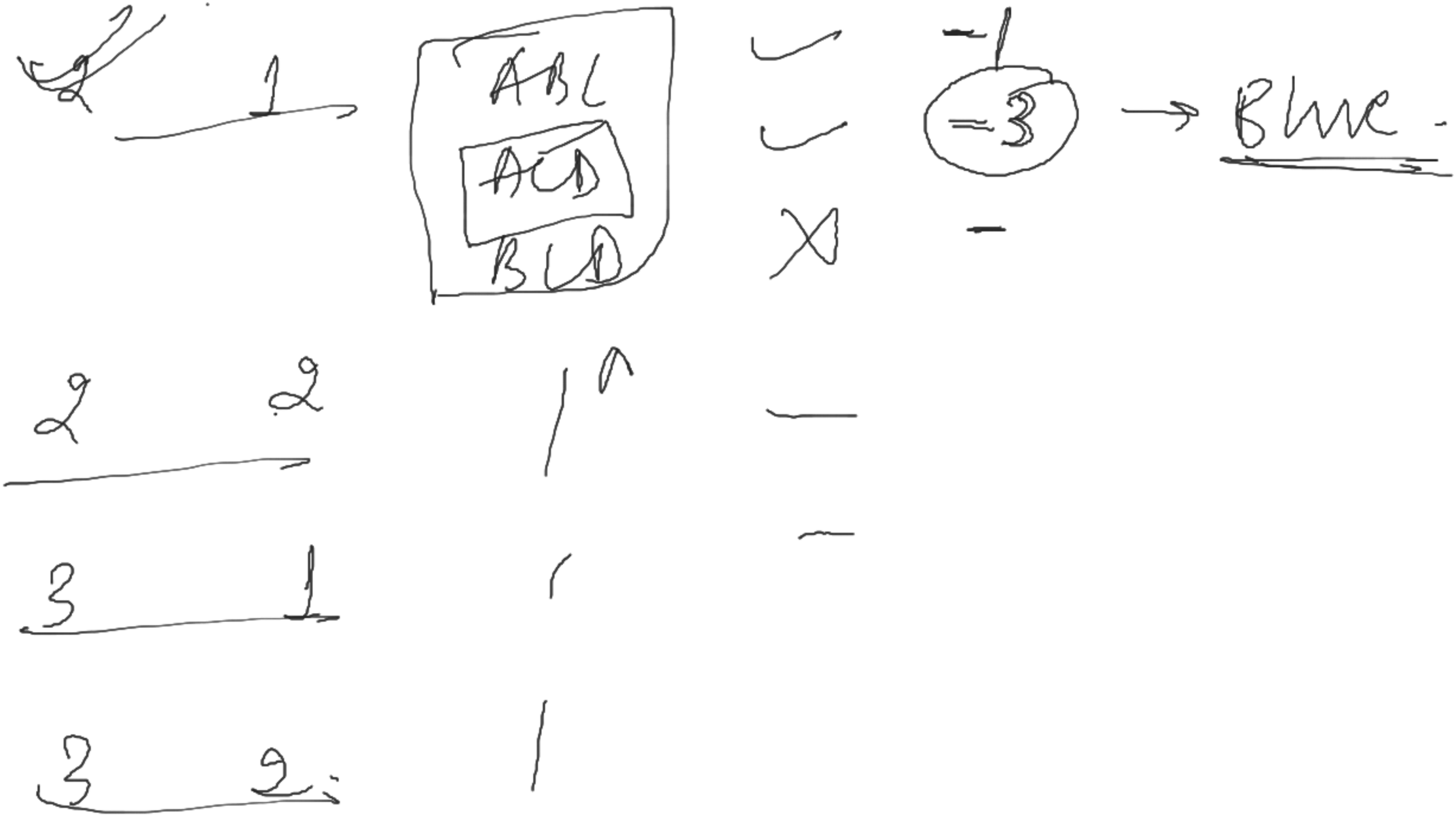
(1 - 2)

x y

Polygon 1

$x \to (1, 3)$ $y \to (1, 2)$ $z = -y$ $-2x + y$

x	y	Polygon	Inside Test	z	Color
1	1	ABD	✓	-1	→ ABD (min z value)
		ACD	✓	-1	
		BCD	X	-	
1	2	ABD	X	=	→ Background.
		ACD	X	=	
		BCD	X	=	


2
1
ABL
ACD
BLD
-1
-3
→ Blue.
2
2
3
1
3
2;