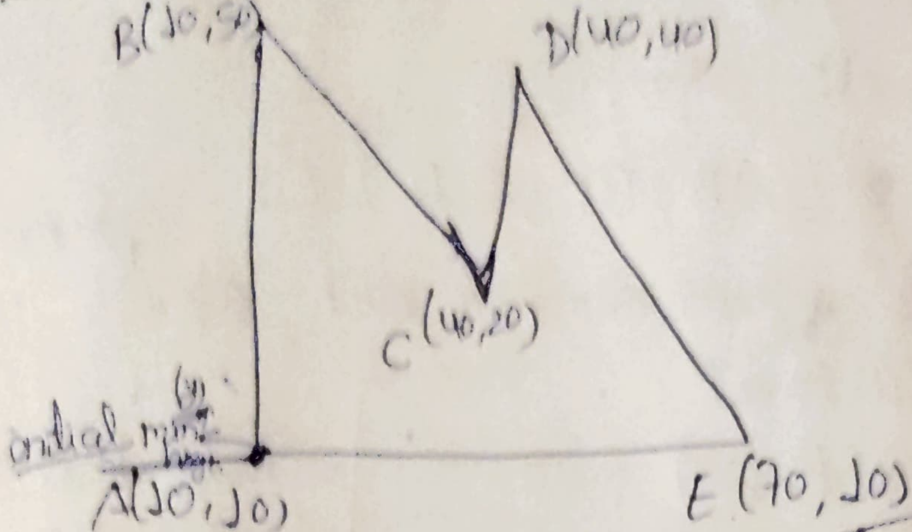
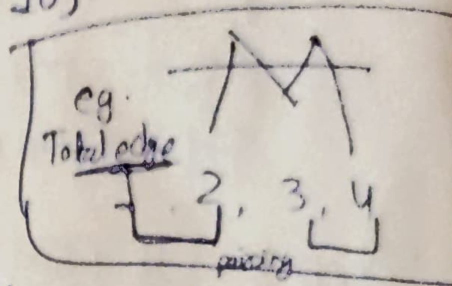
Scanline Polygon filling :-

Date - 5/4/23



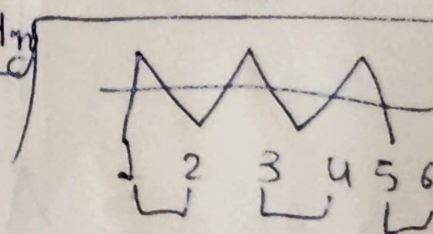
Scanline = line by line filling



⇒ each pixel will be filled.

In this filling is start with min height

⇒ Find first left boundary & Next Right boundary



Step 1 :- Write all edges which are not horizontal

→ Skip. AE A ——— C

edges consider (AB, BC, CD, DE)

Step 2:- Find y_{min} (minimum) of each edge (changing).

$AB = 10$ (y_{min})
$BC = \min(50, 20) = 20$
$CD = \min(20, 40) = 20$
$DE = \min(10, 40) = 10.$

— Note different y value. here $y = \underline{10 \& 20}$

Step 3:- y किस edge के लिए है।

~~20~~ →

y_{max}	x_{max}	slope.

→ info. stored in edges.

10 → AB

50	10	0

$$\frac{y_2 - y_1}{x_2 - x_1} \Rightarrow \frac{50-10}{10-10} \Rightarrow \frac{1}{0} \Rightarrow$$

$$\frac{1}{m} \Rightarrow \frac{1}{0} \Rightarrow \frac{0}{1} \Rightarrow m = 0.$$

DE.

40	70.	-1

$$\frac{40-10}{40-70} \Rightarrow \frac{30}{-30} \Rightarrow (-1).$$

$$\frac{1}{m}$$

Step 4:- ~~Draw~~ fill B color pixel from 10 to 70

filling 3 time 69

Step 5:- Increase y by 1.

$y = 10$

Now $y = 10+1 \Rightarrow 11$

$(70+(-1)) = 69$

~~Step 4~~:- AB. DE

50	10	0.

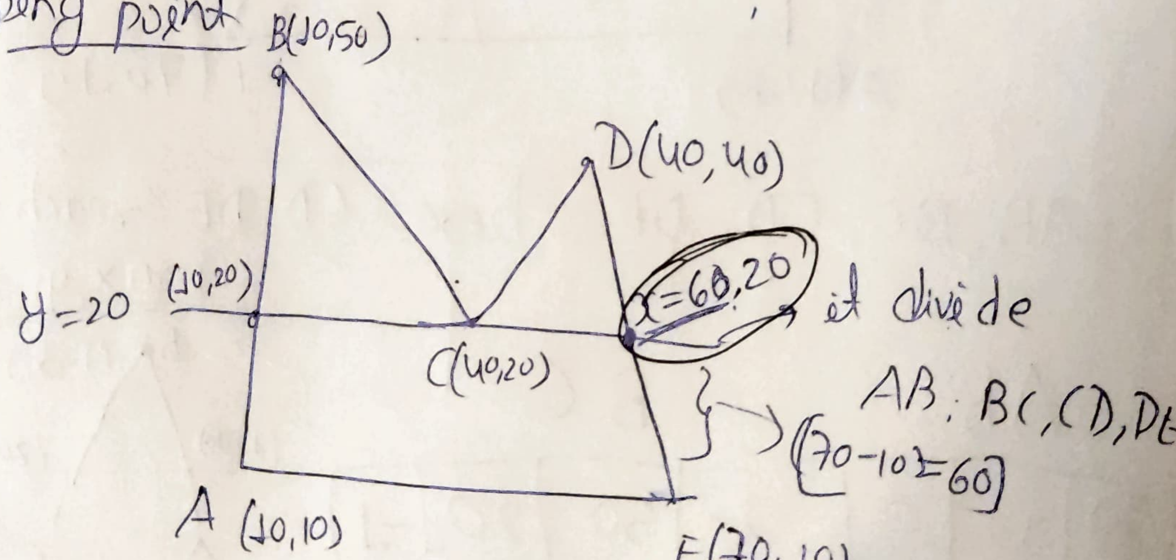
40	69.	-1

10+0.

50	10	0

40	68	-1

Stoping point



AB pair ① BC

50	10	0

50	40	-1

CD pair 2 DE

40	40	0

40	60	-1

Not change because straight line

$\frac{50-20}{10-40} \Rightarrow -1$

$\frac{40-20}{40-40} \Rightarrow 0$

$\frac{40-20}{40-60} \Rightarrow \frac{20}{-20}$

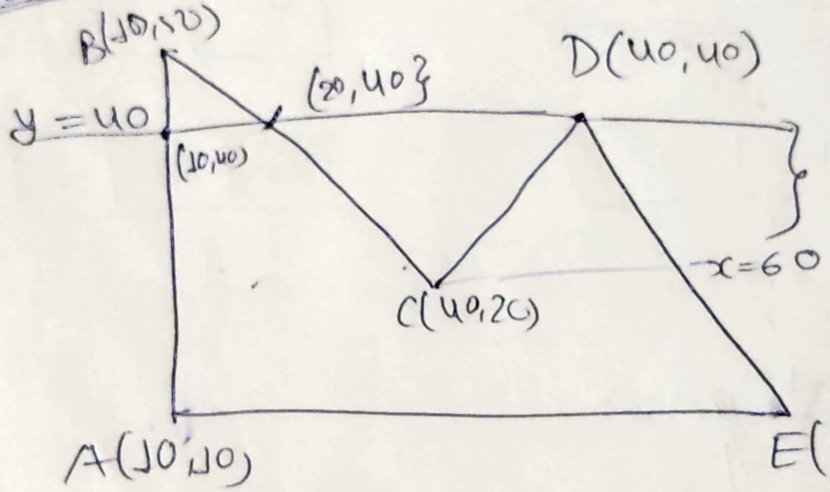
Step 6:- Now pair in two.

10 to 40. | 40 to 60.

50	10	0	50	40	-1	40	40	0	40	60	-1
50	10	0	50	39	-1	40	40	0	40	59	-1
			50	38	-1				40	58	-1

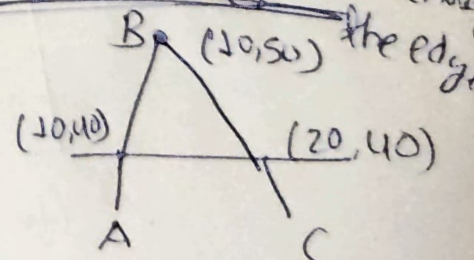
same

Next After y=40



⇒ 60-40 =20

AB, BC, CD, DE here CD, DE reach the max y so remove the edge



AB

50	10	0
50	10	0.

pair 10 to 20

BC

50	20	-1
50	19	-1
50	18	-1

than • (10,50) Stop. coloring is complete

Algorithm :- 1. Find all y_{min} of every edge.

2. Initially active edge list is empty.

3. Repeat for each y_{min}.

↳ (a) Store all cutting edges.

↳ (b) Sort on x value.

Box design Left to Right

↳ (c) fill pixel from x_1 to x_2.

(eg. 10 to 70).

↳ (d) If y_{max} reach remove the edge.

4. $y = y+1$; & $x = x + \frac{1}{M}$

eg. 10 to 70+(-1)

=10 =69

2-D Transformation :-

(Date - 6/4/23)

means changing current position of object

$(x, y) \rightarrow (x', y')$

10 marks

Describe various types of 2-D tran.

types :-

(1) Translation / repositioning / shifting of object
(2) Scaling
(3) Rotation
(4) Reflection
(5) Shearing.

(1) Translation :- Change in position in one direction

or (repositioning / shifting of object to new location)

$\boxed{t_x = x_2 - x_1}$

$\boxed{t_y = y_2 - y_1}$

t_x = translation amount (trans. distance)

$$\boxed{\begin{aligned} x' &= x + t_x \\ y'' &= y + t_y \end{aligned}}$$

eg. $(1, 1)$ x, y → $(2, 2)$ x', y'

eg. $(2, 3) \rightarrow (9, 4)$

$\therefore$ $t_x = 9 - 2 = 7$

$t_y = 4 - 3 = 1$.

current point (x, y)

⇒ Tr... Con... $\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} =$ ...

→ Translation Matrix:-

Converting 2-D into 3-D, Identity matrix

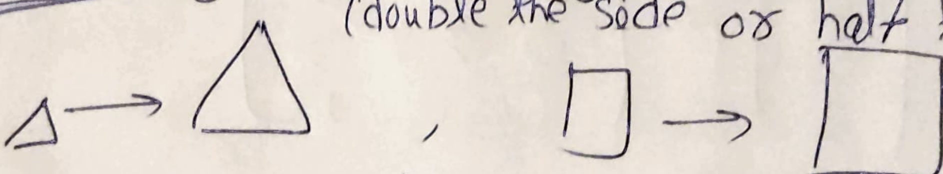
$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 & t_x \\ 0 & 1 & t_y \\ 0 & 0 & 1 \end{bmatrix}$$

$$x*1 + y*0 + 1*t_x \Rightarrow x + t_x$$
$$x*0 + y*1 + 1*t_y \Rightarrow y + t_y$$
$$x*0 + y*0 + 1 \Rightarrow 1$$

means
$$\boxed{\begin{aligned} x' &= x + t_x \\ y' &= y + t_y \end{aligned}}$$

② **Scaling**:- Altering size of the object (double the side or half the size etc.)

eg.



$$\boxed{\begin{aligned} x' &= x \cdot S_x \\ y' &= y \cdot S_y \end{aligned}}$$

Scaling Matrix:

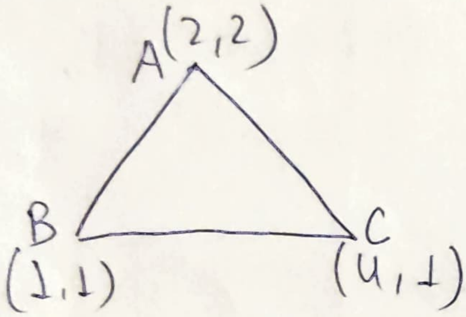
$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} * \begin{bmatrix} S_x & 0 & 0 \\ 0 & S_y & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$x' = x * S_x + y \times 0 + 1 \times 0 \Rightarrow x . S_x$$

$$y' = y * 0 + y \times S_y + 1 \times 0 \Rightarrow y . S_y$$

$$1 = x * 0 + y \times 0 + 1 * 1 \Rightarrow 1 .$$

eg.



if $S_x = 2$

$S_y = 2$.

For A.

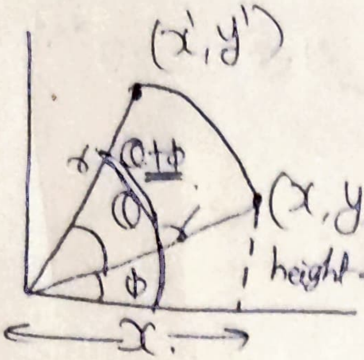
$$\begin{bmatrix} x \\ y \\ 1 \end{bmatrix} = \begin{bmatrix} 2 \\ 2 \\ 1 \end{bmatrix} * \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\therefore = \begin{bmatrix} 4 \\ 4 \\ 1 \end{bmatrix} A$$

$3 \times 3 \times \quad 3 \times 1$

(3) Rotation :-

eg.



→ Rotate anti-clockwise by θ angle.

$$\therefore \cos\phi = \frac{x}{r} \Rightarrow x = r.\cos\phi.$$

$$\sin\phi = \frac{y}{r} \Rightarrow y = r.\sin\phi.$$

$$r.\cos(\theta+\phi) = r\cos\theta.\cos\phi - r\sin\theta.\sin\phi$$

$$r.\sin(\theta+\phi) = r\sin\theta.\cos\phi + r\cos\theta.\sin\phi.$$

$$\therefore r\cos(\theta+\phi) = x\cos\theta - y\sin\theta.$$

$$\& \; r\sin(\theta+\phi) = x\sin\theta + y\cos\theta.$$

Means $\boxed{\begin{aligned} x' &= x\cos\theta - y\sin\theta. \\ y' &= x\sin\theta + y\cos\theta \end{aligned}}$

if $\theta = 30$ than rotation.

$$x' = x\cos 30 - y\sin 30 \Rightarrow$$

$$y' = x\sin 30 + y\cos 30.$$

⇒ Rotation Matrix :-

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \times \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$x' = x\cos\theta - y\sin\theta + 0.$

$y' = x\sin\theta + y\cos\theta + 0.$

$1 = x \times 0 + y \times 0 + 1$

Az

Que. If $(1, 1)$ $\theta = 90°$
$x \quad y.$

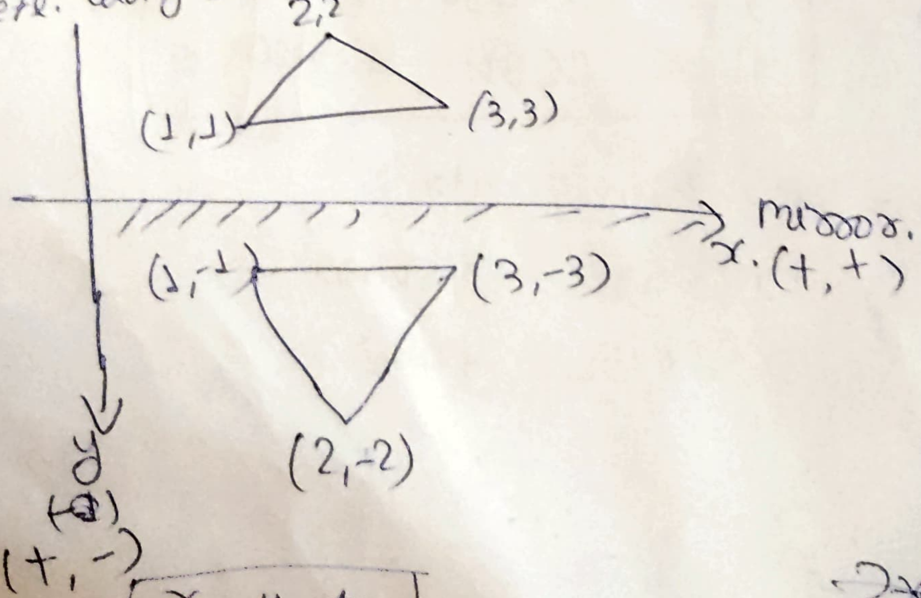
$x' = 1\cos 90 - (1)\sin 90° \Rightarrow -1$

$y' = (1)\sin 90 + (1)\cos 90° \Rightarrow 1.$

(4) Reflection :- Mirroring.

Refe. along x-axis

eg.



[x y]

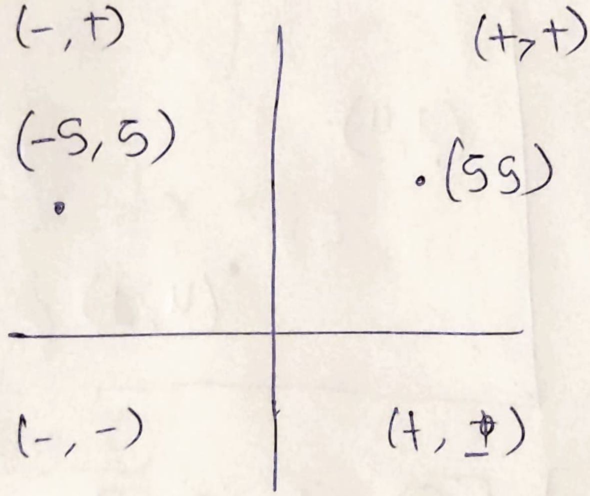
1×3 3×1 3×3 2×3 3×2

Matrix :-

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\boxed{\begin{aligned} x' &= x. \\ y' &= -y. \\ 1 &= 1 \end{aligned}}$$

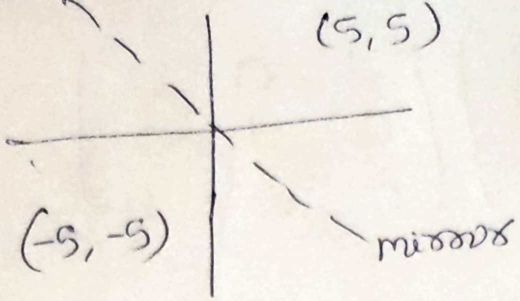
⇒ Reflection along y-axis :-



Matrix

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

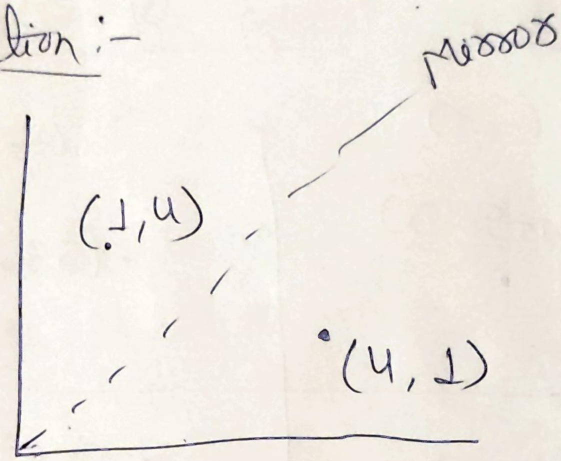
⇒ XY reflection



$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

⇒ Diagonal reflection :-

Interchange the value.

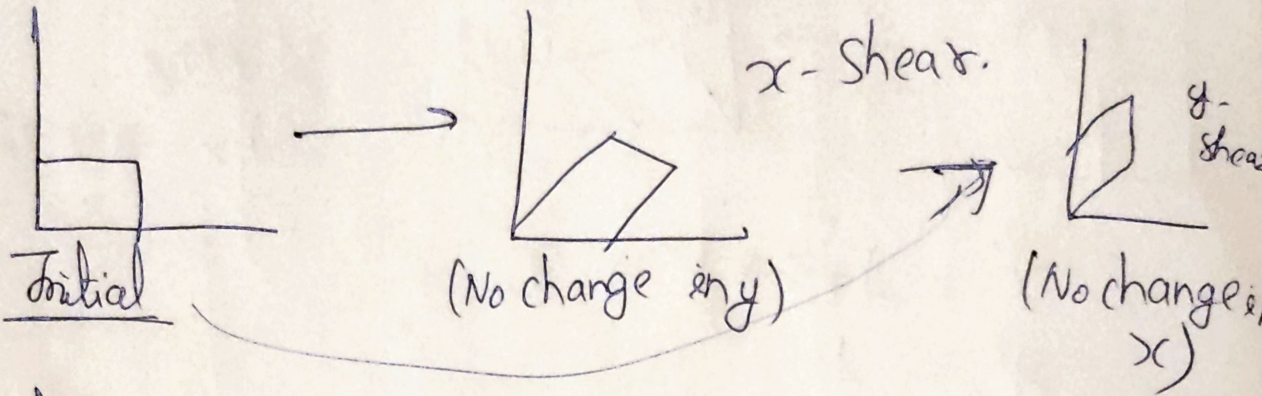


$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\boxed{\begin{aligned} x' &= y. \\ y' &= x \\ 1 &= 1 \end{aligned}}$$

⑤ Shearing :- Means changing shape.

⇒ x & y shearing



Matrix:-

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \begin{bmatrix} 1 & sh_x & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

x-shearing

$$x' = x + Sh_x * y.$$

$$y' = y$$

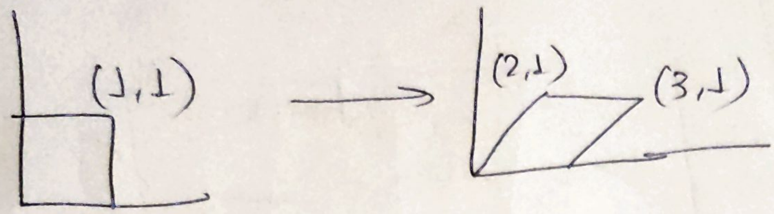
y-shearing

$$y' = y + Sh_y * x.$$

$$x' = x.$$

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ Sh_y & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

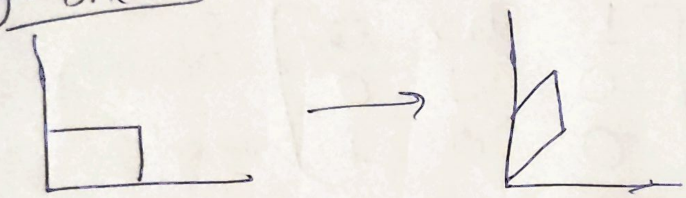
eg. x-shear



Shifting
$Sh_x = 3 - 1 \Rightarrow 2.$

$\therefore x' = 1 + 2 \times 1 \Rightarrow 3.$
$y' = 1.$

eg. y-shear



Date - 10/4/23

☆ 3-D Transformation :-

(1) Translation
(2) Scaling
(3) Rotation
(4) Reflection
(5) Shearing.

(I) Translation :- $x' = x + tx$
$y' = y + ty$
$z' = z + tz$

Matrix:

$$\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & tx \\ 0 & 1 & 0 & ty \\ 0 & 0 & 1 & tz \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(II) Scaling :- $x' = xSx$
$y' = ySy$
$z' = zSz$

Matrix:-

$$\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \begin{bmatrix} Sx & 0 & 0 & 0 \\ 0 & Sy & 0 & 0 \\ 0 & 0 & Sz & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(III) Rotation :- 3 rotation.

(a) Rotation through Z axis :-

$$= \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \begin{pmatrix} \cos\theta & -\sin\theta & 0 & 0 \\ \sin\theta & \cos\theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

(b) Rotation through x axis :- x-axis same

$$\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta & 0 \\ 0 & \sin\theta & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

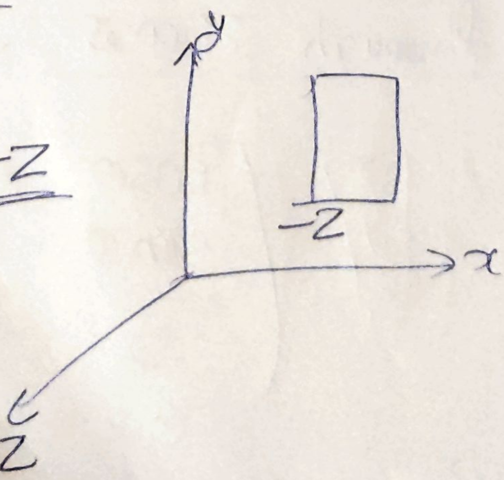
(c) Rotation through y axis :- y position as it is.

$$\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} * \begin{bmatrix} \cos\theta & 0 & \sin\theta & 0 \\ 0 & 1 & 0 & 0 \\ -\sin\theta & 0 & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(4) Reflection :- types
- XY Reflection
- YZ —//—
- ZX

(a) XY reflection :-

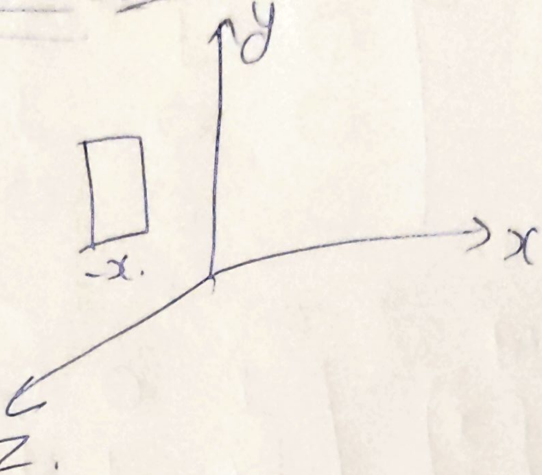
x & y no change
& z is -ve means -Z



Matrix

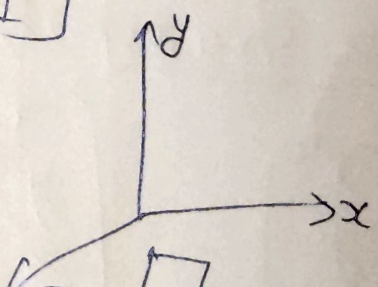
$$\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \times \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(b) YZ reflection : x is -ve



$$\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(c) ZX reflection $\rightarrow$ y is -ve



$$\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

(5) Shearing :-

Matrix :-

x Shear :- x को ~~change~~ fix करो ~~fix~~ change (same)

x - Shearing

$$\begin{bmatrix} 1 & sh_y & sh_z & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

y - Shearing

$$\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ sh_x & 1 & sh_y & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

z - Shearing $\Rightarrow$ z value fix (1) & xy Change.

$$\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ sh_x & sh_y & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$x' = x + y +$

★ Concatenation :- Combining / applying more than one transformation.

Que.
Transformation in 2-D
① Y-axis reflection
② Rotation 90°
③ Translation $tx = 5$, $ty = 8$

point (1, 1)

(i) Y-axis ref. (ii) for transl.

$$\begin{bmatrix} x \\ y \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} * \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} \cos 90 & -\sin 90 & 0 \\ \sin 90 & \cos 90 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 5 \\ 0 & 1 & 8 \\ 0 & 0 & 1 \end{bmatrix}$$

(ii) Rotation 90°

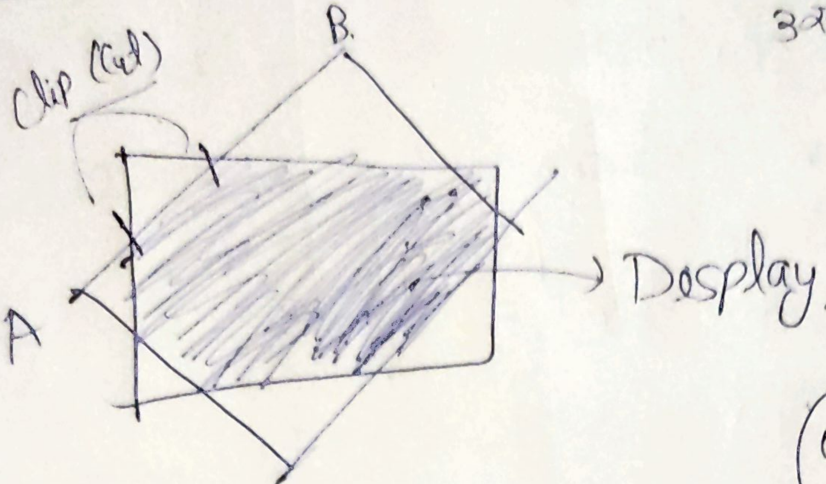
$$\begin{bmatrix} -1 \\ 1 \\ 1 \end{bmatrix} * \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 & 5 \\ 0 & 1 & 8 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} -1 \\ -1 \\ 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 & 5 \\ 0 & 1 & 8 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\Rightarrow \begin{bmatrix} -1*1 + 0 + 1*5 \\ -1*0 + -1*1 + 1*8 \\ -1\times 0 + (-1)*0 + 1\times 1 \end{bmatrix} \Rightarrow \begin{bmatrix} 4 \\ 7 \\ 1 \end{bmatrix}$$ Ans

☆ Polygon Clipping Alg. :-

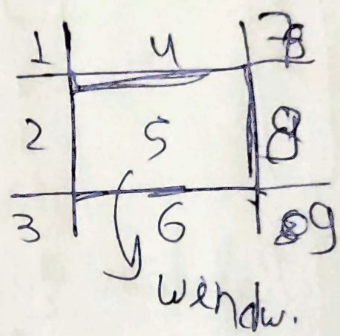
जो range के अंदर नहीं उसको कट.

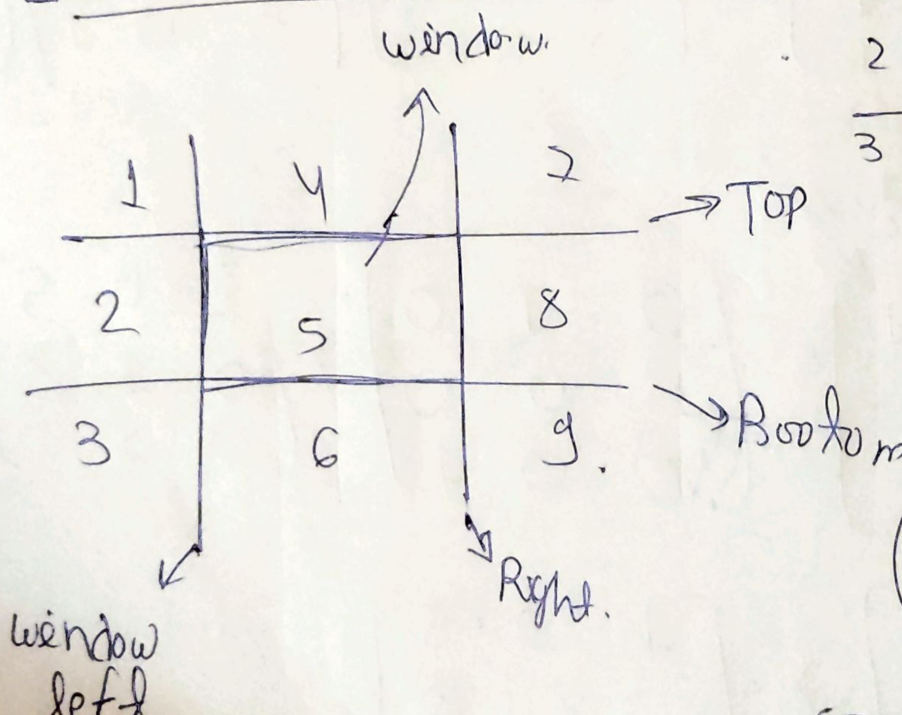


window divided into 9 parts

Algorithm:

① Cohen - Sutherland algo.





Divided into 9 region

each part is represent with 4bit.

4bit	4bit	4bit
4bit	4bitcode	4bit
4bit	4bit	4bit

bit code

Rule for coding :-

step (i)

Assign for bit code

4 bit

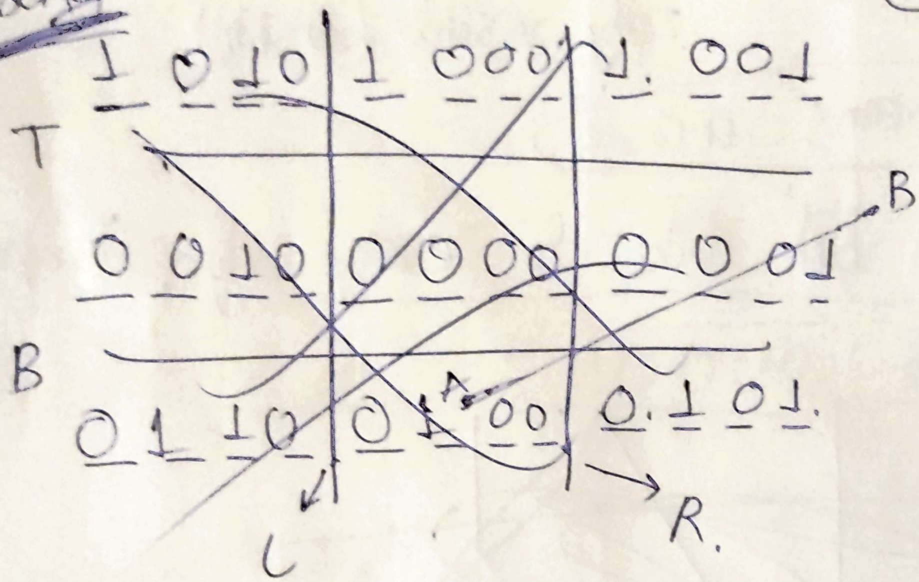
1st bit	2nd	3rd	4th.
Top	Bottom	~~Left~~ Right	~~Right~~ Left

~~st~~ 0/1.

1 = above top line ~~or~~
otherwise. ~~on top~~
0 = In 1st bit

$\boxed{\begin{array}{l} 1 = \text{above top line} \\ \text{Otherwise } 0 \end{array}}$

wrong



$\boxed{\begin{array}{l} \text{Bit code of} \\ A = 0100 \\ B = 0001 \end{array}}$

Bottom (2nd bit)

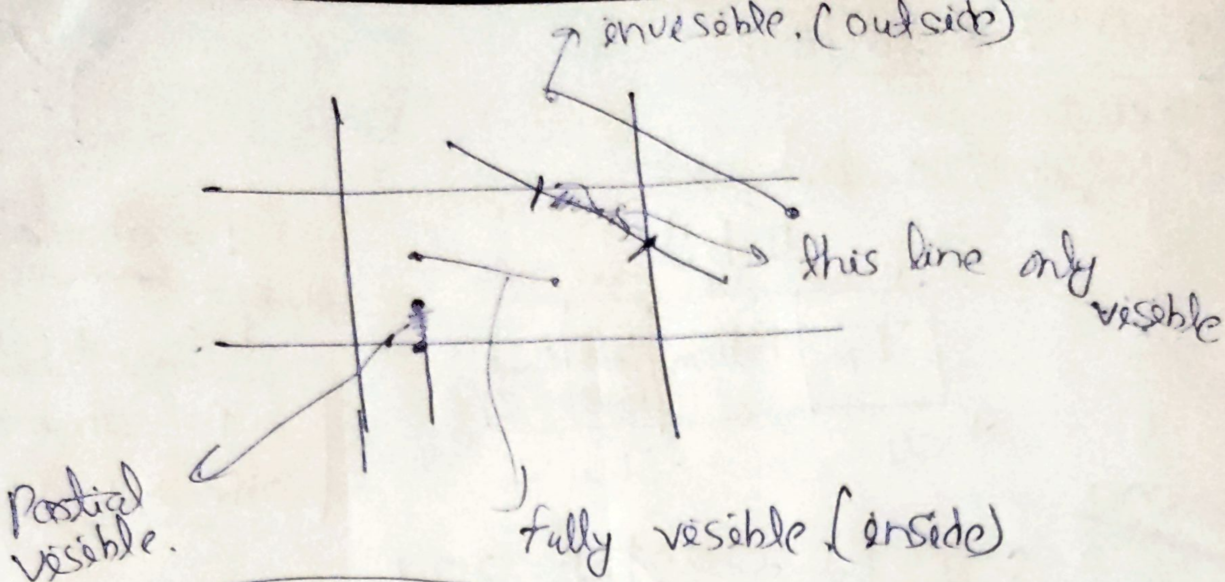
1 = Below Bottom line
otherwise 0

Left (3rd bit)

1 = left, left side
otherwise 0

Right (4th bit)

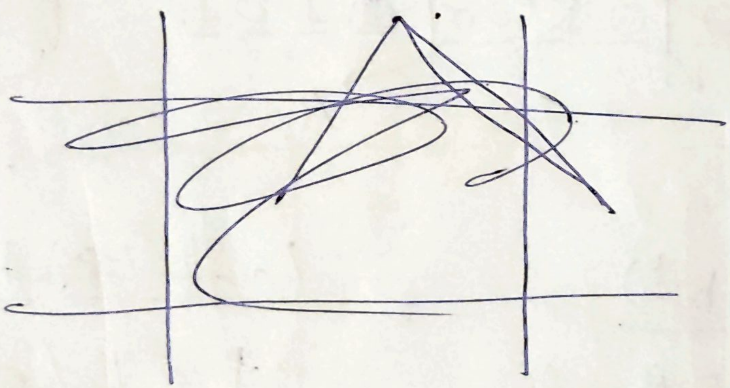
1 = Right line right
otherwise 0



means 4 cases

Step (i) Assign bit code to every edge. (two points)

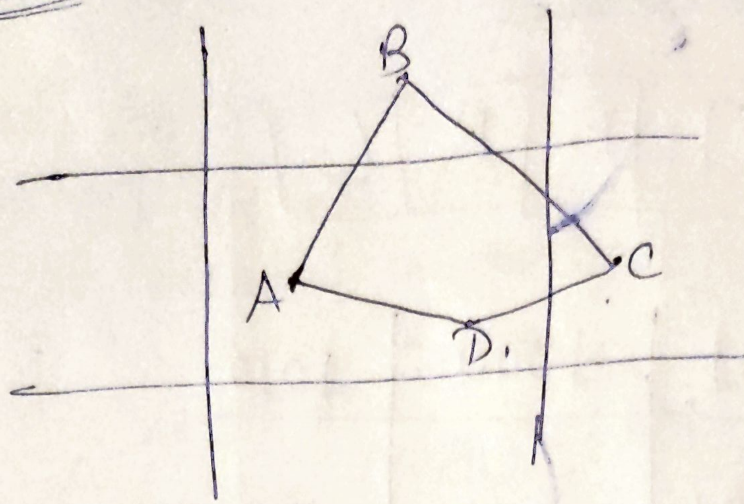
If eg.



(ii) OR if Ans. = 0 than inside.

(iii) AND if Ans ≠ 0 than outside

eg. Inside



(a) AD points A, B

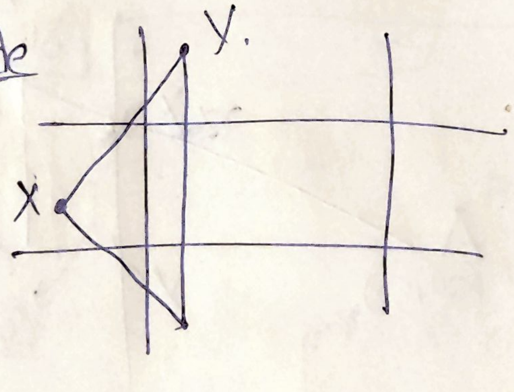
bit A — 0000

bit D — 0000

apply logical OR opⁿ — $\boxed{0000}$ inside

If ans. 0000 than inside

eg. (II) Outside



Step (2) apply AND opⁿ.

XX

bit X — 0 0 0 0 1

bit Y — 1 0 0 0 0

AND opⁿ - 0 0 0 0 0 → Outside

If Ans ≠ 0 than Outside

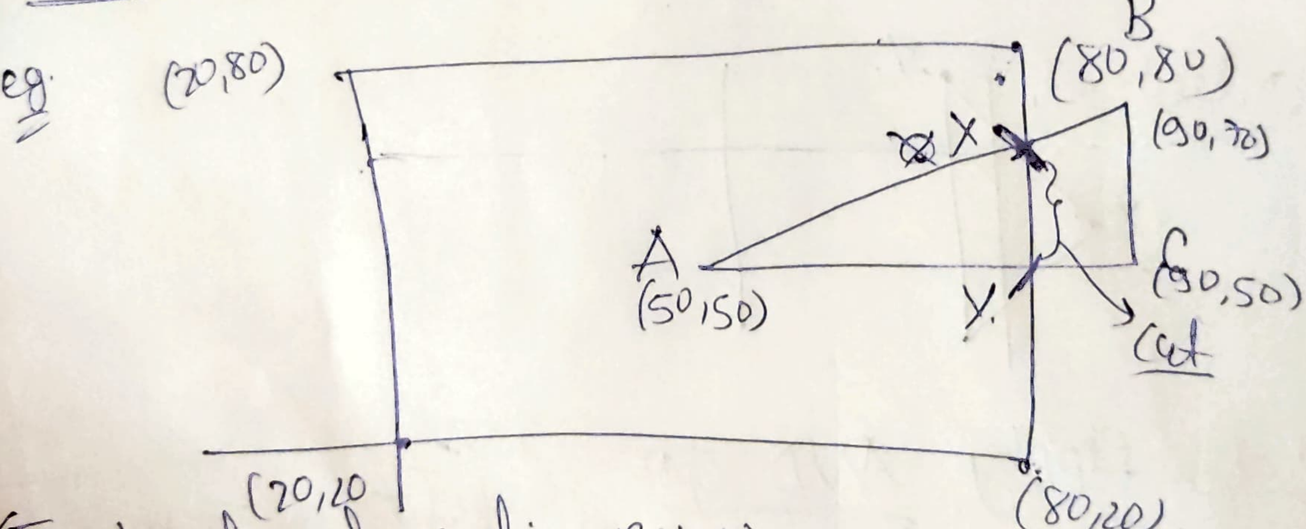
bit code assiging New

T	B	R	L

1001	1000	1010
0001	0000	0010
0101	0100	0110

(3) Else partially visible

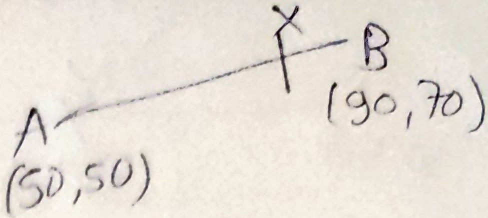
eg.



(Find out intersection point)
Process in which line is cut

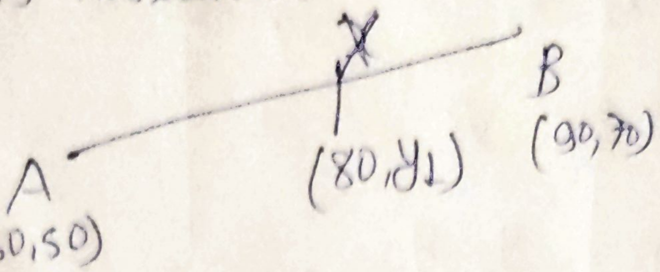
Formula. $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

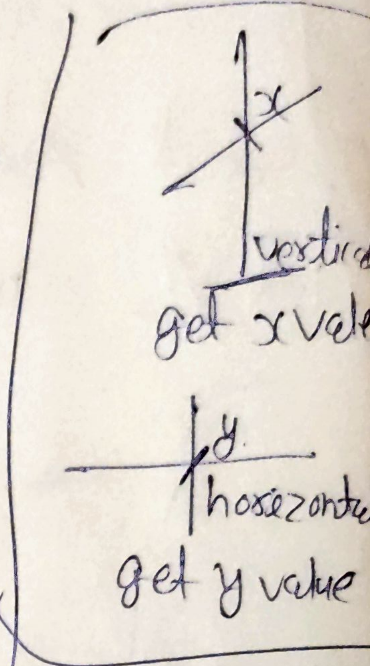
X is lies b/w A & B.



than find AB किस line को cut कर रहा (T, B, L or R)

Find cut is horizontal or vertical.





$$\therefore m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$y_2 - y_1 = m(x_2 - x_1)$$

$$-y_1 = m(x_2 - x_1) - y_2$$

$$\boxed{y_1 = -m(x_2 - x_1) + y_2}$$

From AB find slope $\quad m = \frac{y_2 - y_1}{x_2 - x_1} \Rightarrow \frac{70-50}{90-50} = \frac{1}{2}$

than choose either AX or XB.

Let XB $\quad m = \frac{y_2 - y_1}{x_2 - x_1} \Rightarrow \frac{70 - y_1}{90 - 80} = \frac{1}{2}$

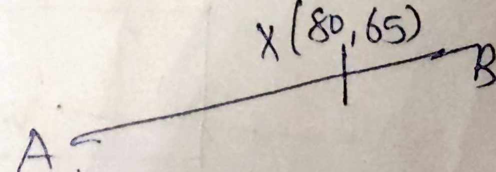
$$\frac{70 - y_1}{10} = \frac{1}{2}$$

$$70 - y_1 = 5.$$

$$-y_1 = -65$$

$$\boxed{y_1 = 65}$$

$\therefore$



(d)

For A ——— V_1 ——— C (90,50)

(50,50) $\quad$ (80, y_1)

$\therefore$ AC $\quad m = \frac{y_2 - y_1}{x_2 - x_1} \Rightarrow \frac{50-50}{90-50} \Rightarrow 0.$

$\therefore$ select AV or VC

let VC $\quad m = \frac{y_2 - y_1}{x_2 - x_1} \Rightarrow 0 = \frac{50 - y_1}{90-80} \Rightarrow \boxed{y_1 = 50}$

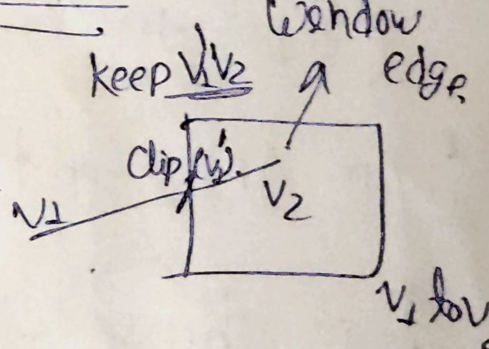
A ——— V_1 ——— C

(80,50)

Cohen - Hodgemen Alg. :-

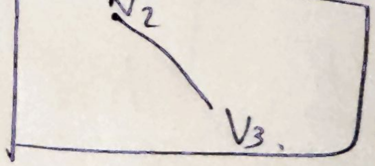
$\Rightarrow$ 4 cases

(a) outside to inside eg.



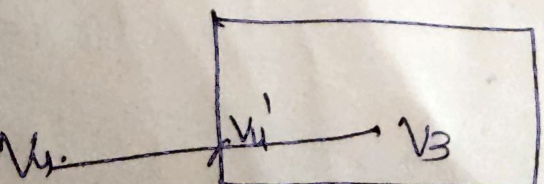
(b) inside to inside

eg.



V_2 to V_3 then keep only V_3

(c) inside-to-outside



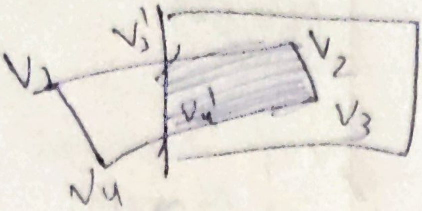
V_3 to V_4

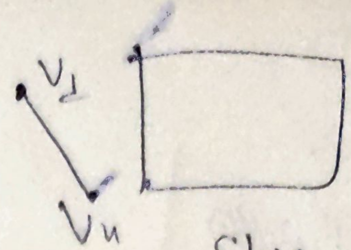
Keep/add V_4' in list

means

keep V_3V_4'

(d) Outside - to - outside





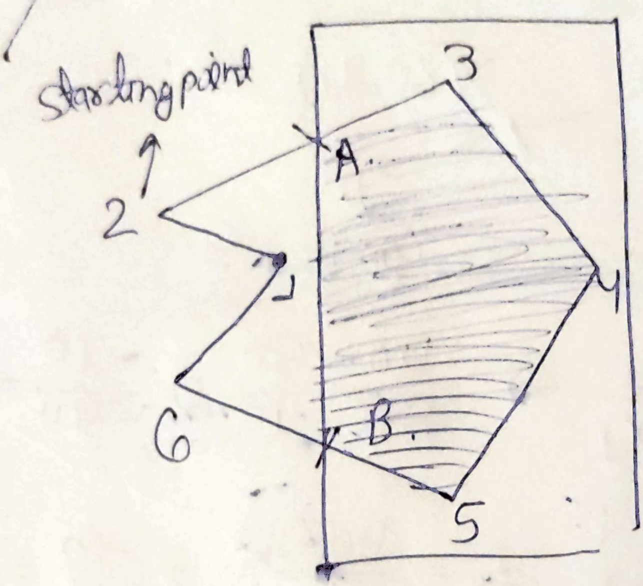
Skip

Ans V_1' V_2 V_3 V_4'

back

eg.

start from left edge always



Stored A 3 4 5 B

back

Date - 13/4/23

Projection :- Process of converting 3-D object to 2-D object.

⇒ Mapping to a view plane.

$X, Y, Z \longrightarrow X, Y$

~~diff type of Projection~~
exam
(Que. Explain with diagram
2-line & diagram.

Types :- ① Parallel
② Perspective.

Projection
- parallel
  - Orthographic
    - Primary
      - Top
      - Side
      - Front
    - Axonometric
      - Isometric
      - bimetric
      - Trimetric
  - oblique
    - caliver
    - Cabinet
- perspective
  - One point
  - 2 point
  - 3 point

① **Parallel** :- $\theta = 90°$

when projection is ~~parallel~~ perpendicular (~~॥~~) ⊥ to view plane.
here object is fixed.

Types of parallel — ~~Primary~~ / Orthographic

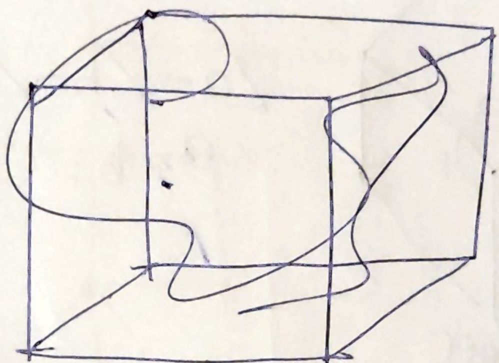
(i) ~~Pr.~~ Orthographic : — Primary,

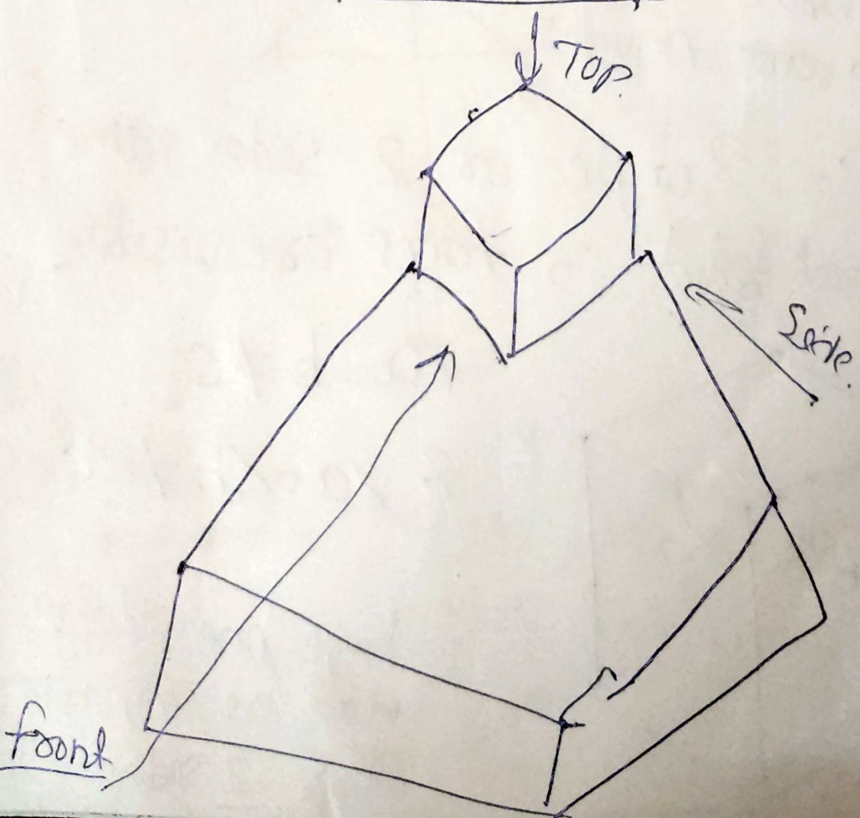
(A) Primary :-

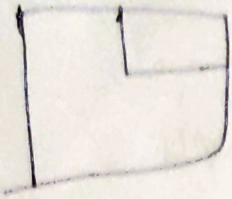
(a) Top

(b) ~~Down~~ Side

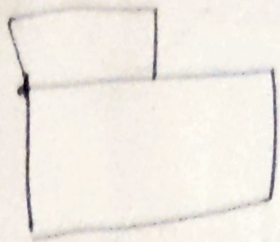
(c) Front.



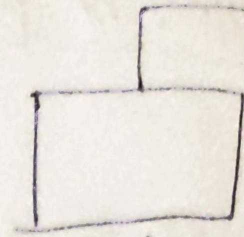




Top view



Front view

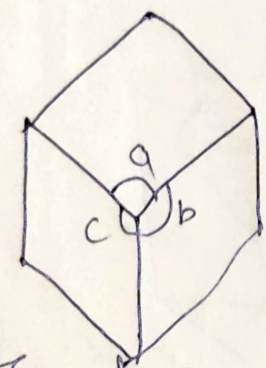


side view.

(B) **Axonometric** → 3 ~~phase~~ faces are visible

(a) Isometric
(b) Bimetric
(c) Trimetric

} more than one phase view

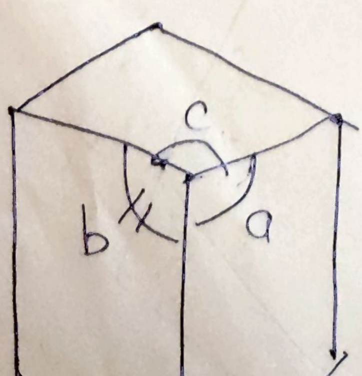


$\angle a = \angle b = \angle c$ means $= 90$.

$a = b = c$

Isometric
all angle are equal.

(b) **Bimetric** :- 2 angle or 2 side same
total 3 faces are visible.



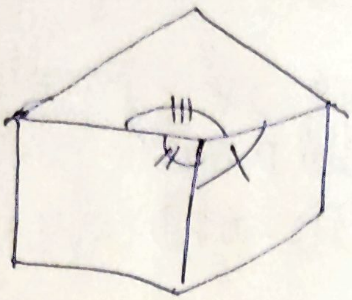
$a = b \neq c$

& $\angle a = \angle b \neq \angle c$

here one side is more as compare to other 2 side.

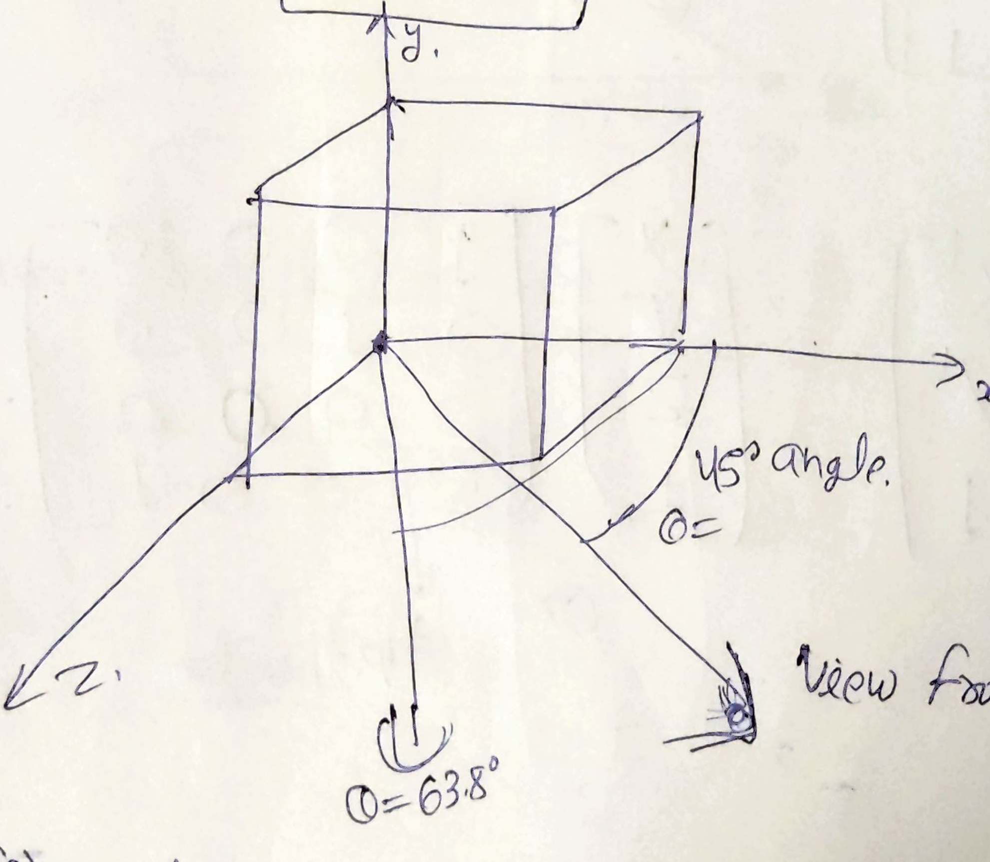
③ Trimetric :- here $a \neq b \neq c$

$\angle a \neq \angle b \neq \angle c$



(ii) 2) Oblique projection :- Viewing angle changes

$\boxed{\theta \neq 90}$



Types

(a) Cavilier :- here $\theta = 45°$

size not change

(b) Cabinet :- $\theta = 63.4°$

length is half

* Diff. b/w cavalier & cabinet

$\theta = 45°$	$\theta = 63.41$
size No change	length is half

Exam → with Diagram

Q. Describe diff. type of parallel projection

~~(2) Perspe~~ Matrix for parallel projection :- 3D → 2D

$$\begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \longrightarrow \begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Or

Skip this line

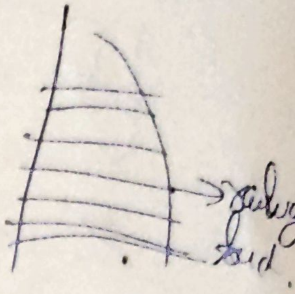
View plane
direction of projection

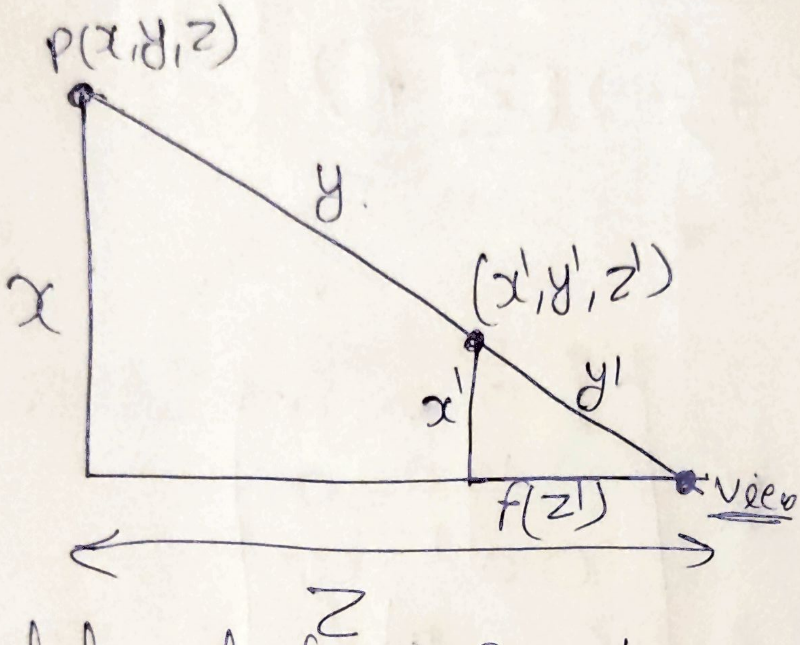
② Perspective Projection :-

View

→ Centre of projection :- No object view only one point

→ Creating realistic image.





<u>Concurrent triangle form</u> $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

$$\therefore \frac{x'}{x} = \frac{y'}{y} = \frac{f}{Z} \rightarrow \text{for size}$$

Formula w.r.t. $\frac{z'f}{Z}$

$$x' = \frac{x.z'}{f}$$

$$y' = \frac{y.z'}{f}$$

$$z = \frac{z.z'}{f} \Rightarrow z.\cancel{\frac{f}{f}} = z$$

Formula w.r.to. $\frac{f}{z}$

$$\boxed{x' = \frac{xf}{z}}$$

$$\boxed{y' = \frac{yf}{z}}$$

$$z' = \frac{zf}{z} \Rightarrow z' = f$$

Matrix:-

$$\begin{pmatrix} x' \\ y' \\ 1 \end{pmatrix} = \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \frac{1}{f} & 1 \end{bmatrix}$$

$$= \begin{pmatrix} x \\ y \\ z \\ \frac{z}{f} \end{pmatrix} \begin{matrix} * f/z \\ * f/z \\ * f/z \\ * \frac{f}{z} \end{matrix} \Rightarrow \begin{pmatrix} \frac{xf}{z} \\ \frac{yf}{z} \\ z \\ 1 \end{pmatrix}$$

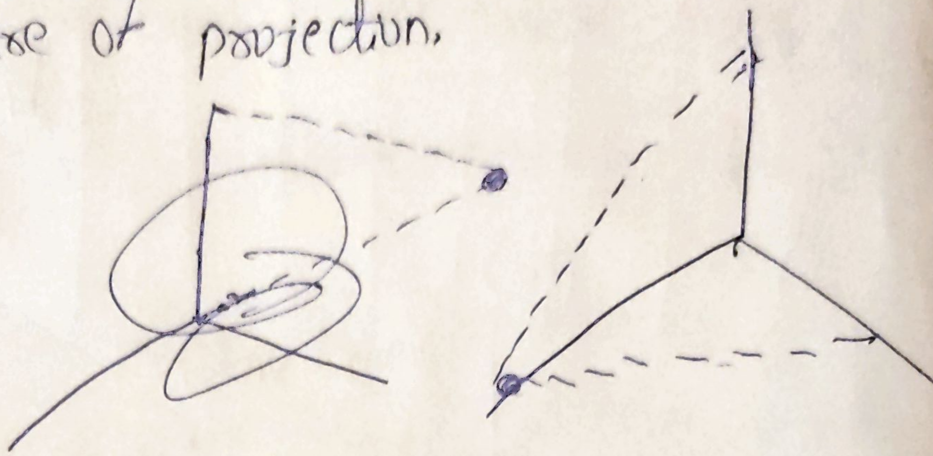
A₃

Que. Write matrix for perspective projection

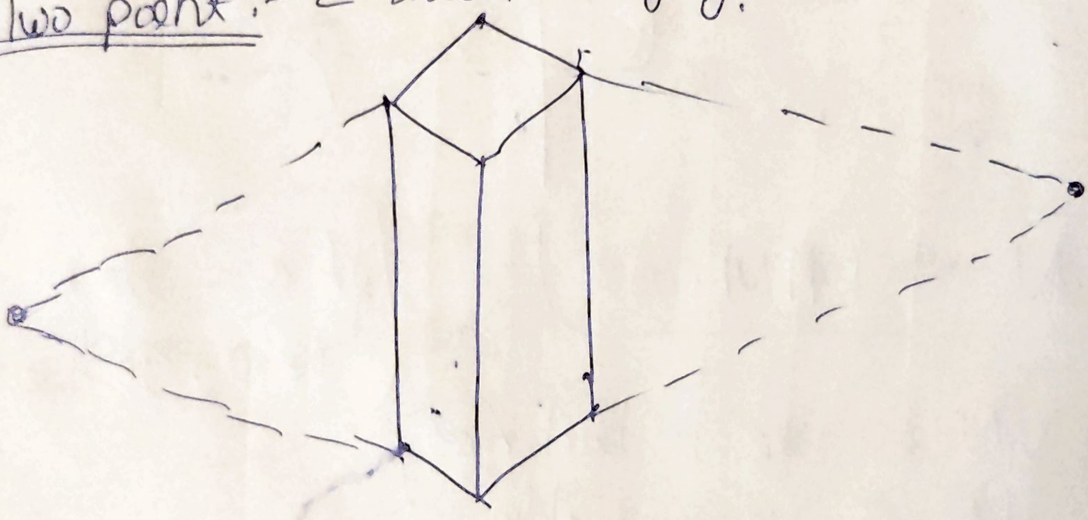
Types:-

(i) **One point:-** (Movement towards centre).

One of the main axis merges with centre of projection.



(ii) **Two point:-** 2 Direction merging.



(iii) **Three point:-** Merging from 3 sides