1: a: In DDA algorithm, there is an extra over head of using roundoff() function. The point generated by this algorithm are not accurate.

c: $P_1(5,3) \rightarrow P_2(12,7)$

x	y	d
5	3	1
6	4	-5
7	4	3
8	5	-3
9	5	5
10	6	-1
11	6	7
12	7	1

$dx = 12-5 = 7$

$dy = 7-3 = 4$

$d = 2dy - dx = 8-7$
$= 1$

$dT = 2(dy-dx) = 2($
$= -6$

$dS = 2dy = 2 \times 4 =$

if, $(d<0)$;
  $d = d + dS$;
else
  $d = d + dT$;
  y++;

2. The steps are to scan convert a line using DDA algorithm :-

Step-1:- Start algorithm.

Step-2: Declare $x_1, y_1, x_2, y_2, dx, y, dx, dy$

Step-3:- Enter the value of x_1, y_1, x_2, y_2 Where; x_1, y_1 are the coordinates of starting point and x_2, y_2 are the coordinates of ending point.

Step-4:- Calculate the value

$$dx = x_2 - x_1$$
$$dy = y_2 - y_1$$

Step-5:- if (abs(dx)) > (abs (dy))

step = abs(dx)

else

step = abs(dy)

Step-6:- X_{inc} = dx/step

Y_{inc} = dy/ step

assign, $x = x_1$

$y = y_1$

Step-7: set pixel(x, y)

Step-8: $x = x + x_{inc}$

$y = y + Y_{inc}$

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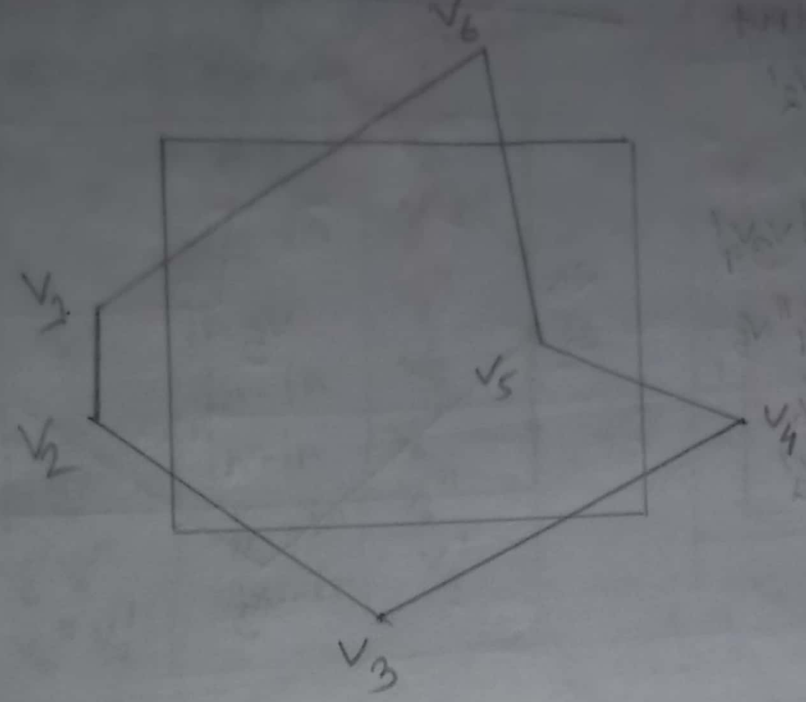
step-9: Repeat step-8 untill $x = x_2$

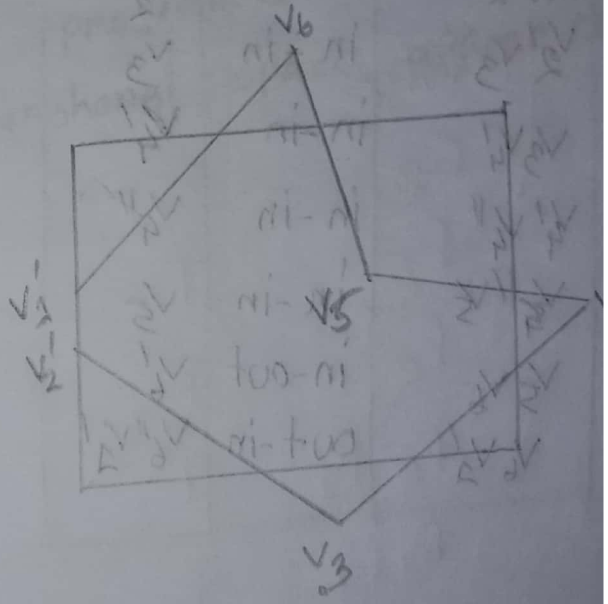
step-10: Stop algorithm.

c:



Left clipping:

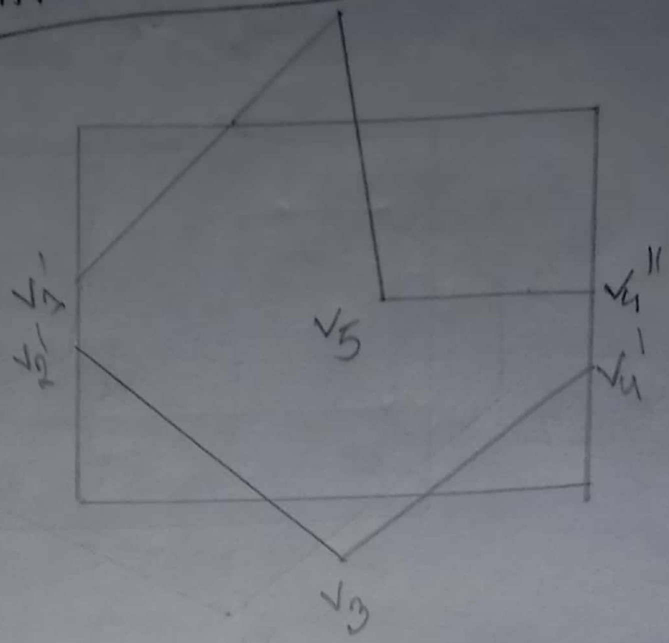
vertex	Case	output
$V_1 - V_2$	out-out	—
$V_2 V_3$	out-in	$V_2' V_3$
$V_3 V_4$	in-in	V_4
$V_4 V_5$	in-in	V_5
$V_5 - V_6$	in-in	V_6
$V_6 - V_1$	out-in	$V_1' V_6$



Right Clipping:

Vertex	Case	output
$V_1' V_2'$	in - in	V_2'
$V_2' V_3$	in - in	V_3
$V_3 V_4$	out - in	$V_3 V_4'$
$V_4 V_5$	out - in ~~in - out~~	$V_4'' V_5$
$V_5 V_6$	in - in	V_6
$V_6 V_1'$	in - in	V_1'

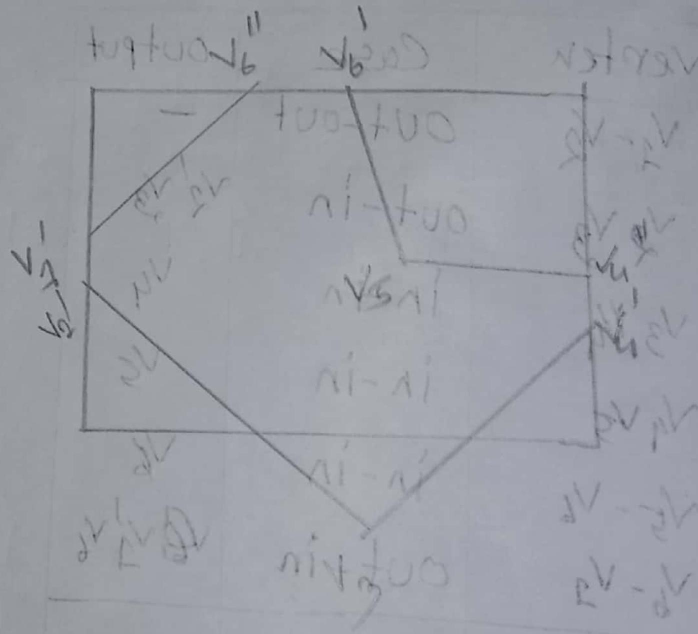
After Clipping:



Top - Clipping:

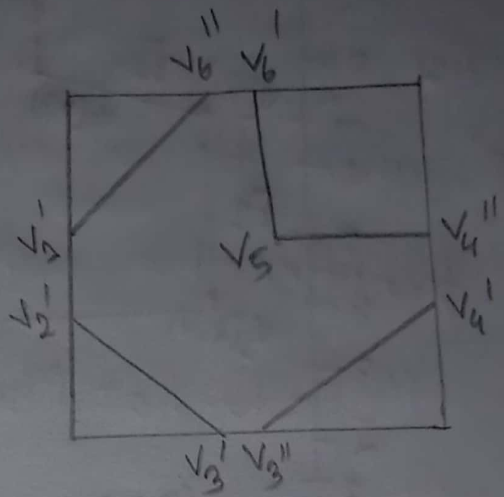
Vertex	Case	output
$V_1' V_2'$	in - in	V_2'
$V_2' V_3$	in - in	V_3
$V_3 V_4'$	in - in	V_4'
$V_4' V_4''$	in - in	V_4''
$V_4'' V_5$	in - in	V_5
$V_5 V_6$	in - out	V_6'
$V_6 V_1'$	out - in	$V_6'' V_1'$

After Clipping:



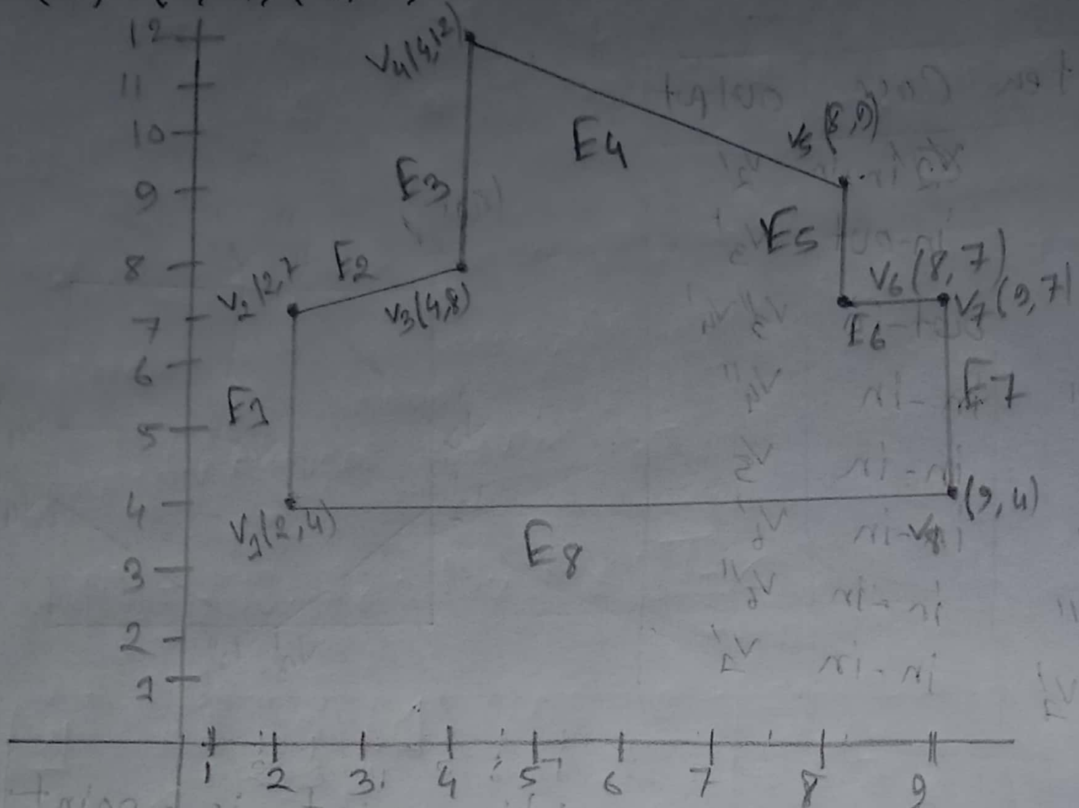
Bottom Clipping:-

vertex	Case	output
$V_1'V_2'$	in-in	V_2'
$V_2'V_3$	in-out	V_3'
V_3V_4'	out-in	$V_3''V_4'$
$V_4'V_4''$	in-in	V_4''
$V_4''V_5$	in-in	V_5
V_5V_6'	in-in	V_6'
$V_6'V_6''$	in-in	V_6''
$V_6''V_1'$	in-in	V_1'



3. a. Vanishing point:- A vanishing point is a point on t
image plane of a perspective rendering where two-dimenshonal perspective projections of mutually parallel lines in three-dimenshonal space appear t
converge.

c) (2,4) (2,7), (4,8), (4,12), (8,9), (8,7), (9,7), (9,4).



Edge	ymin	ymax	x when, y = ymin	1/m
E3	8	12	4	1/m3
E5	7	9-1=8	8	1/m5
E2	7	8-1=7	2	1/m2
~~E6~~ E1	4	7-1=6	2	1/m1
~~E9~~ E7	4	7-1=6	9	1/m7
~~E8~~ E4	9	12	8	1/m4

$y = 5 \rightarrow E_1, E_7,$

$y = 7 \rightarrow E_2, E_5,$

$y = 8 \rightarrow E_2, E_3, E_5$

$y = 9 \rightarrow E_3, E_4$

$y = 11 \rightarrow E_3, E_4.$

— x —

4. b. $\theta = 45^\circ$; $A(0,0), B(1,1), C(5,2)$.

$$R_\theta = \begin{pmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} \cos 45^\circ & -\sin 45^\circ & 0 \\ \sin 45^\circ & \cos 45^\circ & 0 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} \sqrt{2}/2 & -\sqrt{2}/2 & 0 \\ \sqrt{2}/2 & \sqrt{2}/2 & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\therefore R_\theta \cdot (ABC) = \begin{pmatrix} \sqrt{2}/2 & -\sqrt{2}/2 & 0 \\ \sqrt{2}/2 & \sqrt{2}/2 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{array}{c} \begin{array}{ccc} A' & B' & C' \end{array} \\ \begin{pmatrix} 0 & 1 & 5 \\ 0 & 1 & 2 \\ 1 & 1 & 1 \end{pmatrix} \end{array}$$

$$= \begin{pmatrix} 0+0+0 & \sqrt{2}/2 - \sqrt{2}/2 + 0 & 5\sqrt{2}/2 - \sqrt{2} + \\ 0+0+0 & \sqrt{2}/2 + \sqrt{2}/2 + 0 & 5\sqrt{2}/2 + \sqrt{2} + 0 \\ 0+0+1 & 0+0+1 & 0+0+1 \end{pmatrix}$$

$$= \begin{pmatrix} 0 & 0 & 3\sqrt{2}/2 \\ 0 & \sqrt{2} & 7\sqrt{2}/2 \\ 1 & 1 & 1 \end{pmatrix}$$

$A'(0,0)$, $B'(0,\sqrt{2})$, $C'(3\sqrt{2}/2, 7\sqrt{2}/2)$

C.

$$V = \begin{pmatrix} -1 & 0 & 1 & 0 \\ 0 & -2 & 0 & 2 \\ 1 & 1 & 1 & 1 \end{pmatrix}$$

The line $y=2$ has intercept $(0,2)$ and, makes an angle of $0°$ with the x axis, so, with $\theta = 0$, and $V = 2J$.

the transformation matrix is –

$$M_L = T_V \cdot R_\theta \cdot M_x \cdot R_{-\theta} \cdot T_{-V}$$

$$M_L = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & - \\ 0 & 0 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & -2 \\ 0 & 0 & 1 \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 2 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & -2 \\ 0 & 0 & 1 \end{pmatrix}$$

$\boxed{0+2+2}$

$$= \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 4 \\ 0 & 0 & 1 \end{pmatrix}$$

A

5. a. Window to viewport mapping:- The process that converts object in wcs to normalized device coordinate (NDCS) is called window to viewport mapping.

b. The window aspect ration is $a_w = \frac{4}{3}$.

We choose the x extent from 0 to 1 and y extent from 0 to 4/3.

$$\therefore a_v = \frac{1}{3/4} = \frac{4}{3}.$$

$wX_{max} = 4$, $wX_{min} = 0$; $vX_{max} = 1$., $vX_{min} = 0$

$wY_{max} = 3$, $wX_{min} = 0$', $vY_{max} = \frac{3}{4}$, $vY_{min} = 0$

$$N = \begin{pmatrix} \frac{1}{4} & 0 & 0 \\ 0 & \frac{1}{4} & 0 \\ 0 & 0 & 1 \end{pmatrix}$$

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6: $P_1(1,2,0)$, $P_2(2,4,6)$, $P_3(-5,-10,-60)$, $P_4(3,6,20)$

$\mathcal{C}$ — $C(0,0,-10)$.

$\Rightarrow P_0(x_0, y_0, z_0)$, $P_1(x_1, y_1, z_1)$.

$$\overline{P_0P_1} = (x_1 - x_0)\hat{i} + (y_1 - y_0)\hat{j} + (z_1 - z_0)\hat{k}$$

$$x = x_0 + (x_1 - x_0)t$$
$$y = y_0 + (y_1 - y_0)t$$
$$z = z_0 + (z_1 - z_0)t$$

P_1: $x = x_0 + (x_1 - x_0)t$

$= 0 + (1-0)t$

$= t$

$x = t$ or $t = x$ --- (1)

$y = y_0 + (y_1 - y_0)t$

$\Rightarrow y = 0 + (2-0)t$

$\Rightarrow y = 2t$

$z = z_0 + (z_1 - z_0)t$

$= -10 + (0 - \cancel{1}0)t$

$= -10 + 10\cancel{t}t$

CP_2: from equation-1

$x = t$ or $t = x$

$x = 2$ ~~or~~ $t = 2$

$y = 2t$

$= 2 \times 2 = 4$

$z = -10 + 10t$

$= -10 + (10 \times 2)$

$= 10$

~~P_2 lies on the projection line through C and P_1.~~

P_2 is not on the projection line. So, it neither projection ~~line through~~ C and observes nor ~~line through~~ is observes P_1 and P_2.

CP_3: $x = -5$
$t = -5$

$y = 2t$
$= 2 \times (-5)$
$= -10$

$z = -10 + 10t$
$= -10 + 10(-5)$
$= -10 - 50$
$= -60$

P_3 lies onthe projection line throught C and P_3.

CP_4: $x = 3$
$t = 3$

$y = 2t$
$= 2 \times 3$
$= 6$

$z = -10 + 10t$
$= -10 + (10 \times 3)$
$= -10 + 30$
$= 20$

P_4 lies on the projection line through C and P_4.

C occurs on the line at $t = 0$

P_1 occurs at $t = 1$

P_3 occurs at $t = -5$

P_4 occurs at $t = 3$

Thus compairing t values P_3 is in the front of P_1 and P_4 with respect to C. Hence, P_3 obscures P_1 and P_4.