

Roll No.

--	--	--	--	--	--	--	--

KONGU ENGINEERING COLLEGE, PERUNDURAI 638 060
 EVEN SEMESTER 2018-2019
 CONTINUOUS ASSESSMENT TEST I – FEBRUARY 2019
 (Regulations 2014)

Programme : BE	Date : 20.02.2019
Branch : CSE	Time : 9.00 am – 10.30 am
Semester : VI	
Course Code : 14CSC61	Duration : 1 ½ Hours
Course Name : Graphics and Multimedia	Max. Marks : 50

PART - A ($10 \times 2 = 20$ Marks)

ANSWER ALL THE QUESTIONS

1. Identify the applications of computer graphics. CO1 K1
2. Differentiate between bit map and pixel map CO1 K2
3. Name any four interactive input devices. CO1 K1
4. Determine how many intermediate points will be calculate to draw a line with the end points (1,2) (3,4) using DDA. CO1 K3
5. State the purpose of set interiorcolourindex (fc) and setinteriorstyle(fs). CO1 K2
6. Compare aliasing and ant aliasing methods. CO1 K2
7. Apply shearing operation to the following coordinators(0,0) (1,0) (0,1) and (1,1) with shearing parameter values of $\frac{1}{2}$ relative to the line $Y_{ref} = 1$ CO2 K3
8. Give an example to show reflection of an object about Y-axis. Draw the object. CO2 K3
9. Define Traversal. CO2 K1
10. Show the methods used for editing the structure. CO2 K2

Part – B ($3 \times 10 = 30$ Marks)

ANSWER ALL THE QUESTIONS

11. a) i) Draw the line with and points (0,0) and (4,6) using Bresenhem's line drawing algorithm. (6) CO1 K3
 ii) Recall the various methods used in text attribute. (4) CO1 K1
 (OR)
- b) i) Determine the intermediate points to draw the line with end points(1,2) and (5,7) using DDA line drawing algorithm. (6) CO1 K3
 ii) State the working principle of CRT with neat diagram. (4) CO1 K1
12. a) Make use of the midpoint method to derive decision parameter for generating points along circle. Compute the pixel location in the first octant with the centre(4,5) and r=4. (10) CO1 K3
 (OR)
- b) Given an ellipse of major axis and minor axis $r_y=8$, $r_x=10$. Write and demonstrate the midpoint ellipse algorithm by determining the raster positions along the ellipse path. (10) CO1 K3
13. a) Illustrate the basic concept of 2D- geometrical transformations with an example. (10) CO2 K2
 (OR)
- b) Discuss the working of 2D scaling with respect to origin and with respect to fixed(pivot) point with suitable example. (10) CO2 K2

Bloom's Taxonomy Level	Remembering (K1)	Understanding (K2)	Applying (K3)	Analysing (K4)	Evaluating (K5)	Creating (K6)
Percentage	18	35	47	-	-	-

DEPT. OF COMPUTER SCIENCE & ENGG.
KONGU ENGINEERING COLLEGE,
THOOPUPALAYAM (PO)
PERUNDURAI (TK) - 638 060.

Pr *Dam*
Name and signature of Hall Supdt. with Date



KONGU ENGINEERING COLLEGE

PERUNDURAI ERODE - 638 060.
(Autonomous)



Name of the Student	SINDHUJA P	Register No.	1 6 C S R 1 9 2
Programme	B.E	Branch & Semester	CSE - VI
Course Code and Name	14CSC61- Graphics and Multimedia	Date	20.02.19

MARKS TO BE FILLED IN BY THE EXAMINER

PART - A		PART - B		Grand Total Max. Marks : 50
Question No.	Max Marks : 2	Question No.	Max Marks : 10	
1	2	11	i) 5	
2	2	11	ii) 4	
3	2	12	i) 7	
4	2	12	ii)	
5	2	13	i) 9	
6	0	13	ii)	
7	2	14	i)	
8	2	14	ii)	
9	0			
10	0			
TOTAL	14	TOTAL	25	29/50

Total marks in words : Seven Eight

INSTRUCTION TO THE CANDIDATE

- Check the Question Paper, Programme, Course Code, Branch Name etc., before answering the questions.
- Use both sides of the paper for answering questions.
- POSSESSION OF ANY INCRIMINATING MATERIAL AND MALPRACTICE OF ANY NATURE IS PUNISHABLE AS PER RULES.

R. NAVAJA *0000*
Name of the Examiner

Notka
Signature of the Examiner
with Date

PART-A.

1. Identify the applications of computer graphics.

Applications of computer graphics are

- i) User Interface
- ii) Automation
- iii) Medical Field
- iv) Design of Robots and Machinery
- v) Education.

2. Differentiate between Bitmap and pixel map.

Bitmap

Pixel Map.

In a black and white image processing, the pixel points will be either ON or OFF. So, it need one bit per pixel. It is called Bitmap.

In a image has and intensity, the points are plotted are multiple bits per pixel. It is called pixelmap.

3. Name any four interactive input devices.

The interactive input devices are

1. Keyboard
2. Mouse
3. Display Buffer
4. CPU.
5. I/O port.

4. Determine how many intermediate points will be calculated to draw a line with the end points (1, 2) (3, 4) using DDA.

$$x_1 = 1, \quad x_2 = 3$$

$$y_1 = 2, \quad y_2 = 4$$

$$\Delta x = x_2 - x_1 = 3 - 1 = 2$$

$$\Delta y = y_2 - y_1 = 4 - 2 = 2$$

\therefore steps = 2, \therefore Two intermediate points are calculated using the endpoints (1, 2) & (3, 4).

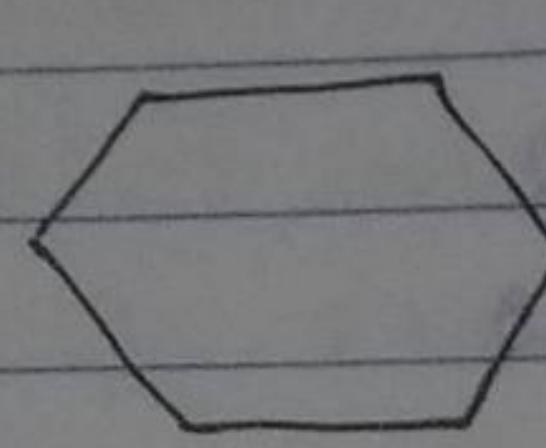
The points are (1, 2), (2, 3) & (3, 4)

5. State the purpose of setinteriorcolorindex (fc) and setinteriorstyle (fs).

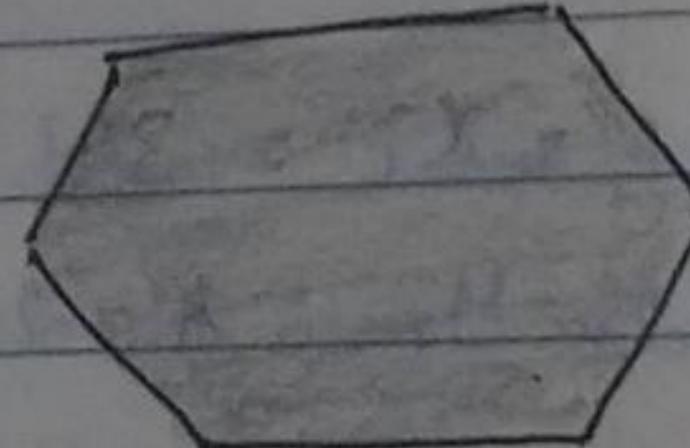
setinteriorstyle (fs) - provides the style of the interior design of the given shape.

fs - denotes the style - hollow, solid, pattern or crossed line.

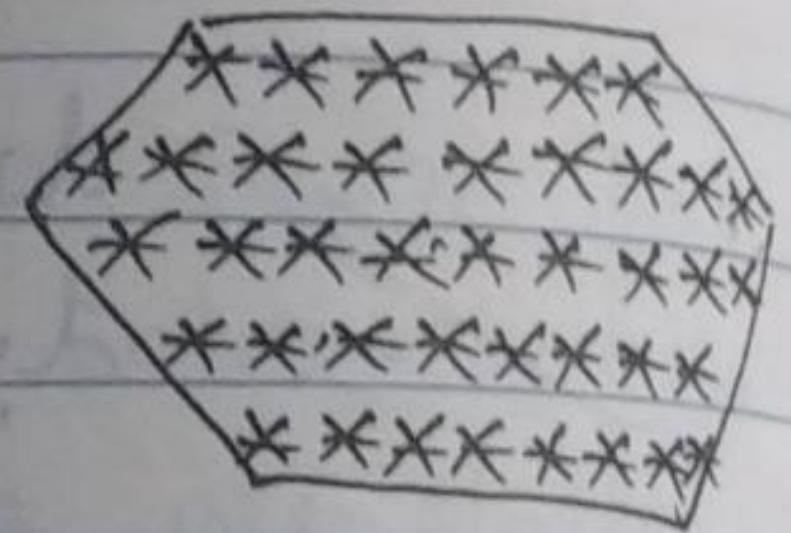
setinteriorcolorindex (fc) - Gives the colour for the interior design. fc - is the colour index.



hollow

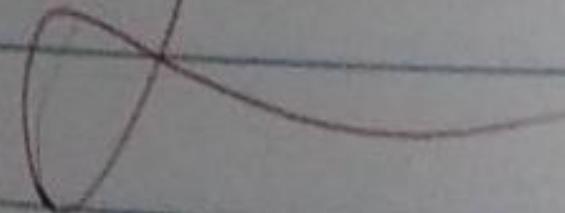


solid



pattern

6. Compare aliasing and ant aliasing methods.



7. Apply shearing operation to the following coordinates $(0,0)$, $(1,0)$, $(0,1)$ and $(1,1)$ with $sh_x = \frac{1}{2}$ relative to the line $y_{ref} = -1$.

$$\text{Shearing} = \begin{bmatrix} 1 & sh_x & -sh_x \cdot y_{ref} \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

coordinates:

$(0,0)$

$$\text{Shearing} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & \frac{1}{2} & \frac{1}{2} \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} \frac{1}{2} \\ 0 \\ 1 \end{bmatrix}$$

$(1,0)$

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & \frac{1}{2} & \frac{1}{2} \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} \frac{3}{2} \\ 0 \\ 1 \end{bmatrix}$$

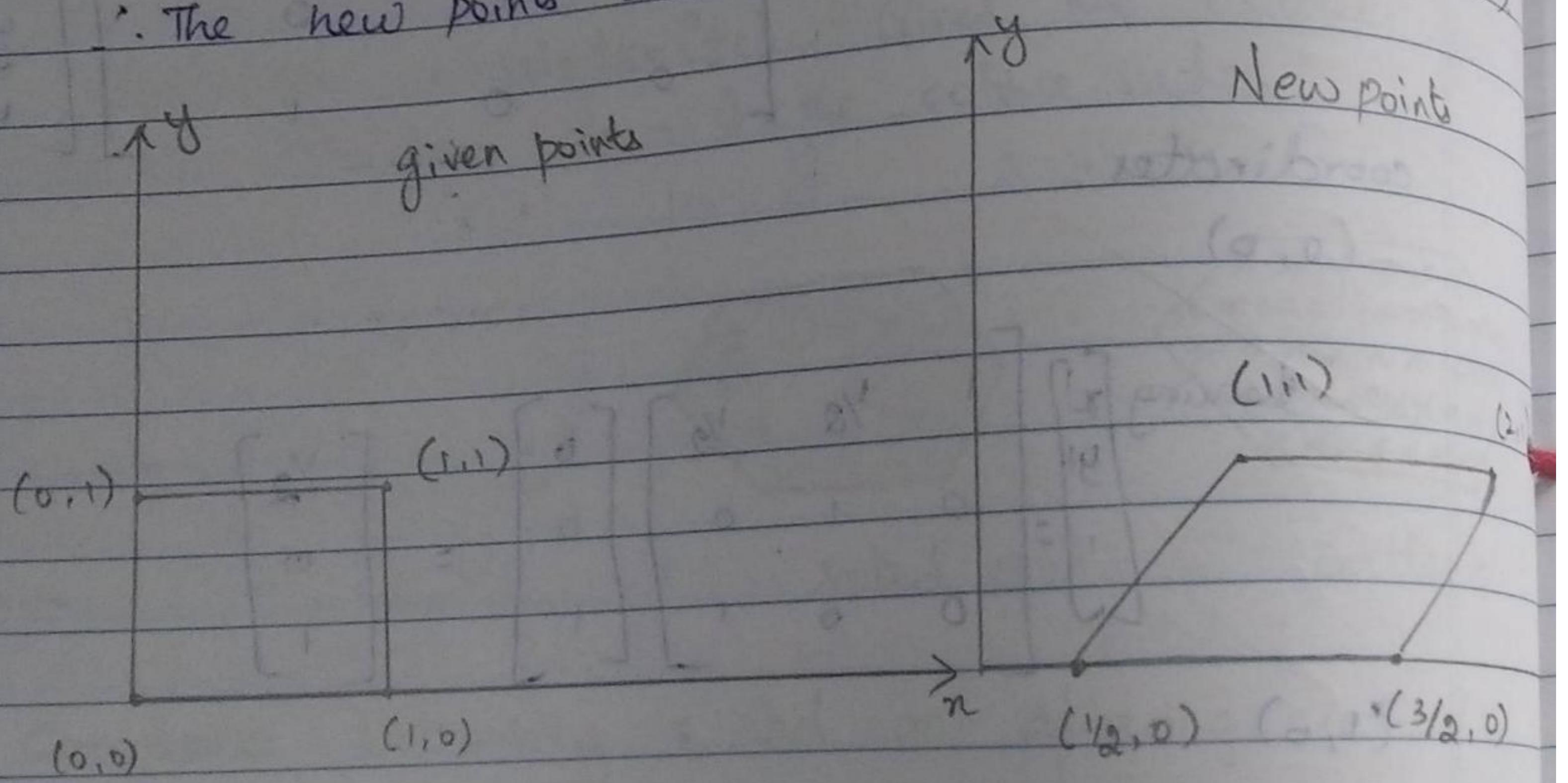
(0,1)

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

(1,1)

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

∴ The new points are $(\frac{1}{2}, 0), (\frac{3}{2}, 0), (1, 1), (2, 1)$

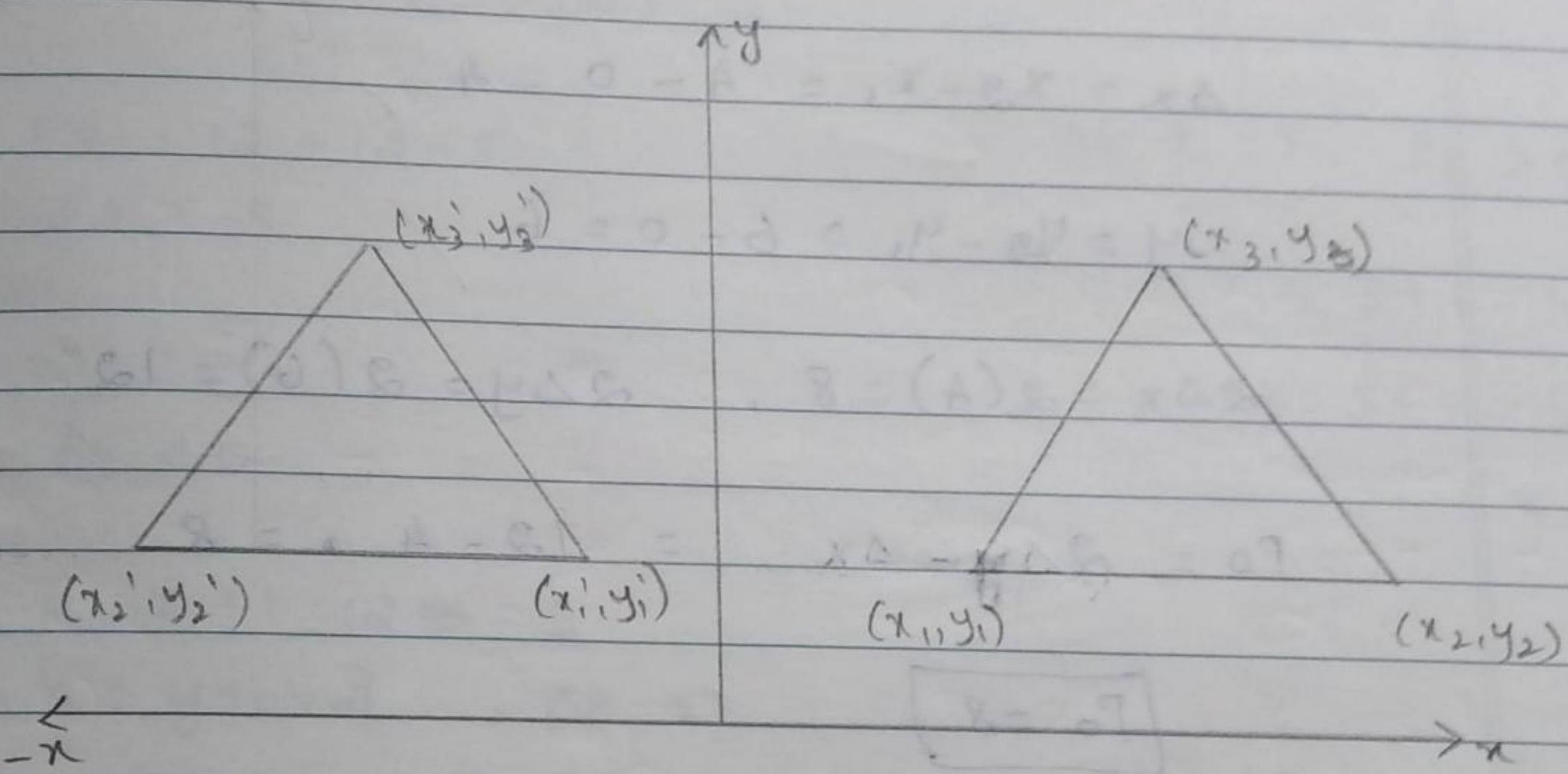


10. Show the methods used for editing the structure.

8. Give an example to show reflection of an object about y-axis. Draw the object.

In y-axis reflection, $y' = y$

$$x' = -x$$



Reflection \Rightarrow

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

9. Define Traversal.

Traversal is the movement of an object from one location to another by using some algorithm.

PART-B

11. a) i) Draw the line with end points $(0, 0)$ and $(4, 6)$ using Bresenham's line drawing algorithm.

$$(x_1, y_1) = (0, 0) \text{ and } (x_2, y_2) = (4, 6)$$

$$\Delta x = x_2 - x_1 = 4 - 0 = 4$$

$$\Delta y = y_2 - y_1 = 6 - 0 = 6$$

$$2\Delta x = 2(4) = 8, \quad 2\Delta y = 2(6) = 12.$$

$$P_0 = 2\Delta y - \Delta x = 12 - 4 = 8$$

$$\boxed{P_0 = 8}$$

$$\Delta y > \Delta x \Rightarrow 6 \text{ steps.}$$

At $k=0$,

$$P_0 > 0, \quad 8 > 0,$$

then

$$x_+ = x + 1$$

$$x_+ = 1, \quad y_+ = y + 1$$

$$y_+ = 0 + 1$$

$$y_+ = 1$$

$$\text{points: } (1, 1)$$

$\text{if } (P_k < 0)$
 $P_{k+1} = P_k + 2\Delta y$
 else
 $P_{k+1} = P_k + 2\Delta y - 2\Delta x$

At $k=4$,

$$P_1 = 8 + 12 - 8$$

$$P_1 = 12$$

$$P_4 \geq 0,$$

$$x = x = 2 + 1 = 3$$

$$y = 4 + 1 = 5$$

$$(3, 5)$$

At $k=1$,

$$P_1 > 0,$$

$$x = 1 + 1 = 2$$

$$y = 1 + 1 = 2 \quad (2, 2)$$

$$P_5 = 0 + 12 - 8$$

$$P_5 = 4$$

$$P_2 = 12 + 12 - 8$$

$$P_2 = -8$$

At $k=5$, $P_k > 0$,

$$x = 3 + 1 = 4$$

$$y = 5 + 1 = 6$$

$$(4, 6)$$

$$x = x + 1 = 2 + 1 = 3$$

$$y = y + 1 = 2 \quad (2, 3)$$

$$P_3 =$$

$$P_3 = -8 + 12 - 8 = -16 + 12$$

$$P_3 = -4$$

At $k=3$,

$$P_3 < 0$$

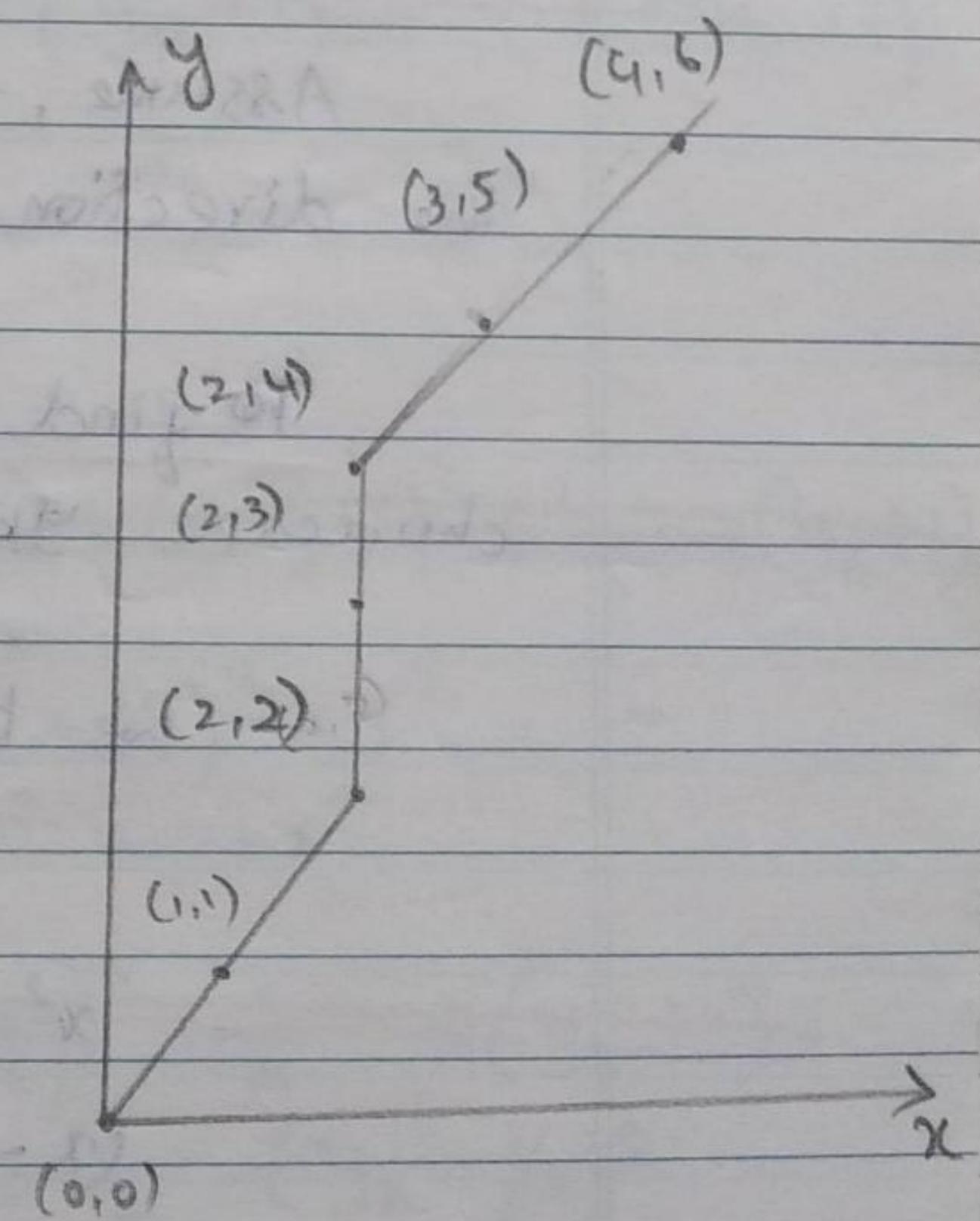
$$x = 2 + 1 = 3$$

$$y = 3 + 1 = 4$$

$$(3, 4)$$

$$P_4 = -4 + 12 - 8$$

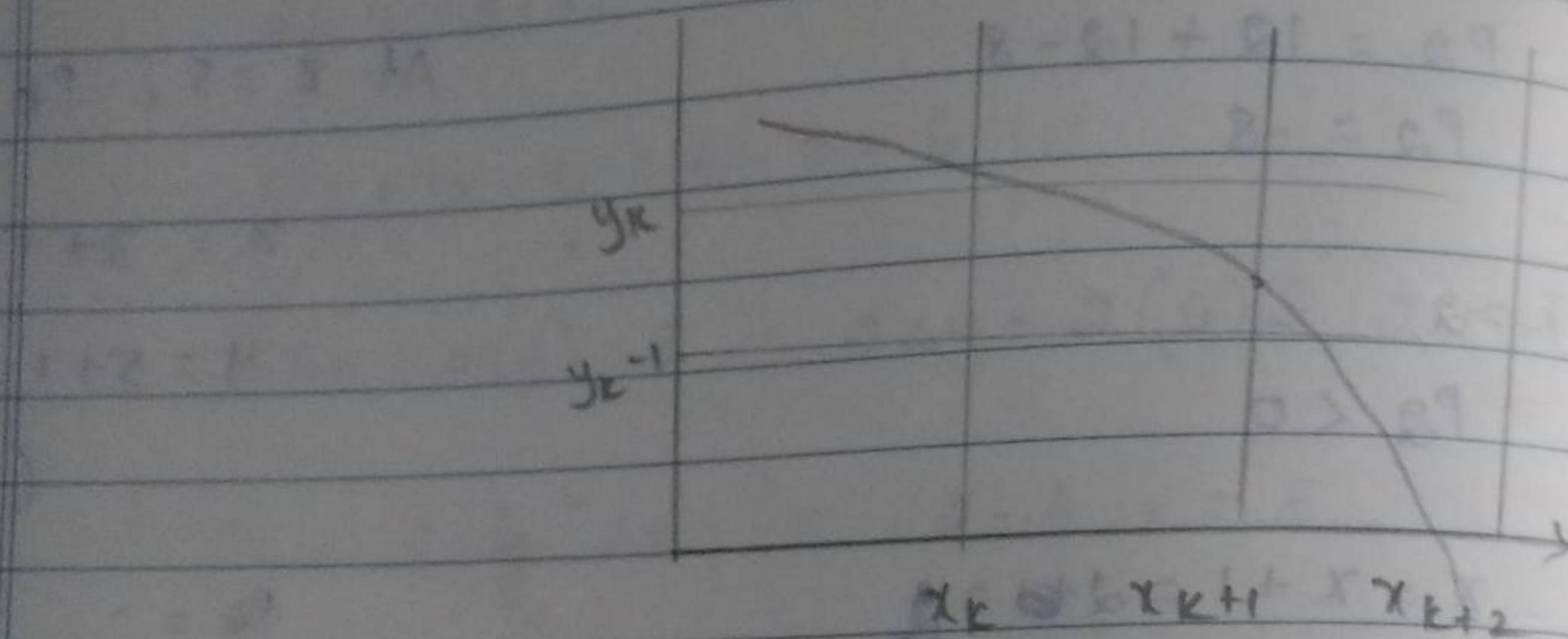
$$P_4 = -12 + 12 = 0$$



PART - B

12. a) Make use of the midpoint method to derive decision parameter for generating points along circle. Consider a circle with centre $(4, 5)$ and $r=4$.

i) compute the radius r .



Assume, we have the points x_{lc}, y_k and move in the direction of x .

To find the points of y at x_{lc+1} , we have two choices y_k or y_{k-1} .

We know that

$$f(x, y) = x^2 + y^2 - r^2$$

$$x^2 + y^2 = r^2 \quad (\text{At origin})$$

$$(x - x_c)^2 + (y - y_c)^2 = r^2 \quad (\text{At some point})$$

$$\text{Midpoint} = \frac{y_k + y_{k-1}}{2}$$

$$= \frac{2y_k - 1}{2}$$

$$\text{Midpoints} = y_k - \frac{1}{2}$$

The points are $(x_{k+1}, y_k - \frac{1}{2})$.

$$P_k = f(x, y) = x^2 + y^2 - r^2$$

$$P_k = (x_{k+1})^2 + (y_k - \frac{1}{2})^2 - r^2$$

$$P_{k+1} = (x_{k+1} + 1)^2 + (y_{k+1} - \frac{1}{2})^2 - r^2$$

$$= ((x_{k+1}) + 1)^2 + ((y_{k+1}) - \frac{1}{2})^2 - r^2$$

$$P_{k+1} = (x_{k+1})^2 + 1 + 2(x_{k+1}) + (y_{k+1})^2 + \frac{1}{4} - 2(y_{k+1})$$

$$((y_{k+1}) - \frac{1}{2})^2 - r^2$$

$$P_{k+1} - P_k = (x_{k+1})^2 + 1 + 2(x_{k+1}) + (y_{k+1})^2 + \frac{1}{4} - 2(y_{k+1})$$

$$+ ((y_{k+1}) - \frac{1}{2})^2 - r^2 - (x_{k+1})^2 - (y_k - \frac{1}{2})^2 + r^2$$

$$P_{k+1} - P_k = 1 + 2(x_{k+1}) + (y_{k+1})^2 + \frac{1}{4} - 2(y_{k+1}) -$$

$$+ ((y_{k+1}) - \frac{1}{2})^2 - (y_k - \frac{1}{2})^2$$

If $P_k = 0$, it lies on the circumference of the circle, then $y_{k+1} = y_k$

If $P_k < 0$, it lies inside the circle, then $y_{k+1} = y_k + \frac{1}{2}$

If $P_k > 0$, it lies outside the circle, then $y_{k+1} = y_k - \frac{1}{2}$

$$P_{k+1} - P_k = 1 + 2x_{k+1} + y_{k+1}^2 - y_k^2 - 2y_k - 1$$

$$= ((y_k + \frac{1}{2})^2 - y_k^2) - 2y_k - 1$$

If $P_k < 0$, then $y_{k+1} = y_k + \frac{1}{2}$

$$\begin{aligned} P_{k+1} &= P_k + 1 + 2x_{k+1} + y_{k+1}^2 - y_k^2 - 2y_k - 1 \\ &= P_k + 1 + 2x_{k+1} + y_k^2 + \frac{1}{4} - 2y_k - y_k^2 - 1 \end{aligned}$$

$$P_{k+1} = P_k + 1 + 2x_{k+1}$$

$$P_{k+1} = P_k + 1 + 2(x_k + 1)$$

If $P_k > 0$, then $y_{k+1} = y_k - \frac{1}{2}$

$$P_{k+1} = P_k + 1 + 2x_{k+1} + y_{k+1}^2 - y_k^2 - 2(y_k - \frac{1}{2})$$

$$+ ((y_k - \frac{1}{2})^2 - (y_k - \frac{1}{2})^2)$$

$$= P_k + 1 + 2(x_{k+1}) + y_{k+1}^2 + 1 - 2y_k + \frac{1}{4} - 2y_k + 2$$

$$- y_k^2 - \frac{1}{4} + y_k$$

$$= P_k + 1 + 2(x_{k+1}) + (y_{k+1})^2 + \frac{1}{4} - (y_{k+1})$$

$$- (y_k - 1/2)^2$$

$$= P_k + 1 + 2(x_{k+1}) + y_{k+1}^2 + 1 - 2y_k + 1/4 - y_{k+1}$$

$$- y_k^2 - \frac{1}{4} + y_k$$

$$= P_k + 1 + 2(x_{k+1}) - 2y_k + 2$$

$$P_{k+1} = P_k + 1 + 2(x_{k+1}) - 2(y_{k+1})$$

Then

$$P_0 = P_k + 1 + 2x_0 + (y_0 - 1/2)^2 - (y_0 - 1/2)^2 \quad (x_0, y_0) = (0, 1)$$

$$= 1 + 2x_0 +$$

$$P_0 = (x_0 + 1)^2 + (y_0 - 1/2)^2 - r^2$$

$$= x_0 + 1 + 2x_0 + y_0^2 + \frac{1}{4} - y_0 - r^2$$

$$= 0 + 1 + 0 + \cancel{x^2} + \frac{1}{4} - \cancel{y^2} - \cancel{r^2}$$

$$= 1 + \frac{1}{k} - r$$

$$P_0 = \frac{5}{4} - r$$

centre $(4, 5)$ and $r = 4$, $b = 1 + k = -$

$$(0, r) = (0, 4) - 1 -$$

$$k = 0, b = 1 + k = 1 + 0 = 1 + 1 = 2$$

$$P_0 = 1 - r = 1 - 2 = 3$$

$$P_0 > 0,$$

$$x = x + 1 = 0 + 1 = 1 + 1 = 2 + 1 = 3$$

$$y = 4 - 1 = 3$$

$$\rightarrow P_1 = 3 + 1 + 2(1) - 2(3)$$

$$P_1 = 6 - 6 = 0$$

$$k = 1$$

$$P_1 > 0,$$

$$x = x + 1 = 2$$

$$y = 4 - 1 = 3$$

$$P_2 = 6 + 1 + 4$$

$$P_2 = 11$$

13. a) 2-D geometrical transformation.

Transformation:

changing the size, shape and location of an object.

1. Translation

2. Rotation

3. Shearing

4. Scaling

5. Reflection.

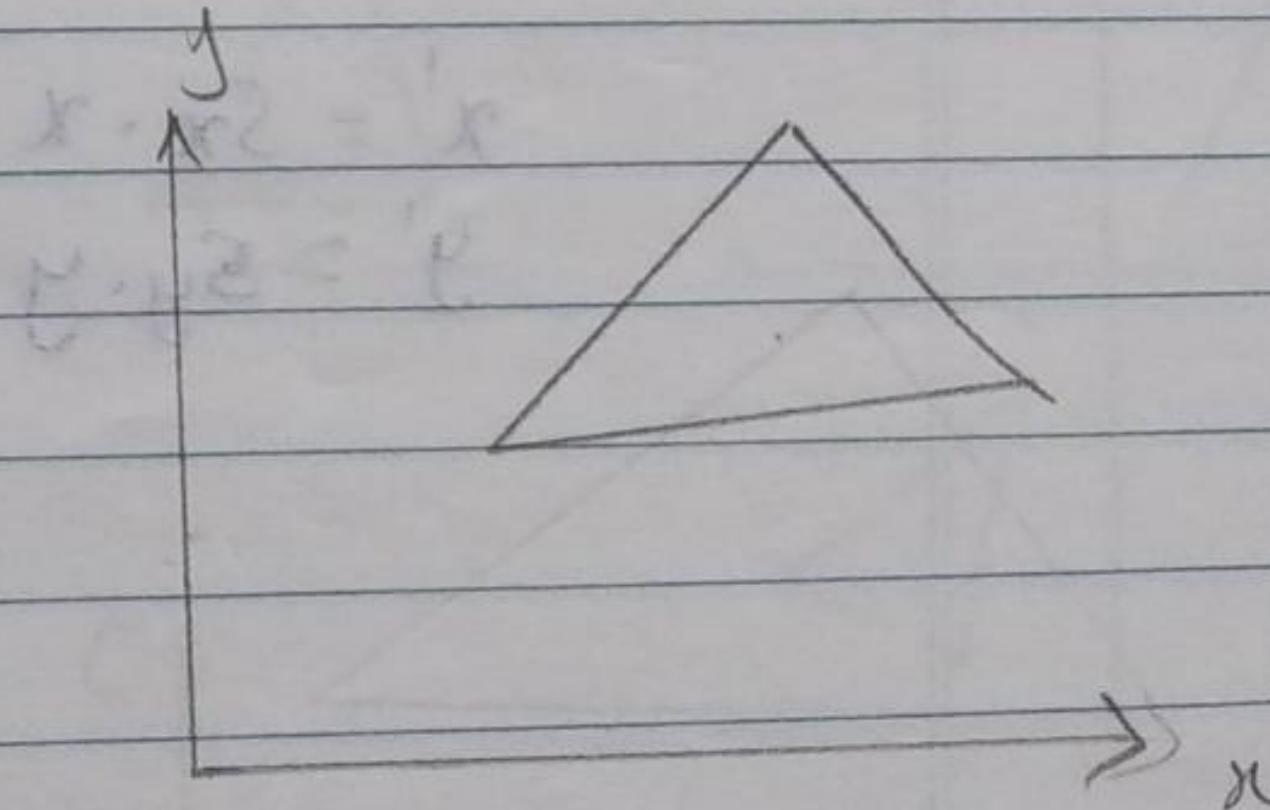
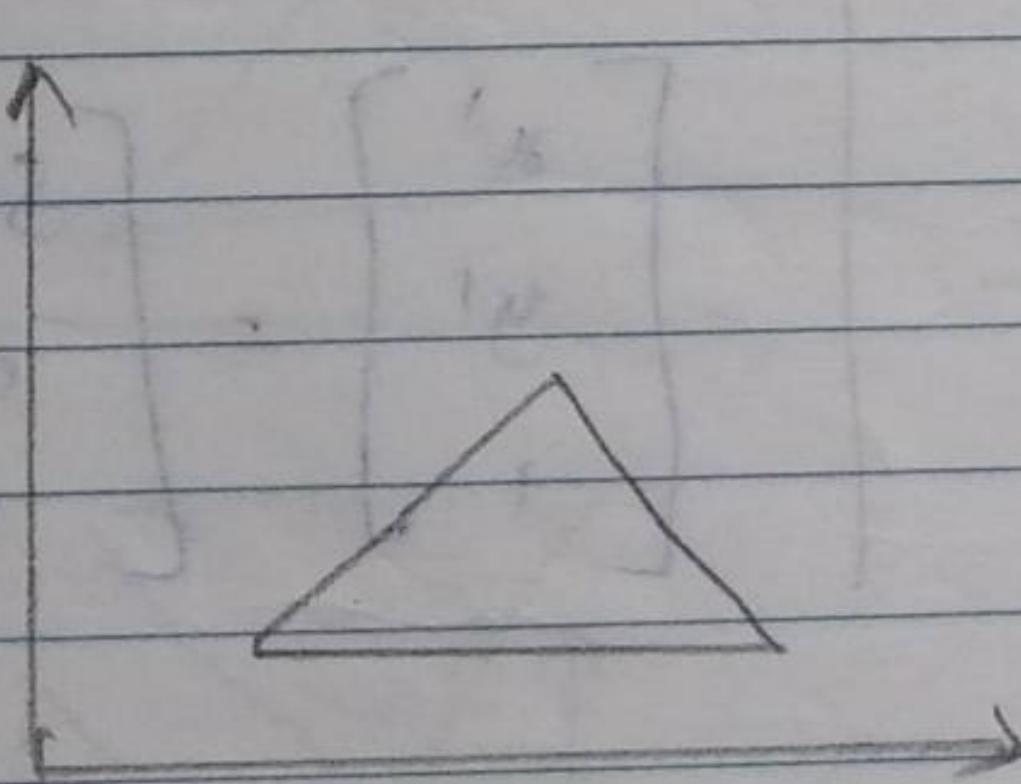
1. Translation:

Homogeneous

$$P' = P + t$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} x + tx \\ y + ty \end{bmatrix}$$

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



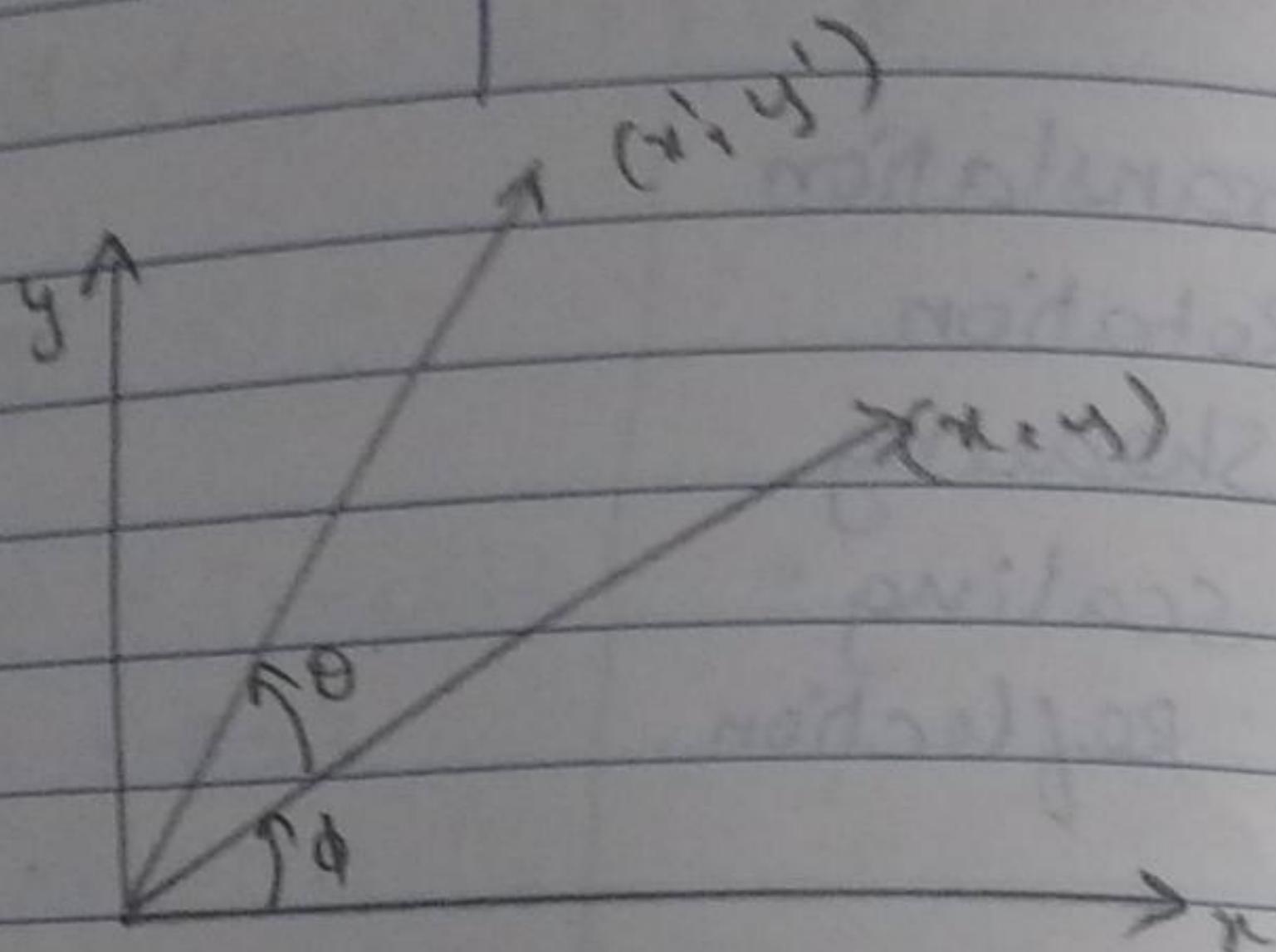
Rotation:

$$P' = R(\theta) \cdot P$$

$$x' = x \cos \theta - y \sin \theta$$

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

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



Scaling:

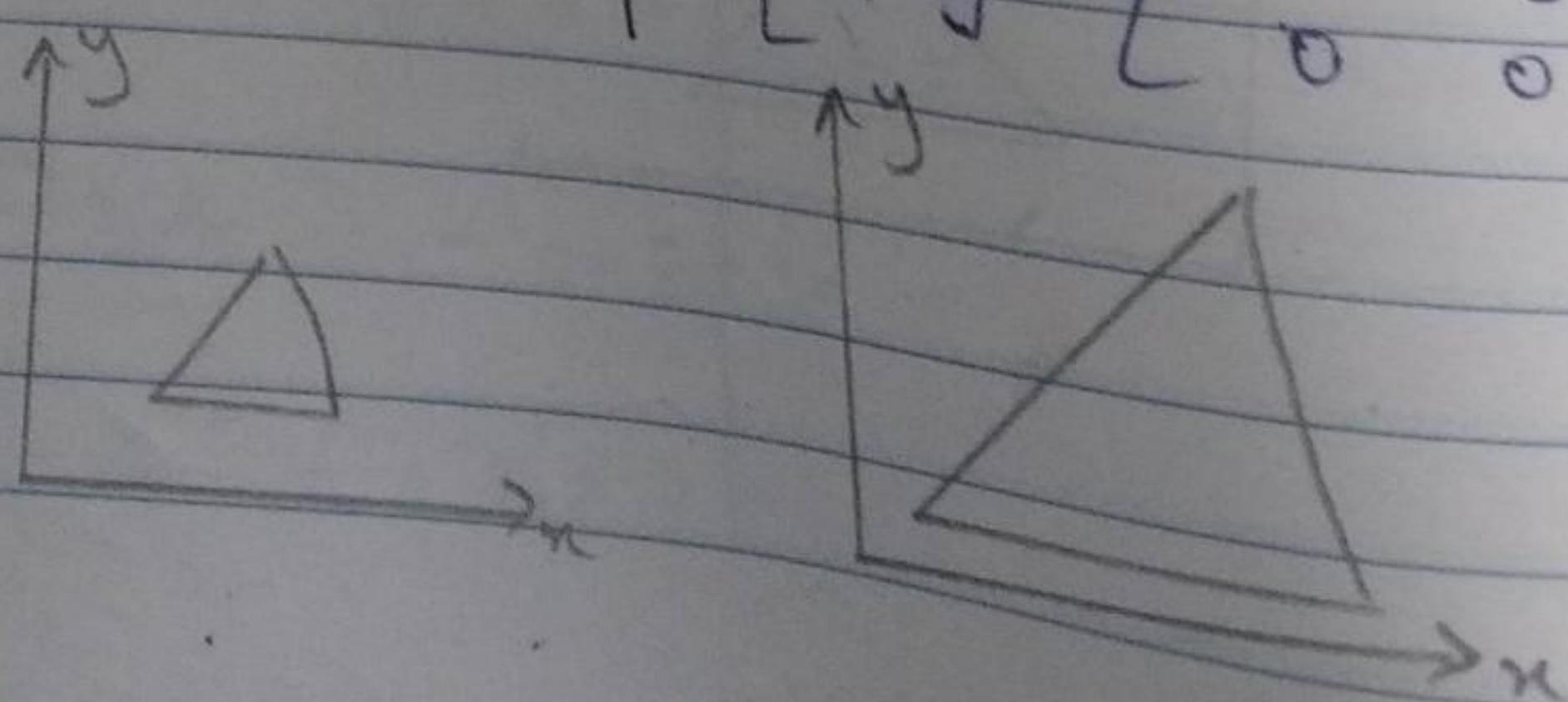
- 1. Uniform Scaling - x & y axis change in same value.
- 2. Different scaling - x & y axis change in different values.

change in size.

$$x' = S_x \cdot x$$

$$y' = S_y \cdot y$$

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



shearing:

with respect to x-axis

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

with respect to y-axis

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

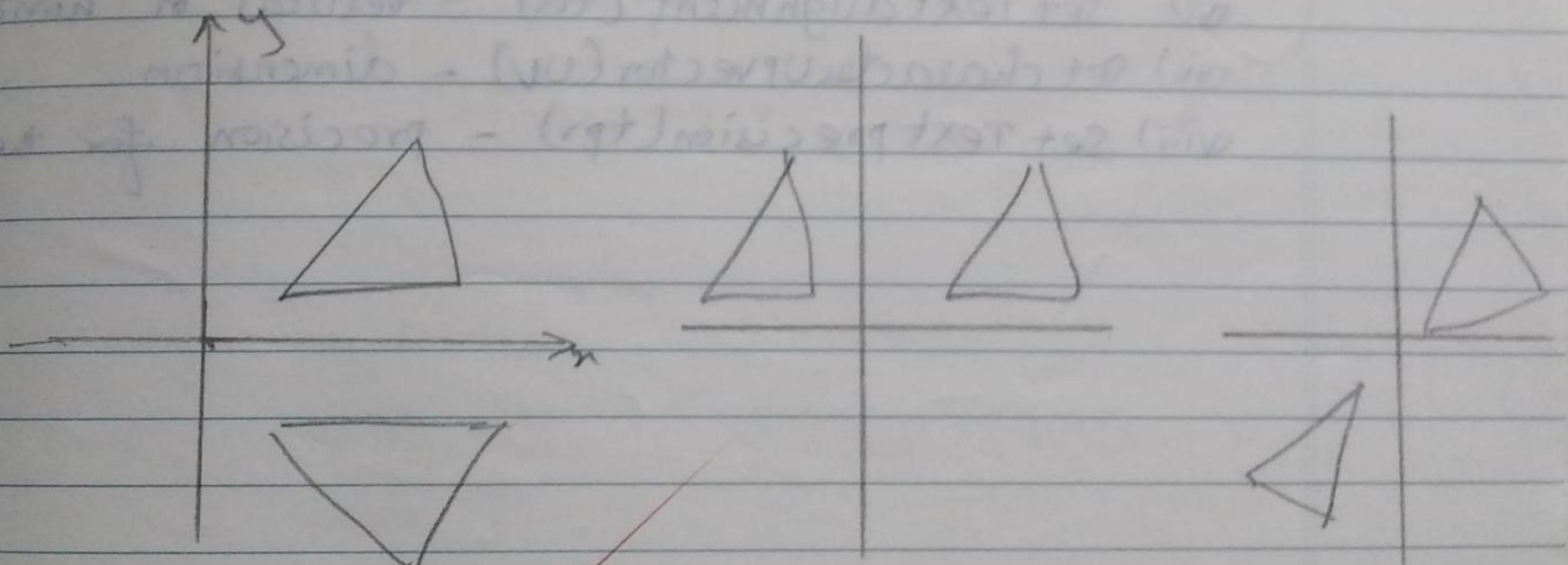
with respect to x-point

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & \text{shx} & -\text{shx} \cdot y_{ref} \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

with respect to y-point

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ \text{shy} & 1 & -\text{shy} \cdot x_{ref} \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

Reflection:



$$x' = x$$

$$y' = -y$$

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

$$x' = -x$$

$$y' = y$$

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

$$x' = -x$$

$$y' = -y$$

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

- ii. a) iii) Recall the various methods used in `Text` attribute.
- i) `setTextFont(tf)` → define the font
 - ii) `setTextColorIndex(cl)` - color for the font
 - iii) `setCharacterHeight(ch)` - size of character
 - iv) `setCharacterExpansionFactor(Ef)` - character expansion
 - v) `setTextPath(p)` → left, right, up or down
 - vi) `setTextAlignment(ta)` - vertical or horizontal
 - vii) `setCharacterUpvector(uv)` - dimension
 - viii) `setTextPrecision(tp)` - precision for the text

DEPT. OF COMPUTER SCIENCE & ENGG.
KONGU ENGINEERING COLLEGE,
THOIPPUPALAYAM (PO)
PERUNDURAI (TK), ERODE - 638 060



KONGU ENGINEERING COLLEGE

PERUNDURAI ERODE - 638 060.
(Autonomous)



P.J
Name and signature of Hall Supdt. with Date

Name of the Student	R.M. SREENITHI	Register No.	1 6 C 8 R 2 D 0
Programme	B.E	Branch & Semester	CSE - VI
Course Code and Name	14CSCB1 - GRAPHICS AND MULTIMEDIA	Date	20.2.19
		No. of Pages Used	6

MARKS TO BE FILLED IN BY THE EXAMINER

PART - A		PART - B		Grand Total Max. Marks : 50
Question No.	Max Marks : 2	Question No.	Max Marks : 10	
1	✓	11	i) 2	
2	✓	ii) 1		
3	✓	12	i) 6	
4	0	ii) 1		
5	✓	13	i) 9	
6	-	ii) 1		
7	-	14	i) 0	
8	0	ii) 0		
9	0			
10	-			
TOTAL	8	TOTAL	18	521.

Total marks in words : Five Two

INSTRUCTION TO THE CANDIDATE

1. Check the Question Paper, Programme, Course Code, Branch Name etc., before answering the questions.
2. Use both sides of the paper for answering questions.
3. POSSESSION OF ANY INCRIMINATING MATERIAL AND MALPRACTICE OF ANY NATURE IS PUNISHABLE AS PER RULES.

R. Manjula
Name of the Examiner

Signature of the Examiner
with Date

PART A

1. Applications of computer graphics:

- i) Computer Aided Design
- ii) Presentation graphics
- iii) Computer Art
- iv) Entertainment
- v) Education and training
- vi) Visualisation
- vii) Image Processing
- viii) Graphical User Interface.

2. Bitmap : For the computer graphics systems, one bit per pixel on the screen in the frame buffer.

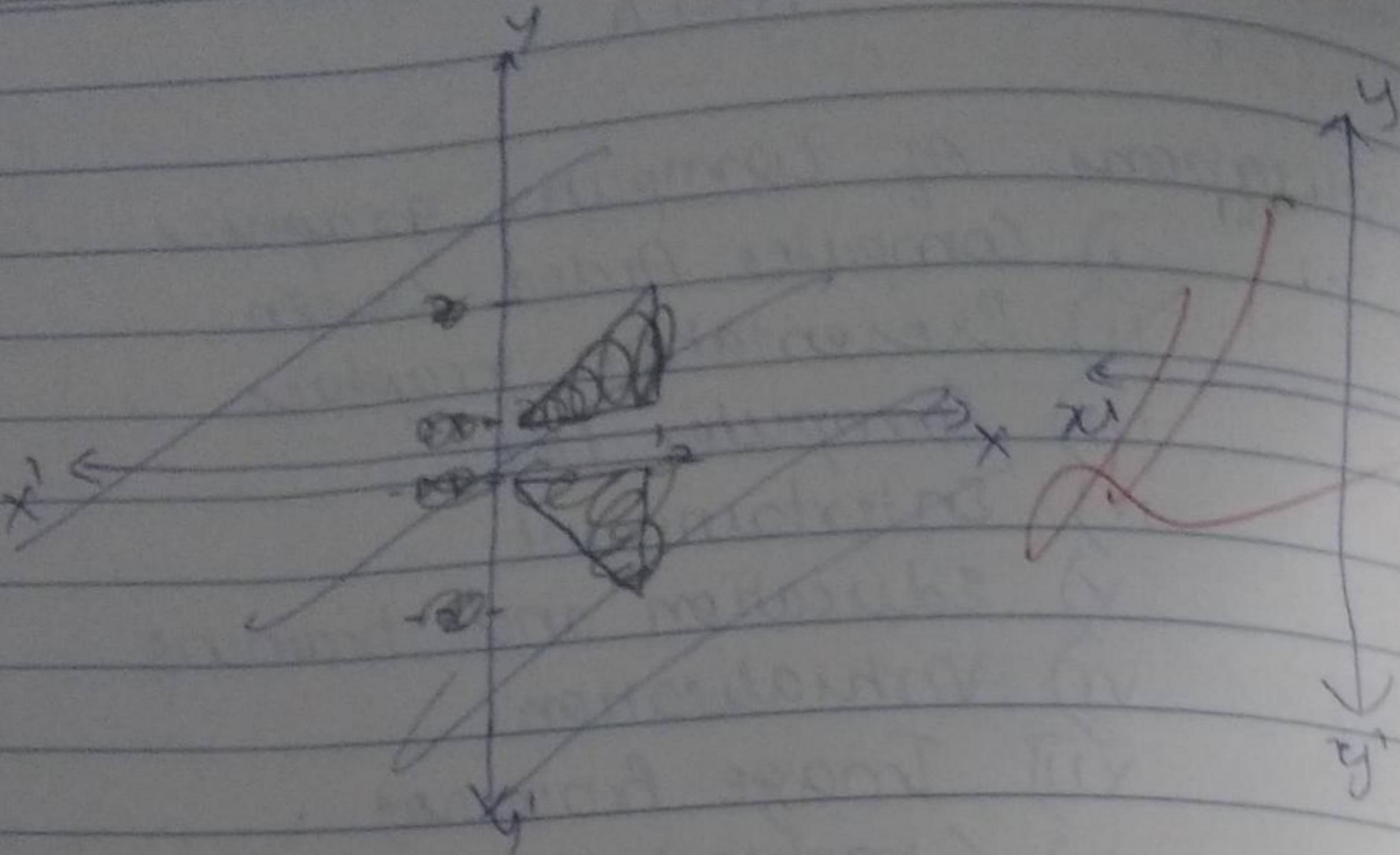
Pixel map : For the graphics systems, multiple bit per pixel for the screen in the frame buffer.

3. Interactive Input devices:

- i) keyboard
- ii) Mouse
- iii) Joy sticks
- iv) Image scanner.

4. Traversal is defined as either the forward tracking or backward tracking of the beam (model) input given.

8.



5. The purpose of set interior colour index is to manually set the color of the pixel by the user and set interior style is to give style of font/width by the user.

PART-B

Inputs:

$$(0,0) + (4,6)$$

$$y = mx + c$$

$$(x_k, y_k) = (0, 0)$$

when decision parameter

$$P_k = 2\Delta y - \Delta x = 2 \times 6 - 4 = 12 - 4 = 8 > 0$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{6 - 0}{4 - 0} = \frac{6}{4} = \frac{\Delta y}{\Delta x}$$

$$\therefore \Delta y = 6, \Delta x = 4$$

If $P_k \leq 0$, then (x_{k+1}, y_k) $P_{k+1} = P_k + 2\Delta y$
else

$P_k \geq 0$, then (x_{k+1}, y_{k+1}) $P_{k+1} = P_k + 2\Delta y - \Delta x$

At $k=0$

$$P_0 = 2\Delta y - \Delta x = 8 > 0$$

then

$$(x_{k+1}, y_{k+1}) = (5, 7)$$

$$\begin{array}{r} 12 - 8 = 4 \\ 8 - 12 = -4 \\ \hline 12 - 12 = 0 \end{array} (4, 5)$$

At $k=1$

$$P_{k+1} = 8 + 2(6) = 8 + 12 = 20 > 0$$

then

$$(x_{k+1}, y_{k+1}) = (6, 8)$$

$$\begin{array}{r} 12 - 8 = 4 \\ 8 - 12 = -4 \\ \hline 12 - 12 = 0 \end{array} (4, 5)$$

At $k=2$

$$P_{k+1} = 20 + 2(6) - 4 = 20 + 12 - 4 = 28 > 0$$

then

$$P_{k+1} = 28 + 8 = 36 > 0$$

$P < 0$

$$\begin{array}{r} 12 - 8 = 4 \\ 8 - 12 = -4 \\ \hline 12 - 12 = 0 \end{array} (1, 1)$$

$$\begin{array}{r} 12 - 8 = 4 \\ 8 - 12 = -4 \\ \hline 12 - 12 = 0 \end{array} (2, 2)$$

$$\begin{array}{r} 11 - 8 = 3 \\ 8 - 11 = -3 \\ \hline 11 - 11 = 0 \end{array} (3, 3)$$

$$\text{pt } P^0 \quad (0,0)$$

$$P_0 = 2sy - \Delta x$$

$$= 2(6) - 4 = 8 > 0$$

Then

$$P_{k+1} = P_k = P_0 + 2sy - \Delta x \quad (x_{k+1}, y_{k+1})$$

$$= 8 + 2(6) - 4$$

$$= 8 + 12 = 16 > 0$$

Then

$$P_{k+1} = P_k = P_1 + 2sy - \Delta x \quad (x_{k+1}, y_{k+1})$$

$$= 16 + 8$$

$$= 24 > 0$$

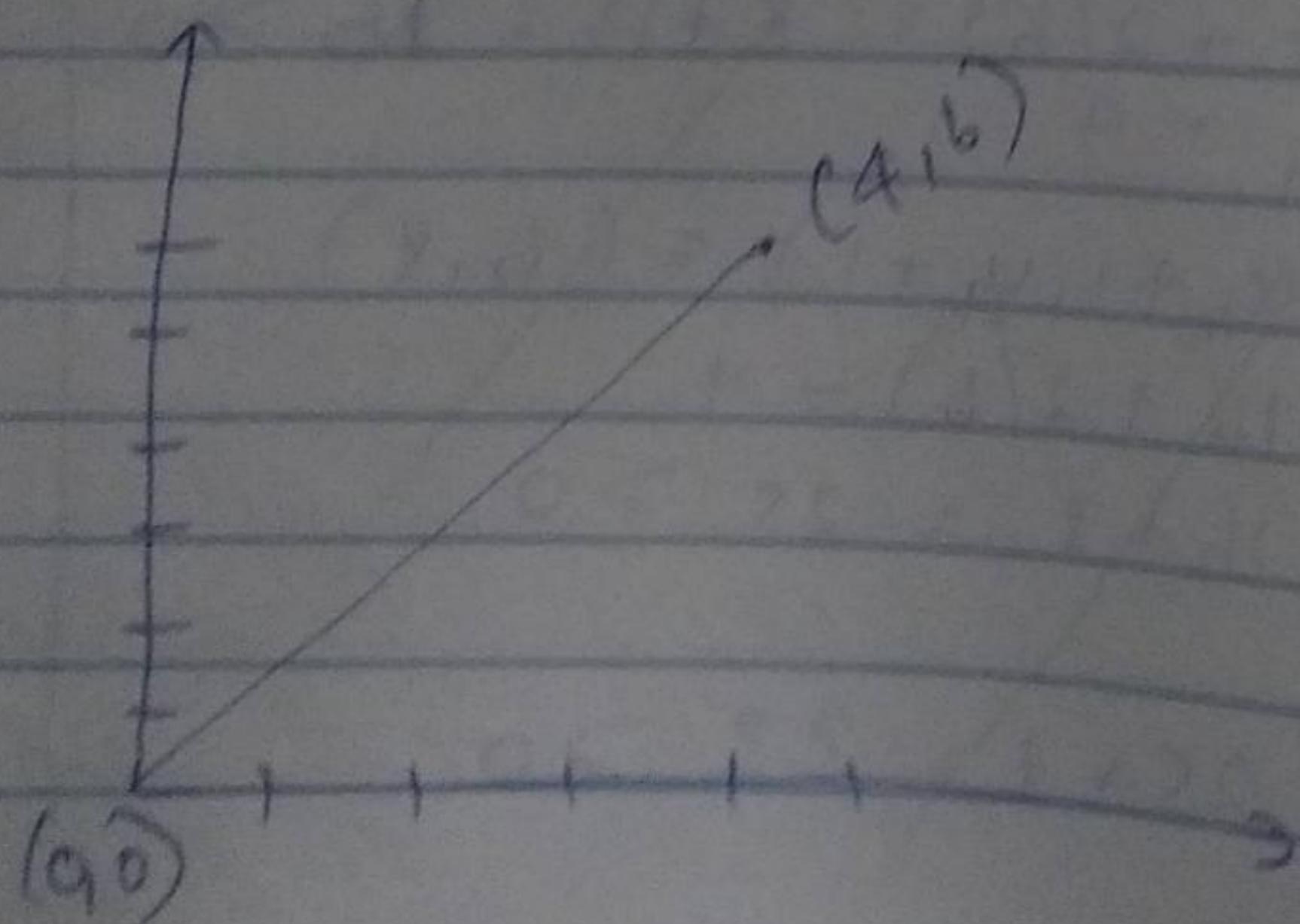
Then

$$P_{k+1} = P_2 = P_1 + 2sy - \Delta x \quad (x_{k+1}, y_{k+1}) = (3,$$

$$= 24 + 8$$

$$= 32 > 0$$

?



1.2.ii) Various methods in text attribute:

i) text size

ii) text color

iii) text font

iv) text Bold, Italic and underline

v) text space and indentation

vi) text case sensitive.

vii) text width

i) text size: Size of texts can be changed ranging from 4 to some limit

ii) text color: Color of the text can also be changed using RGB color method.

iii) font: The font style can be changed with various types of style are available in graphics

iv) Text Bold, Italic and underline:

The mode of text to be visible or for highlighting can also be changed.

v) Text Indentation:

Text spacing / indentation is also available in the computer graphics

vi) Text case-sensitive:

It can be either in upper-case or in lower case.

vii) Text width:

There is an option for changing the width of the text also.

13. a) Basic Concepts of 2D - geometrical transformations are:

- i) x and y axis
- ii) translation
- iii) scaling
- iv) Rotation

Other concepts are

- i) Shearing
- ii) reflection

i) translation.

when (x, y) is changed from (x', y') then it is represented as

$$(tx, ty)$$

$$x' = x + tx$$

$$y' = y + ty$$

The decision parameter is changed as
 $P \rightarrow P'$

$$P' = P + T$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} tx \\ ty \end{bmatrix} + \begin{bmatrix} x \\ y \end{bmatrix}$$

ii) Scaling:

It is represented as S_x, S_y and maybe maximum or minimum scale

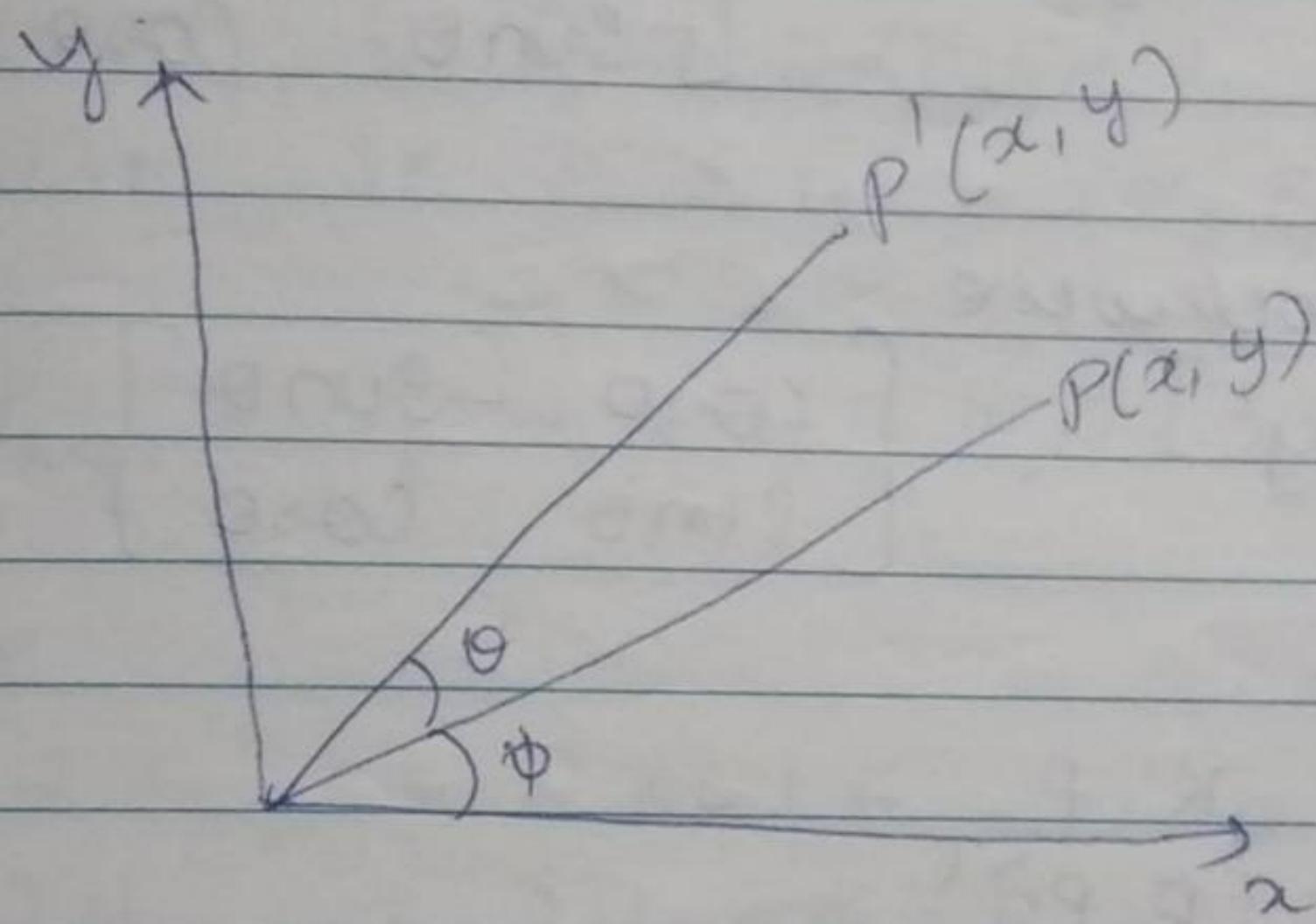
$$x' = x \cdot s_x$$

$$y' = y \cdot s_y$$

and deviation parameter is converted from P to P'.

$$\begin{bmatrix} x' & y' \end{bmatrix} = \begin{bmatrix} s_x & 0 \\ 0 & s_y \end{bmatrix} \cdot \begin{bmatrix} x & y \end{bmatrix}$$

(ii) Rotation:



$$\cos(\phi + \theta) = \frac{x'}{\sqrt{v}}$$

$$x' = \sqrt{v} \cos(\phi + \theta)$$

$$\sin(\phi + \theta) = \frac{y'}{\sqrt{v}}$$

$$y' = \sqrt{v} \sin(\phi + \theta)$$

$$x' = \cos \phi \cos \theta - \sin \phi \sin \theta$$

$$y' = \sin \phi \cos \theta + \cos \phi \sin \theta$$

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

and $P' = R P$

In rotation it is either anticlockwise
or clockwise

In clockwise

$$P' [x', y'] = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix}$$

~~(a)~~ In anticlockwise

$$[x', y'] = \begin{bmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{bmatrix} \cdot \begin{bmatrix} x \\ y \end{bmatrix}$$

$$\therefore P' = R P$$

$$P'^T = (R P)^T$$

$$P'^T = P^T R^T$$

12.0) Midpoint Circle Algorithm

Input radius $r = 4$

Circle centre $(x_c, y_c) = (4, 5)$

Decision Parameter

$$P_0 = 1 - r$$

At each x_k , starting at $k=0$,
the next ~~pt~~ we plot for (x_{k+1}, y_k)
IF $P_k < 0$ is

$$P_{k+1} = P_k + 2x_{k+1} + 1$$

otherwise if $P_k > 0$, (x_{k+1}, y_{k-1})

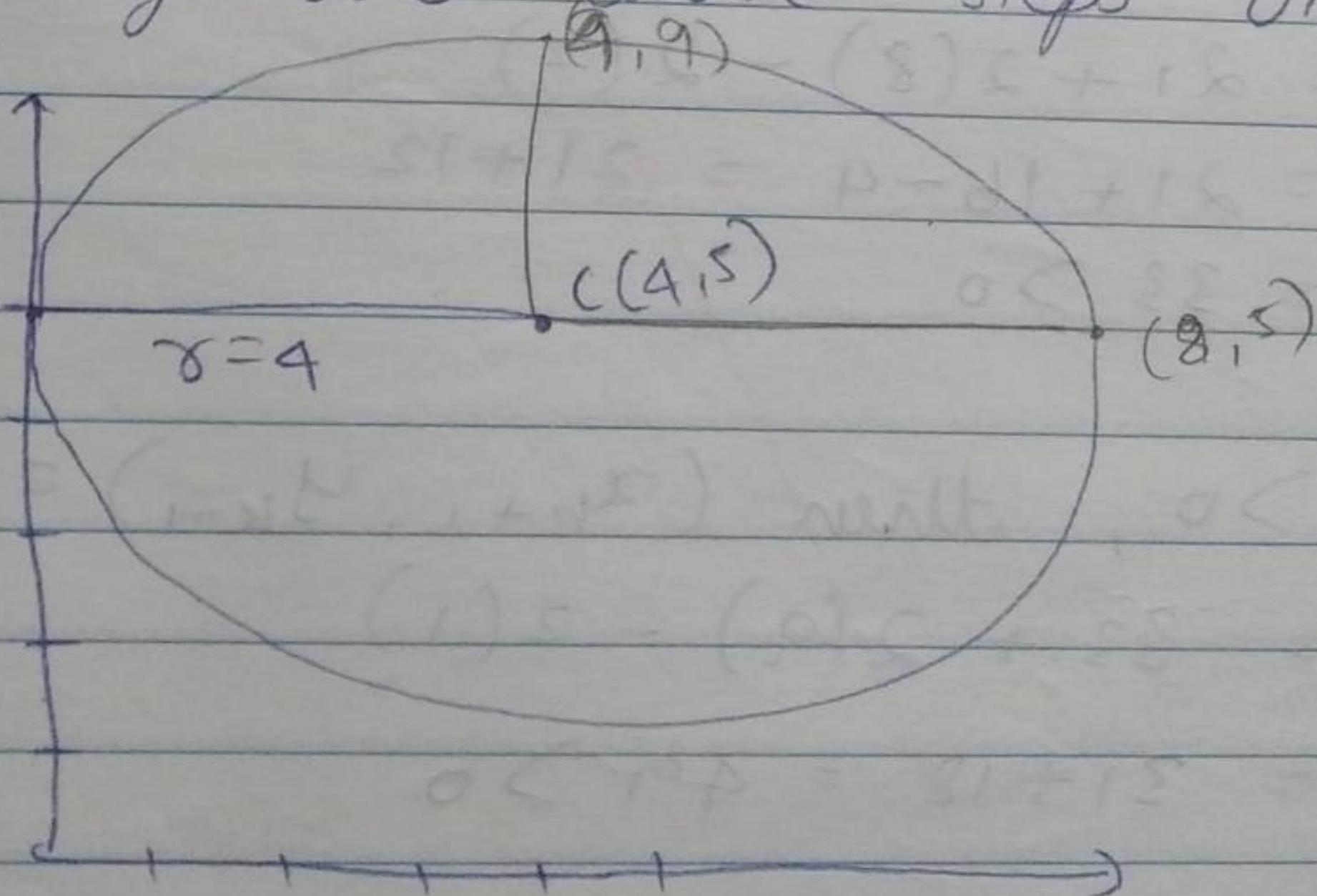
$$P_{k+1} = P_k + 2x_{k+1} + 1 - 2(y_k - 1)$$

where

$$1 + 2x_{k+1} = 2x_k + 2$$

~~$$2y_{k-1} = 2y_k - 2$$~~

Repeating the above steps until $x \geq y$



$$\text{At } k=0 \\ (x_k, y_k) = (4, 5)$$

$$P_0 = 1 - 4 = -3 < 0 \quad (\text{F})$$

$$\text{At } k=1 \\ (x_{k+1}, y_k) = (5, 5)$$

$$x_{k+1} = x_k + 1$$

$$\begin{aligned} P_{k+1} &= -3 + 2(5) + 1 \\ &= -3 + 10 + 1 \\ &= 11 - 3 = 8 \end{aligned}$$

$$\text{At } k=2 \\ P_{k+1} > 0, \text{ then } (x_{k+1}, y_{k-1}) = (6, 4)$$

$$\begin{aligned} P_{k+1} &= -8 + 2(6) + 1 - 2(4) \\ &= -8 + 12 + 1 - 8 \\ &= -\cancel{8} + 13 \cancel{- 8} > 0 \end{aligned}$$

$$\text{At } k=3$$

$$P_{k+1} > 0, \text{ then } (x_{k+1}, y_{k-1}) = (7, 3)$$

$$\begin{aligned} P_{k+1} &= -\cancel{13} + 2(7) - 2(3) \\ &= 13 + 14 - 6 = 21 > 0 \end{aligned}$$

$$\text{At } k=4$$

$$P_{k+1} > 0, \text{ then } (x_{k+1}, y_{k-1}) = (8, 2)$$

$$\begin{aligned} P_{k+1} &= 21 + 2(8) - 2(2) \\ &= 21 + 16 - 4 = 21 + 12 \\ &= 33 > 0 \end{aligned}$$

$$k=5$$

$$P_{k+1} > 0, \text{ then } (x_{k+1}, y_{k-1}) = (9, 1)$$

$$\begin{aligned} P_{k+1} &= 33 + 2(9) - 2(1) \\ &= 33 + 18 = 49 > 0 \end{aligned}$$

At $k=6$

$$P_{k+1} > 0, \quad (x_{k+1}, y_{k+1}) = (10, 0)$$

$$\begin{aligned} P_{k+1} &= 49 + 2(10) \\ &= 69 > 0 \end{aligned}$$

(4, 5) (9, 5)

2

$$\frac{2+14-6}{10}$$

DEPT. OF COMPUTER SCIENCE & ENGG.
KONGU ENGINEERING COLLEGE,
THOOPUPALAYAM (PO),
PERUNDURAI (TK), ERODE - 638 060



Estd : 1984

KONGU ENGINEERING COLLEGE

PERUNDURAI ERODE - 638 060.
(Autonomous)



PN
Name and signature of Hall Supdt. with Date

Name of the Student	T. Soundar	Register No.	16 C S R 195
Programme	BE	Branch & Semester	CSE - D VI - Semester
Course Code and Name	14 CSC 61 Graphics and Multimedia	Date	20.2.19

MARKS TO BE FILLED IN BY THE EXAMINER

PART - A		PART - B		Grand Total Max. Marks : 50
Question No.	Max Marks : 2	Question No.	Max Marks : 10	
1	2	11	i) 4	
2	-	ii)		
3	-	12	i) 1	
4	2	ii)		
5	-	13	i) 8	
6	-	ii)		
7	-	14	i)	
8	2	ii)		
9	-			
10	-			
TOTAL	6	TOTAL	13	

Total marks in words : Three Eight

19
50
381
verified by,
T. Soundar

INSTRUCTION TO THE CANDIDATE

- Check the Question Paper, Programme, Course Code, Branch Name etc., before answering the questions.
- Use both sides of the paper for answering questions.
- POSSESSION OF ANY INCRIMINATING MATERIAL AND MALPRACTICE OF ANY NATURE IS PUNISHABLE AS PER RULES.

R. Manjula
Name of the Examiner

Signature of the Examiner
with Date
R. Manjula
20/2/19

Part - A

1. Applications of Computer Graphics :

- * Computer Aided Designing for architectural system.
- * Computer Art
- * Graphical User Interface
- * Entertainment
- * Education and Training
- * Image processing
- * Presentation graphics

A DDA :

$$(x_0, y_0) = (1, 2)$$

$$\Delta x = 3 - 1 = 2$$

$$\Delta y = 4 - 2 = 2$$

$$2\Delta y = 4$$

$$2\Delta y - 2\Delta x = 4 - 4 = 0$$

$$2\Delta y - \Delta x = 4 - 2 = 2$$

$$P_0 = 2\Delta y - \Delta x = 2$$

$$K=0 : P_0 > 0 \Rightarrow x_{K+1} = x_K + 1, y_{K+1} = y_K + 1$$

$$x_1 = x_0 + 1 = 1 + 1 = 2, \quad y_1 = 2 + 1 = 3$$

$$P_K > 0, \quad y_{K+1} = y_K = 1$$

$$P_{K+1} = P_K + 2\Delta y - \Delta x$$

$$= 1 + 2(2K+1) \quad P_1 = P_0 + 2$$

$$-(y_K^2 - y_{K+1}^2)$$

$$+ (y_K - y_{K+1}) = 2 + 2 = 4$$

$$= 1 + 2(2K+1) - (y_K^2 - y_{K+1}^2 - 1 + 2y_K) + 1$$

$$= 1 + 2(2K+1) + 1 - 2y_K + 1 = 1 + 2(2K+1) + 2 - 2y_K$$

Point is (2, 3)

School of Communication and...

$$K=1 \quad P_1 > 0 \Rightarrow x_2 = x_1 + 1 \quad y_2 = y_1 + 1$$

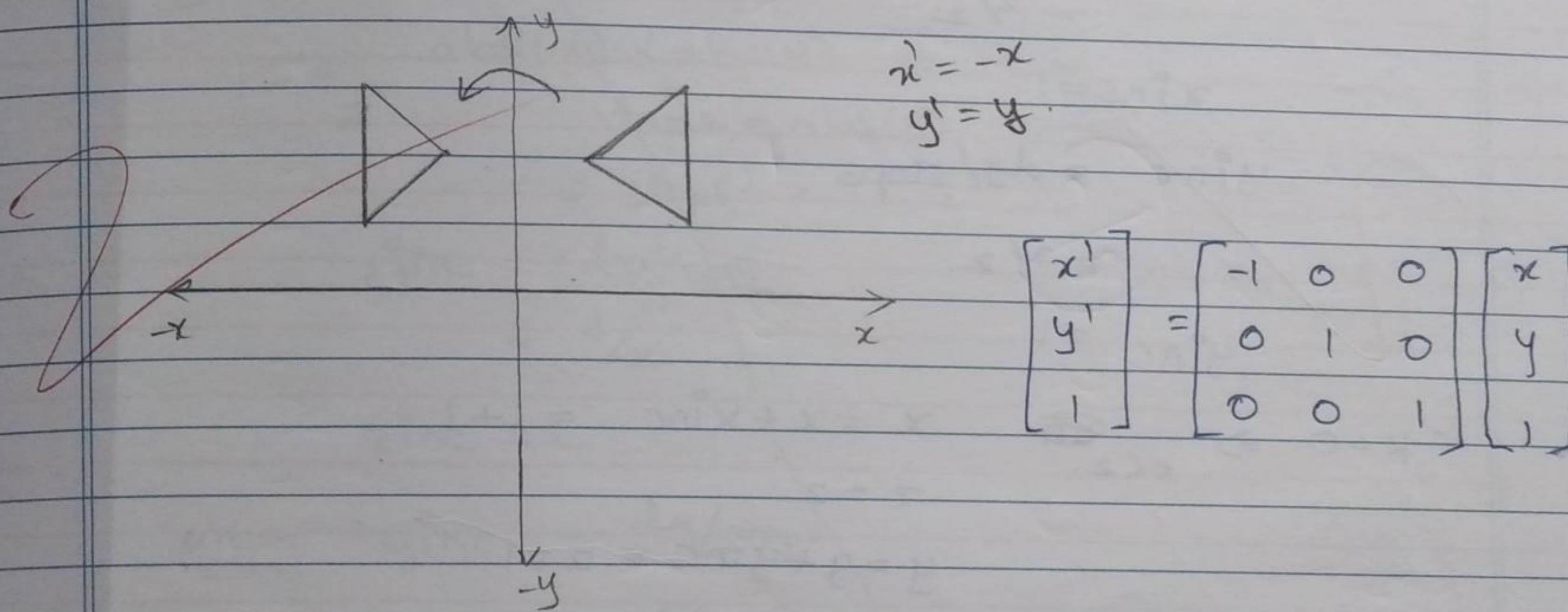
$$x_2 = 2 + 1 = 3 \quad y_2 = 3 + 1 = 4$$

$$R_2 = P_1 + 2\Delta y - \Delta x$$

$$P_2 = 4 + 2 = 6. \quad \text{Point is } (3, 4).$$

K	P_K	Points
0	2	(1, 2)
1	4	(2, 3)
6		(3, 4).

8 Reflection:



10 Methods for editing structure:

- i) Translation
- ii) Reflection
- iii) Scaling
- iv) Shearing
- v) Rotation.

4. DDA

$$(x_1, y_1) = (1, 2)$$

$$(x_2, y_2) = (3, 4)$$

$$x = x_1 \Rightarrow x = 1$$

$$dx = 3 - 1 = 2$$

$$y = y_1 \Rightarrow y = 2.$$

$$dy = 4 - 2 = 2$$

$$\text{abs}(x) < \text{abs}(y)$$

$$\text{steps} = \text{abs}(y)$$

$$\Rightarrow \text{steps} = 2.$$

$$x^{\text{inc}} = dx/\text{steps}$$

$$= 2/2$$

$$x^{\text{inc}} = 1$$

$$y^{\text{inc}} = dy/\text{steps}$$

$$= 2/2$$

$$y^{\text{inc}} = 1$$

$$k=0 \Rightarrow x = x + x^{\text{inc}} = 1 + 1$$

$$x = 2$$

$$y = y + y^{\text{inc}} = 2 + 1$$

$$y = 3$$

$$(2, 3)$$

$$k=1 \Rightarrow x_2$$

$$x = x + x^{\text{inc}} = 2 + 1$$

$$x = 3$$

$$y = y + y^{\text{inc}} = 3 + 1$$

$$y = 4$$

$$(3, 4)$$

intermediate

points

$$(1, 2)$$

$$(2, 3)$$

$$(3, 4)$$

$$k=2 \Rightarrow$$

x_2
exit

Part-B.

11. b) (a) DDA line Drawing Algorithm.

$$(x_1, y_1) = (1, 2)$$

$$(x_2, y_2) = (5, 7)$$

$$\Delta x = 5 - 1 = 4$$

$$\Delta y = 7 - 2 = 5$$

$$x = x_1 \Rightarrow x = 1$$

$$y = y_1 \Rightarrow y = 2$$

$$\text{abs}(x) > \text{abs}(y) \Rightarrow 1 < 2$$

$$\text{steps} = \text{abs}(y)$$

$$\Rightarrow \text{steps} = 2$$

$$x^{\text{inc}} = \Delta x / \text{steps}$$

$$= 4/2$$

$$x^{\text{inc}} = 2$$

$$y^{\text{inc}} = \Delta y / \text{steps}$$

$$= 5/2$$

$$y^{\text{inc}} = 2.5$$

$$k=0 \Rightarrow 0 < 4, \quad x = x + x^{\text{inc}} = 1 + 2$$

$$x = 3$$

$$y = y + y^{\text{inc}} = 2 + 2.5$$

$$y = 4.5$$

$$(3, 4.5)$$

$k=1, k \leq 4$

$$x = x + x^{\text{inc}} = 2 + 2$$

$$x = 5$$

$$y = y + y^{\text{inc}} = 4.5 + 2.5$$

$$y = 7$$

Part - B

12 .a) Midpoint Circle:

$$(x_c, y_c) = (4, 5)$$

$$r = 4$$

$$(x_0, y_0) = (0, 0)$$

$$x = 0$$

$$y = \gamma \Rightarrow y = 4.$$

$$P_0 = 1 - \gamma.$$

$$P_0 = 1 - 4 = -3.$$

$$P_0 < 0, \quad x_{k+1} = x_k + 1 \Rightarrow x_1 = x_0 + 1$$

$$x_1 = 0 + 1$$

$$x_1 = 1$$

$$P_{k+1} = P_k + 1 + 2x_{k+1}$$

$$\begin{aligned} P_1 &= P_0 + 1 + 2x_1 \\ &= -3 + 1 + 2 \end{aligned}$$

$$P_1 = 0$$

$P_1 = 0$, lies on the circle.

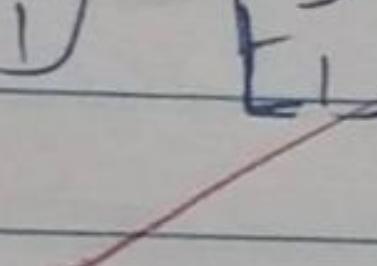
13. a) 2D geometrical transformation:

- i) Translation
- ii) Rotation
- iii) Scaling
- iv) Shearing
- v) Reflection.

Translation:

$$x' = x + tx$$

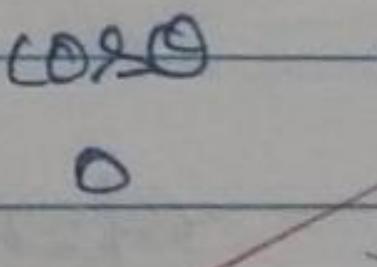
$$y' = y + ty.$$

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


Rotation:

$$x' = x \cos \theta - y \sin \theta$$

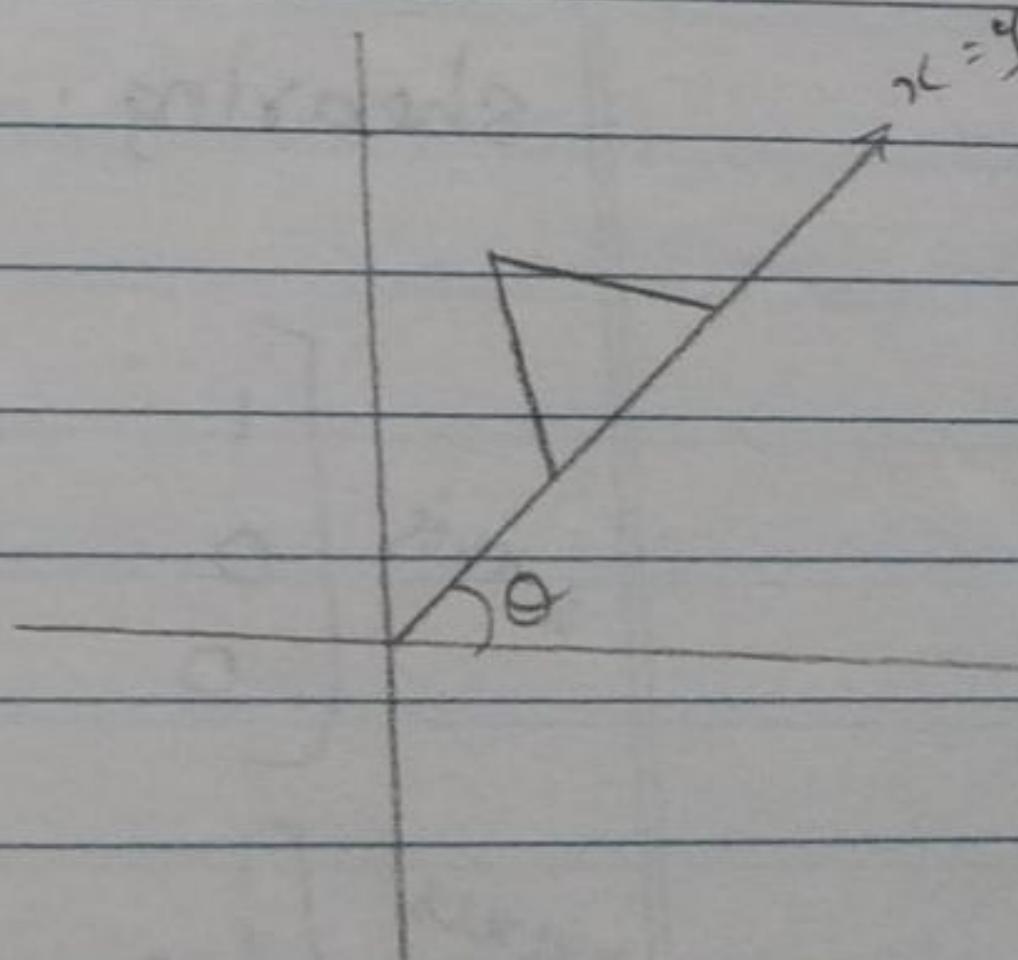
$$y' = x \sin \theta + y \cos \theta.$$

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


$$x_r' = x_r + r \cos(\phi + \theta)$$

$$y_r' = x_r + r \cos \phi \cos \theta + r \sin \phi \sin \theta.$$

$$x_r' = x_r \cos \theta + y_r \sin \theta$$



$$y' = y_r + r \sin(\theta + \phi)$$

$$y' = y_r + r \sin \phi \cos \theta + r \cos \phi \sin \theta$$

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

scaling:

$$x' = x \cdot s_x$$

$$y' = y \cdot s_y$$

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

shearing:

x axis

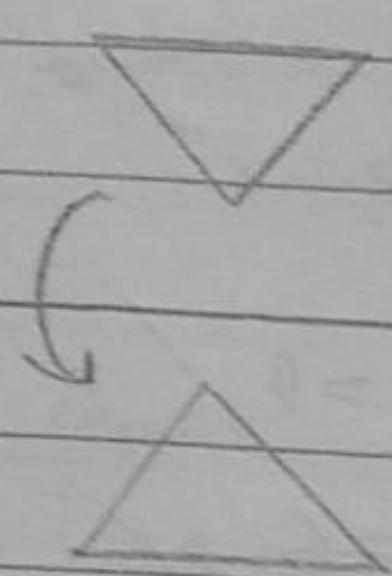
$$\begin{bmatrix} 1 & shx & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \xrightarrow{\text{reference}} \begin{bmatrix} 1 & shx & shx \cdot y \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

y axis

$$\begin{bmatrix} 1 & 0 & 0 \\ shx & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \xrightarrow{\text{reference}} \begin{bmatrix} 1 & 0 & 0 \\ shx & 1 & shx \cdot y \\ 0 & 0 & 1 \end{bmatrix}$$

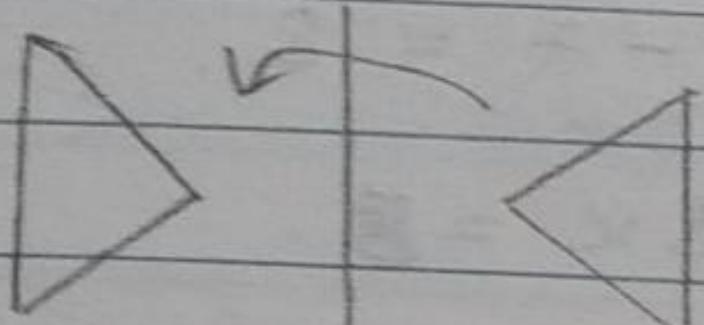
Reflection:

$$x' = x \\ y' = -y$$



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

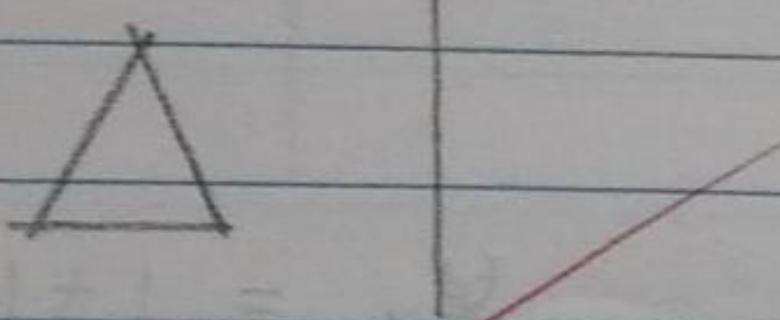
$$x' = -x \\ y' = y$$



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

8

$$x' = -x \\ y' = -y$$



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

11. a) (i) Bresenham's line drawing algorithm.

$$(x_0, y_0) = (0, 0)$$

$$\Delta x = 4 - 0 = 4$$

$$\Delta y = 6 - 0 = 6$$

$$2\Delta y = 12$$

$$2\Delta y - \Delta x = 12 - 4 = 8.$$

$$P_0 = 2\Delta y - \Delta x = 8.$$

$k=0$.

$$P_0 > 0, x_{k+1} = x_k + 1 \quad y_1 = 0 + 1$$

$$x_1 = 0 + 1 \\ = 1.$$

$$P_{k+1} = P_k + 2\Delta y - \Delta x$$

$$P_1 = P_0 + 8$$

$$= 8 + 8$$

$$= 16$$

$k=1$

$$P_1 > 0, x_2 = 1 + 1 \quad y_2 = 1 + 1$$

$$= 2$$

$$y_2 = 2$$

$$\textcircled{2} \quad P_2 = 16 + 8$$

$$= 24$$

$k=2$

$$P_2 > 0$$

$$x_3 = 3$$

$$y_2 = 3$$

$$P_3 = 24 + 8$$

$$= 32$$

$$k = 3$$

$$P_3 = 7^0$$

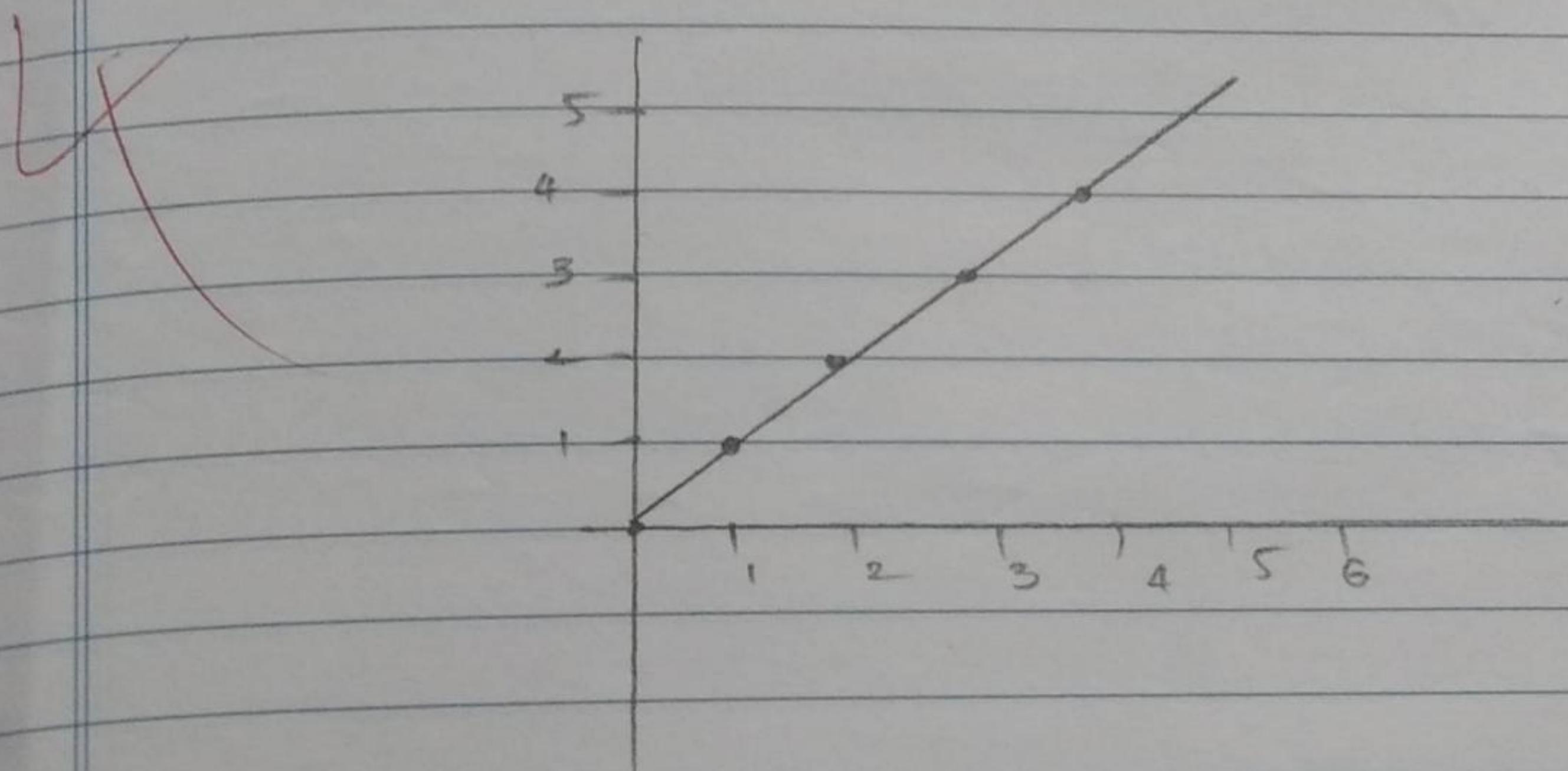
$$x_3 = 4$$

$$y_3 = 4$$

$$P_3 = 32 + 8$$

$$= 40.$$

K	P_{K+1}	Points.
0	16	(1, 1)
1	24	(2, 2)
2	32	(3, 3)
3	40.	(4, 4)



Continuous Assessment - I

14CSC61 Graphics and Multimedia.

Answer key

Part-A

Answer the following:

1. Applications (any 4)
- * Computer aided design * Education + training (2)
 - * presentation graphics * visualization
 - * computer art
 - * Entertainment * Image processing
 - * Graphical user interface.

2. BIT MAP

for black and white

display one bit information
is stored in buffer this
storage is called Bit map

PIXEL MAP

For colour images more than
one bit is stored in a buffer
this storage is called pixel
map.

3. Input devices.

keyboard

mouse

trace ball

digitizer

4. Determine the intermediate points - DDA

(1, 2) (3, 4)

$$m = \frac{y_2 - y_1}{x_2 - x_1} \Rightarrow \frac{4 - 2}{3 - 1} = \frac{2}{2} = 1$$

$m \geq 1$ the slope

$$x_{k+1} = x_k + 1 \Rightarrow (i) \quad 1+1=2 \Rightarrow x_{k+1}$$

$$1+2=3 \Rightarrow y_{k+1}$$

$$y_{k+1} = m + y_k \Rightarrow (ii) \quad 2+1=3 \Rightarrow x_{k+1}$$

$$2+1=4 \Rightarrow y_{k+1}$$

(1, 2) (2, 3) (3, 4)
 ↓ intermediate pt.

5. set interior colour index (fc)

To choose an interior colour with the given colour parameters
(fc)

Set interior style (fs)

To fill the interior portion of an object with particular fill style ie hollow, pattern or solid. with the fill style parameter

b. Aliasing: Distortion of information due to low - frequency sampling

Anti-aliasing: to compensate the under sampling.

7.

$$shx = \frac{1}{2}$$

$$y_{ref} = -1$$

$$y^1 = y$$

$$\begin{bmatrix} 1 & shx & + shx \cdot y_{ref} \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= x^1 = x + shx(y - y_{ref})$$

$$y^1 = y$$

pts (0,0) (0,1) (1,0) (1,1)
(ii) (0,1)

$$(i)(0,0)$$

$$= x^1 = 0 + \frac{1}{2}(0 - (-1))$$

$$= 0 + \frac{1}{2}(1)$$

$$y^1 = \frac{1}{2}$$

$$= 0$$

$$= (\frac{1}{2}, 0)$$

$$(iii) x^1 = 1 + \frac{1}{2}(0 - (-1))$$

$$= 1 + \frac{1}{2}$$

$$y^1 = \frac{3}{2}$$

$$= 0$$

$$= (3/2, 0)$$

case(i) (0,0)

$$(0,0) \quad x^1 = 0 + \frac{1}{2}(0+1)$$

$$(0,1) \quad = \frac{1}{2}(1)$$

$$(1,0) \quad = 1 + \frac{1}{2}(0)$$

$$(1,1) \quad y^1 = 0 \quad (y_2, 0)$$

(case ii)

$$(0,1) \quad (0+1)/2 \quad (0+1)$$

$$x^1 = 1 + \frac{1}{2}(0+1)$$

$$y^1 = 1 \quad x^1 = 1 + \frac{1}{2}(2)$$

$$= (-\frac{1}{2}, 1) \quad y^1 = \emptyset$$

(case iii)

$$(1,0) \quad (0+1)/2 \quad (1+1)$$

$$x^1 = 1$$

$$y^1 = 1$$

$$(1,1)$$

$$(1,1) \Rightarrow 0 + \frac{1}{2}(1+1)$$

(iv)

3

2

1

0

1

2

3

$$y^1 = 2$$

$$= 1$$

$$= (2, 1)$$

$P_{out} \leftarrow B$

Answer the following.

(i) a) Bresenham's Line Drawing Algorithm

Starting point (x_0, y_0)

Ending point (x_1, y_1)

$$m = \frac{y_1 - y_0}{x_1 - x_0} = \frac{6-0}{4-0}, \quad b_m = 3y_0 + 1/2$$

k	P_k	x_{k+1}	y_{k+1}
0	1	1	1 ($1, 1$)
1	3	2	2 ($2, 2$)
2	5	3	3 ($3, 3$)
3	7	4	4 ($4, 4$)

$$P_0 = 2\Delta y - \Delta x \\ = 4 - 3$$

$$P_k < 0 \Rightarrow (x_{k+1}, y_k)$$

$$P_{k+1} = P_k + 2\Delta y$$

$$P_k > 0 \Rightarrow (x_k, y_{k+1})$$

$$P_{k+1} = P_k + 2\Delta y - 2\Delta x$$

case(i):
 $P_{k+1} = P_k + 2\Delta y - \Delta x \\ = 1 + 6 - 4 \\ = 3$

case(ii):
 $P_{k+1} = 3 + 6 - 4 \\ = 5$

case(iii):
 $P_{k+1} = P_k + 2\Delta y - 2\Delta x \\ = 5 + 6 - 4 \\ = 7$

$$P_k > 0 \Rightarrow x_{k+1} \text{ as } x_k + 1 \rightarrow y_{k+1}$$

$$P_{k+1} = P_k + 2\Delta x - 2\Delta y$$

$$P_k < 0 \Rightarrow (x_{k+1}, y_k)$$

$$P_{k+1} = P_k + 2\Delta x$$

g. Reflection w.r.t. y-axis

Let the pt. of triangle be $(4, 1)$ $(3, 1)$ $(2, 3)$

$$x'^1 = x$$

$$y'^1 = y$$

(i) $(1, 1)$ (ii) $(-3, 1)$ (iii) $(-4, 3)$

$$x^1 = -4$$

$$y^1 = 1$$

$(-4, 1)$

$$x^1 = 3$$

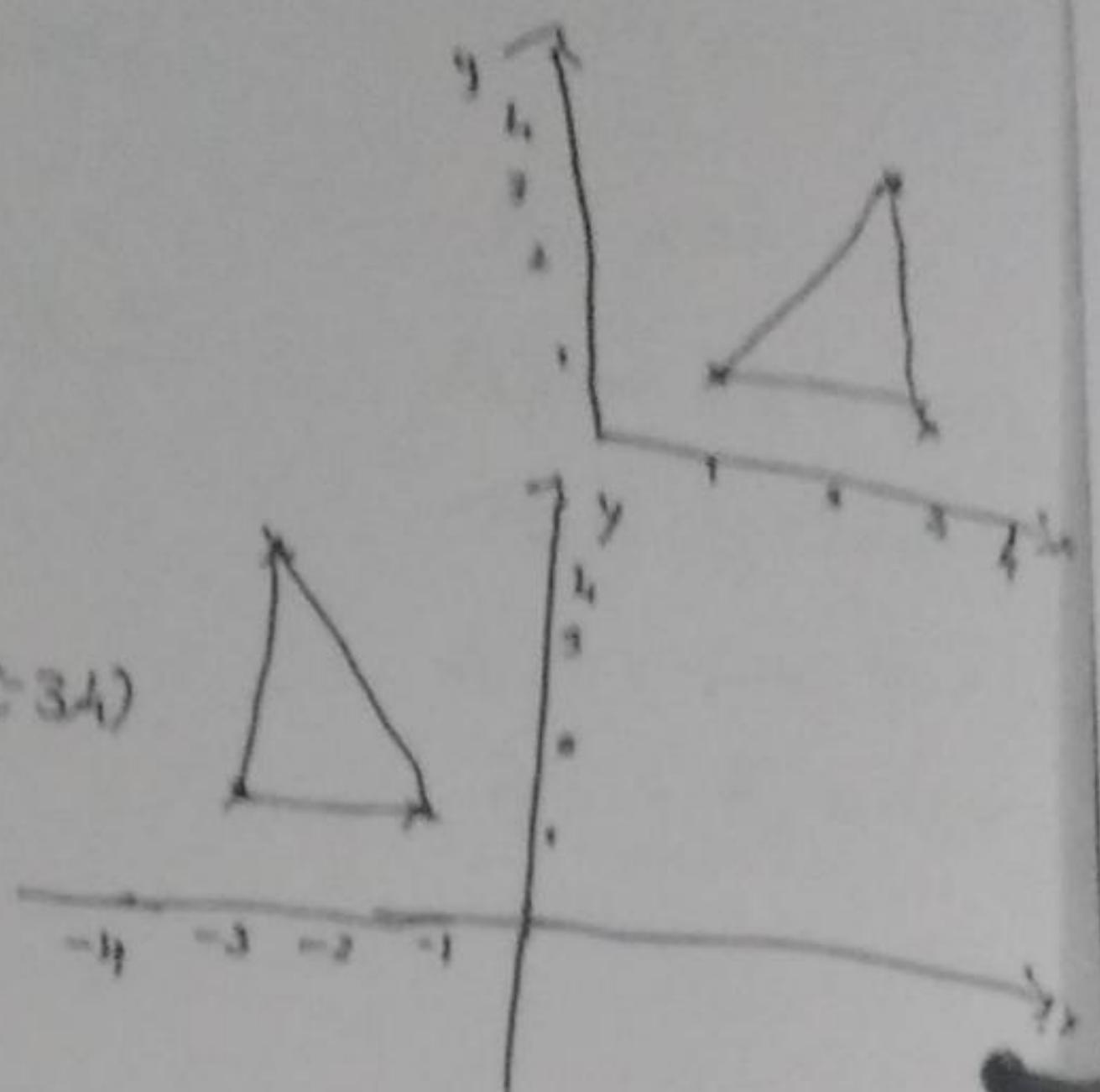
$$y^1 = 1$$

$(-3, 1)$

$$x^1 = -3$$

$$y^1 = 3$$

~~$(-2, 3)$~~ $(-3, 3)$



4) Traversal:

Scanning the structure and sending the graphical output to a workstation is called traversal.

10. Methods used for editing the structure:

i) append:

open structure (id)

:

close structure

open structure (id)

:

close structure (id)

2) edit mode

set edit (mode)

3) To insert

open structure (id)

set edit mode (insert/replace)

;

close structure

To remove

Select element pointer (No.)

delete element.

To copy

open structure (s)

copy all element from structure (id)

close structure;

Part-B

Answer the following.

ii. a) Bresenham's line drawing algorithm.

(0,0) (4,6)

$$m = \frac{\Delta y}{\Delta x} = \frac{6-0}{4-0} = \frac{3}{2} > 1$$

$$P_0 = 2 \Delta x - \Delta y$$

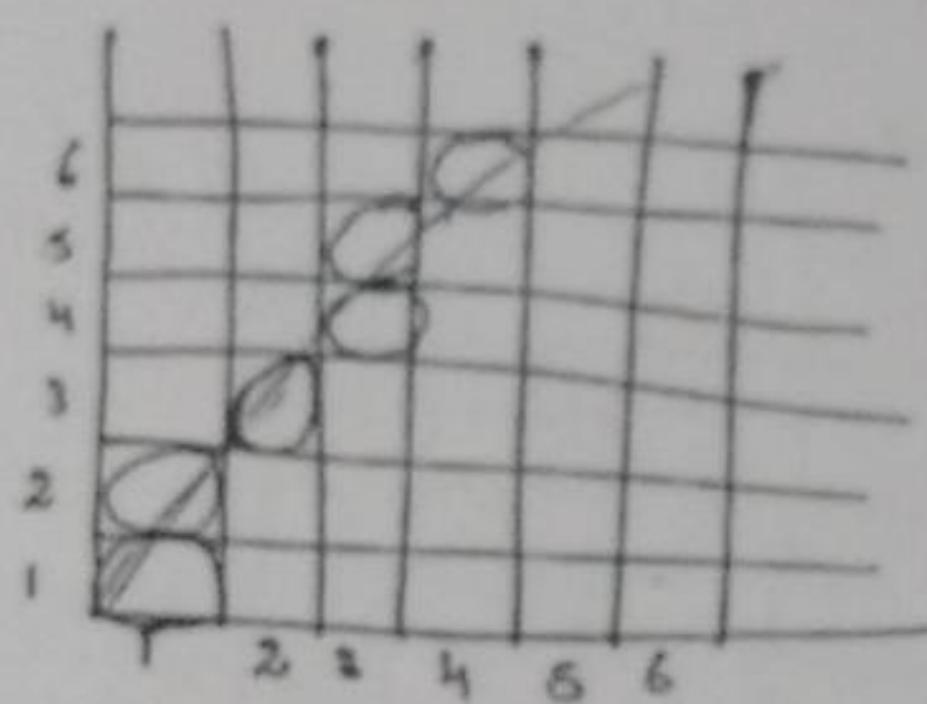
$$P_k > 0 : (x_{k+1}, y_{k+1})$$

$$P_{k+1} = P_k + 2\Delta x - 2\Delta y$$

$$P_k < 0 : (x_k, y_k)$$

$$P_{k+1} = P_k + 2\Delta x$$

k	P_k	x_{k+1}	y_{k+1}	(x_k, y_k)
0	1	1	1	(0,1)
1	-1	1	2	(1,2)
2	3	2	3	(2,3)
3	1	3	4	(3,4)
4	-1	3	5	(3,5)
5	3	4	6	(4,6)



ii. b)
(ii) Text Attributes

setTextFont (tf)

setTextColourIndex (tc) - colour code for text.

Set Character Expansion Factor (cw) - character width.

Set character Spacing (cs) -

Set character UpVector (cupvect) - controls orientation of txt.

get TextPath (tp)

Set Text Alignment (h,v)

Set Text precision (tpri)

ii b) DDA - Algorithm.
 $(1, 2)$ $(5, 7)$

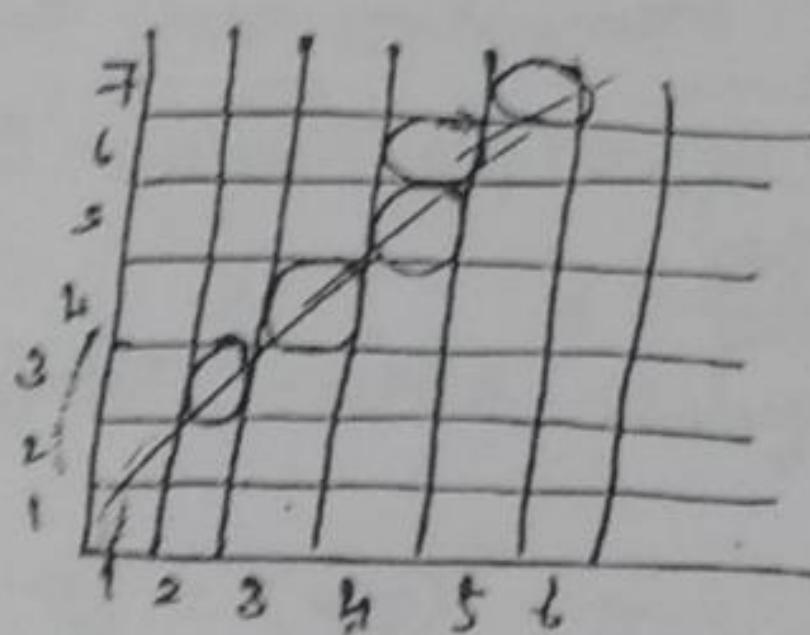
$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{7 - 2}{5 - 1} = \frac{5}{4} > 1$$

$$x_{k+1} = x_k + 1/m$$

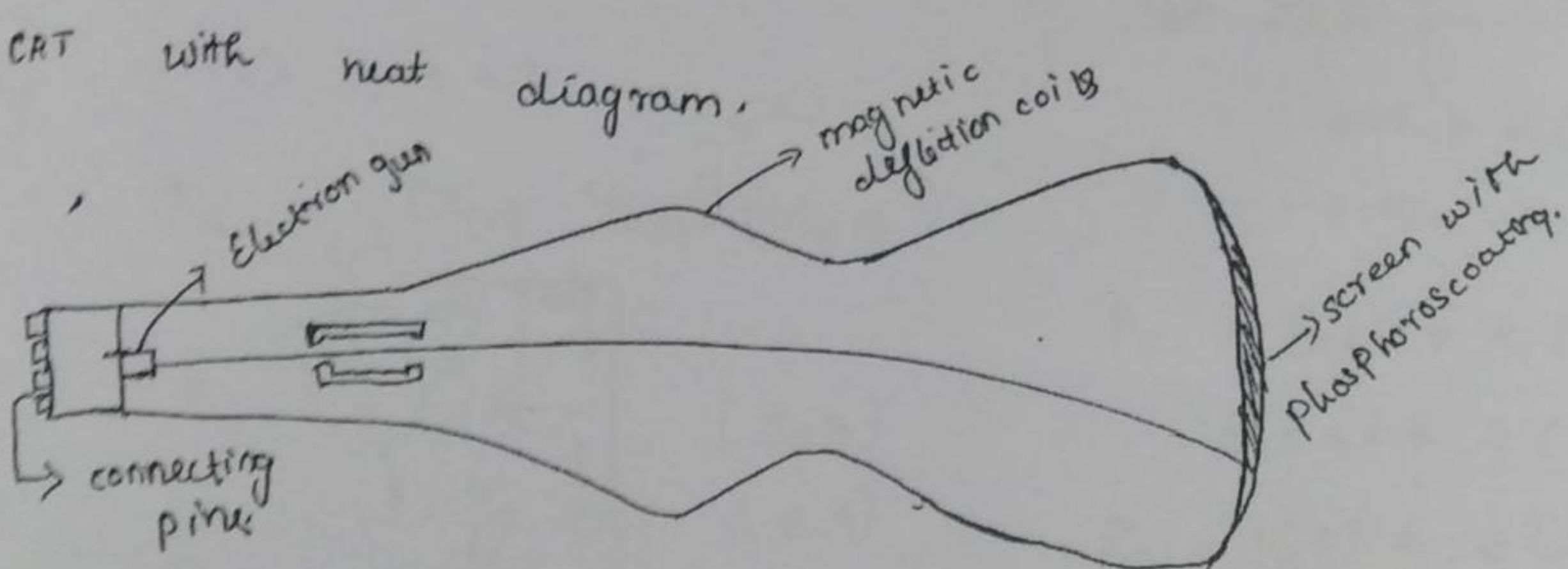
$$y_{k+1} = y_k + 1/m \Rightarrow 1/m = 1/1.25 = 0.8$$

$$(x_{k+1}, y_{k+1}) = (\text{round}(x_k + 1/m), y_k)$$

x_k	y_k	$x_{k+1} = x_k + 1/m$	$y_{k+1} = y_k + 1/m$	
1	2	2.8	2.8	(2, 3)
2.8	3	3.6	3.6	(3, 4)
3.6	4	4.4	4.4	(4, 5)
4.4	5	5.2	5.2	(4, 6)
5	6	5.8	5.8	(5, 7)



(ii) CRT with neat diagram.



- * The base is connected with the electron gun heats and emits an electron beam.
- * Which is passed through the focusing anode & accelerating anode
- * The magnetic deflection coil will make the beam to fall on the

Scanned by CamScanner

correct position of the phosphorous coated screen.

12) a) Midpoint circle algorithm:

1. Input radius r and the circle center (x_c, y_c) and obtain the first point on the circumference of a circle centered on origin as $(x_0, y_0) = (0, r)$

2. Calculate the initial value of the decision parameter as

$$P_0 = 5/4 - r$$

3. At each position. If $P_k < 0$ then next point is (x_{k+1}, y_k) and

$$P_{k+1} = P_k + 2x_{k+1} + 1$$

otherwise the next point along the circle is (x_{k+1}, y_{k-1})

$$P_{k+1} = P_k + 2x_{k+1} + 1 - 2y_{k+1}$$

where $2x_{k+1} = 2x_k + 2$ and $2y_{k+1} = 2y_k - 2$

4. Eg Determine the symmetry points in the other seven octants

5. move each calculated pixel position (x, y) onto the circular path centered on (x_c, y_c)

$$x = x + x_c \quad y = y + y_c$$

6. Repeat steps 3 through 5 until $x \geq y$

$$(x_c, y_c) = (4, 5) \quad r=4$$

(contd) \Rightarrow

$$P_1 = P_{k+1} + 2(x_{k+1} + 1)$$

$$= -3 + 1 + 2(1)$$

$$= -2 + 2 = 0$$

K	P_k	(x_{k+1}, y_{k+1})	(x, y)	
0	-3	1, 4	(5, 9)	
1	0	1, 4	(5, 9)	
2	5	2, 3	(6, 8)	
3	4	3, 2	(7, 7)	

$$P_2 = P_{k+1} + 2(x_{k+1})$$

$$= 0 + 1 + 2(1)$$

$$P_2 = P_k + 2(x_{k+1})$$

$$= 1 + 2(2)$$

$$= 5$$

$$P_3 = P_{k+1} + 2(x_{k+1}) - 2(y_{k+1})$$

$$= 6 + 2(2) - 2(3)$$

Scanned by CamScanner

Q) b) Mid point ellipse Algorithm.

- i. Input r_x, r_y and ellipse center (x_c, y_c) and obtain the first pt.
ellipse centered on the origin as
 $(x_0, y_0) = (0, r_y)$

- ii. Decision parameter.

$$P_{l_0} = r_y^2 - r_x^2 r_y + \frac{1}{4} r_x^2$$

- iii. When $P_{l_k} < 0$ then the pt. is (x_{k+1}, y_k)

$$P_{l_{k+1}} = P_{l_k} + 2r_y^2 x_{k+1} + r_y^2$$

when $P_{l_k} > 0$ then the pt is (x_k, y_{k-1})

$$P_{l_{k+1}} = P_{l_k} + 2r_y^2 x_{k+1} - 2r_x^2 y_{k+1} + r_y^2$$

with $2r_y^2 x_{k+1} = 2r_y^2 x_k + 2r_y^2$, $2r_x^2 y_{k+1} = 2r_x^2 y_k - 2r_x^2$

continue until $2r_y^2 x \geq 2r_x^2 y$

- iv. Decision parameter of region 2:

$$P_{2_0} = r_y^2 (x_0 + \frac{1}{2})^2 + r_x^2 (y_0 - 1)^2 - r_x^2 r_y^2$$

when $P_{2_k} > 0$ (x_k, y_{k-1})

$$P_{2_{k+1}} = P_{2_k} - 2r_x^2 y_{k+1} + r_x^2$$

when $P_{2_k} < 0$ (x_{k+1}, y_{k-1})

$$P_{2_{k+1}} = P_{2_k} + 2r_y^2 x_{k+1} - 2r_x^2 y_{k+1} + r_x^2$$

- v. Determine the symmetry points in other quadrants.

- vi. for a given center

$$x = x + x_c \quad y = y + y_c$$

- vii. Repeat the steps until $2r_y^2 x \geq 2r_x^2 y$.

$$\gamma_y = 8 \quad \gamma_{yy} = 10 \quad \text{center pt } (0, 8)$$

Initial pt $(0, \gamma_y) = (0, 8)$

$$r_k \quad (x_{kn}, y_{kn}) \quad 2\gamma_y^2 x_{k+1} \quad (2\gamma_y^2 y_{k+1})$$

$-$ $\alpha_1 \cdot 8$ $-$ $-$

0	-711	(1, 8)	128	1600
1	-519	(2, 8)	256	1600
2	-199	(3, 8)	384	1600
3	249	(4, 7)	512	1400
4	-575	(5, 7)	640	1400
5	130	(6, 6)	786	1200
6	-238	(7, 6)	896	1200
7	722	(8, 5)	<u>1024</u>	1000

Region 2:

1.	-176	(9, 4)
2.	276	(9, 3)
3.	-224	(10, 2)
4.	756	(10, 1)
5.	656	(10, 0)

1.2) a) 2D- Transformation

1. Translation

(2)

$P(x, y)$ given pt.
 $T(t_x, t_y)$ translation parameters.

$$P' = P + T$$

$$x' = x + t_x \Rightarrow \begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \\ 0 \end{bmatrix}$$

$$y' = y + t_y$$

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

2. Scaling - Re-size

(4)

$S(s_x, s_y)$
 if $(s_x \neq s_y)$ No change in shape.

if (s_x, s_y) in b/w 0,1 then the pt. is closer to

orig in. - size decreases.

if (s_x, s_y) is > 1 then the pt. is away from

origin size increases.

if $(s_x = s_y)$ then the scaling is done uniformly

$$P(x, y) \quad S(s_x, s_y) \Rightarrow \begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \\ 1 \end{bmatrix} \begin{bmatrix} s_x & 0 \\ 0 & s_y \end{bmatrix}$$

$$P' = S \cdot P \quad x' = s_x \cdot x \quad y' = s_y \cdot y$$

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

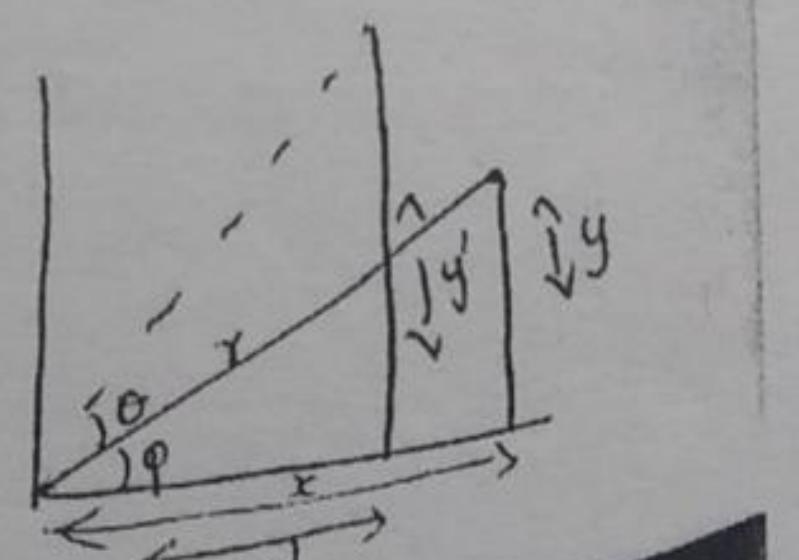
3. Rotation

$$x = r \cos \theta$$

$$y = r \sin \theta$$

$$\text{New angle after rotation} = (\phi + \theta)$$

$$x' = r(\cos \phi + \theta) \quad y' = r(\sin \phi + \theta)$$



Scanned by CamScanner

$$x' = r \cos \theta \cos \phi - r \sin \theta \sin \phi$$

$$x' = r \cos \theta - r \sin \phi$$

$$y' = r \sin \theta \cos \phi + r \cos \theta \sin \phi$$

$$y' = r \sin \theta + r \cos \phi$$

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

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

clock wise rotation

$$x' = r \cos(\phi - \theta)$$

$$y' = r \sin(\phi - \theta)$$

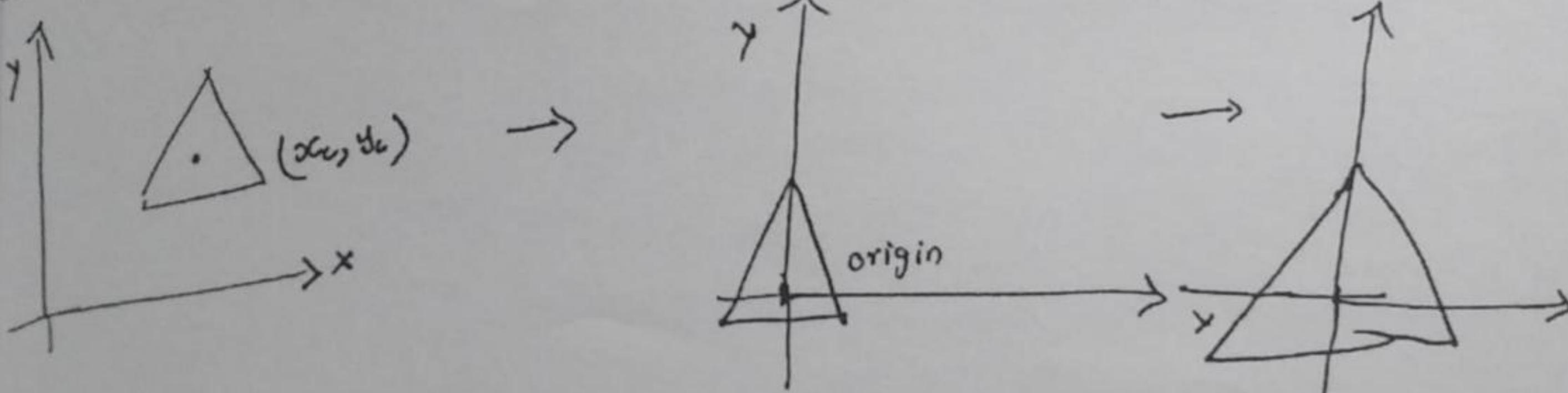
$$x' = x \cos \theta + y \sin \theta$$

$$y' = y \cos \theta - x \sin \theta$$

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

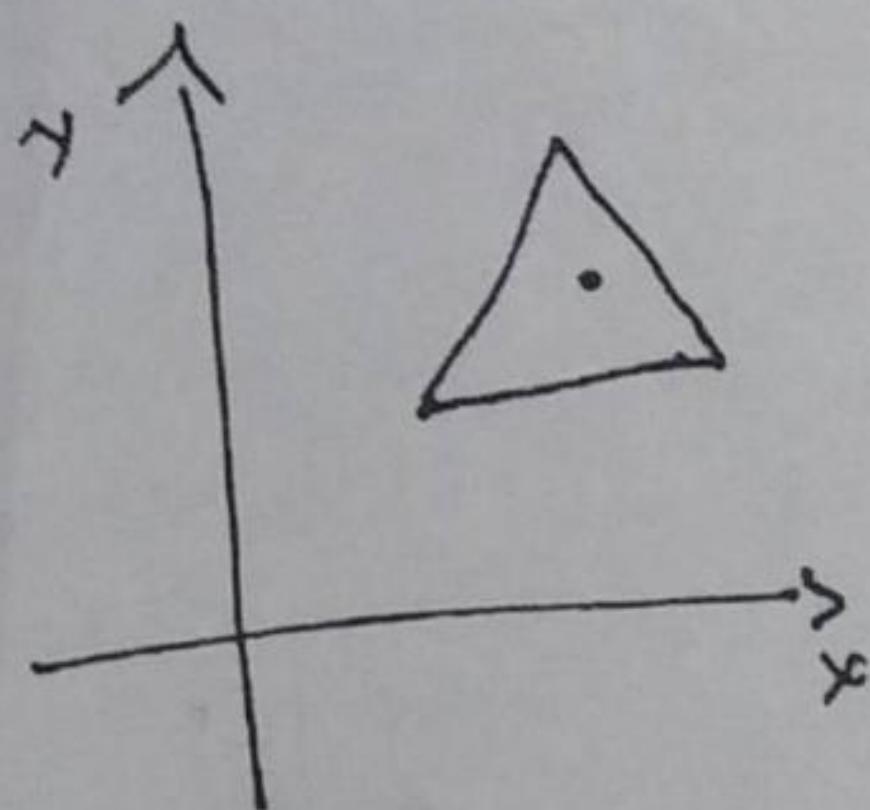
$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} x & y \end{bmatrix} \begin{bmatrix} \cos \theta & -\sin \theta & 0 \\ \sin \theta & \cos \theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

b) scaling with respect to origin
Translation to origin
Scaling

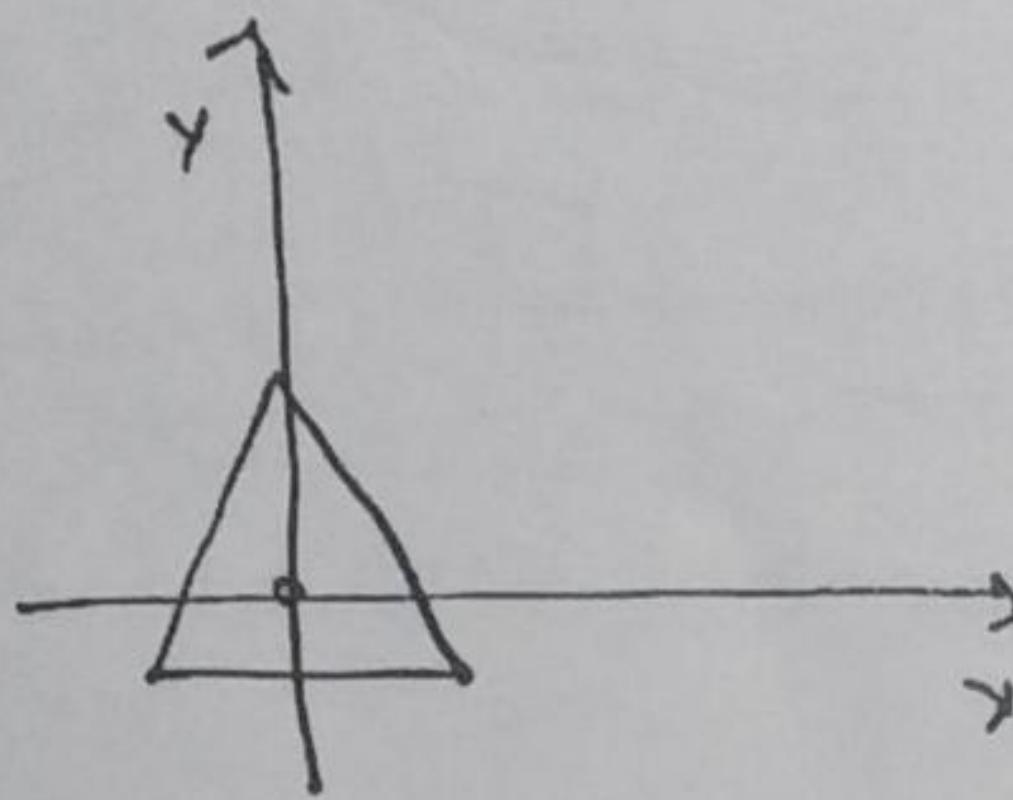


$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -x_1 & -y_1 & 1 \end{bmatrix} \begin{bmatrix} Sx_1 & 0 & 0 \\ 0 & Sx_2 & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} Sx_1 & 0 & 0 \\ 0 & Sx_2 & 0 \\ -Ix_1 & -y_1 & 1 \end{bmatrix}$$

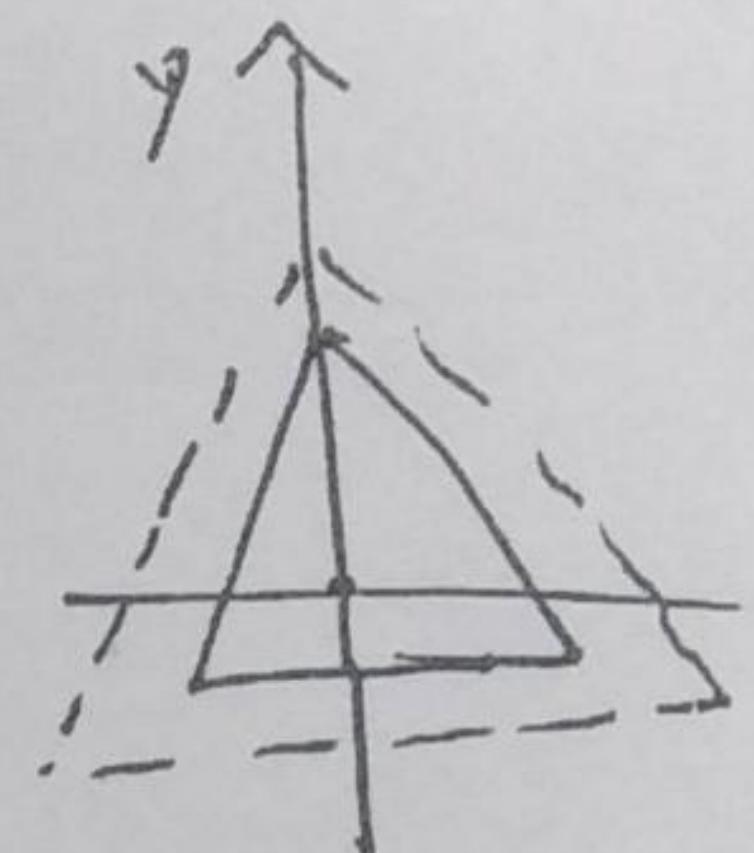
Scaling. w.r.t pivot point.



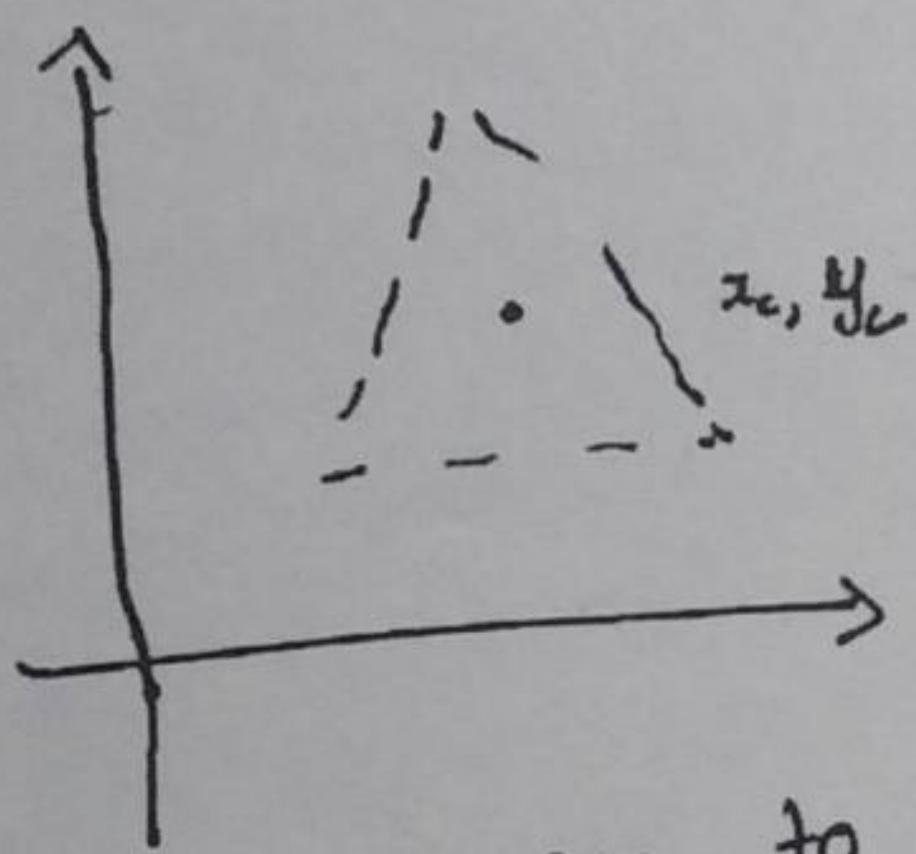
Given



Translation to
origin



Scaling



Translation to
pivot point.