Department of Computer Science and Engineering

Imperial College of Engineerig

(Affiliated By Rajshahi University)

B.Sc.(Engg.) Part III (Even Semester) Model Test-2023

Course Code: CSE 3221 | Course Title: Computer Graphics

Full Marks: 52.5 | Time: 3 Hours

[You have to answer 3 questions from each part]

			Marks
		Part A	
1.	a)	What do you mean by computer graphics?	1.75
	b)	List and briefly explain 8 applications of computer graphics.	4.00
	c)	Write down and explain the color models in computer graphics.	3.00
2.	a)	What is the full meaning of CRT?	1.75
	b)	What are the Parts of CRT? Explain	3.00
	c)	Write down the working mechanism of CRT.	4.00
3.	a)	What is the full meaning of LCD?	2.00
	b)	What are the attributes of a good Display Device?	3.75
	c)	Write down the working principle of LCD.	3.00
4.	a)	Write down the applications, advantages and limitations of LCD.	5.00
	b)	Which type of display do you think is better? Justify your answer.	3.75
		Part B	
5.	a)	What do you mean by DDA? Explain with an example.	3.75
	b)	Draw a line from (2, 5) to (20, 32) using DDA algorithm.	5.00
6.	a)	What do you mean by Bresenham's Line Drawing Algorithm? Explain with an example.	3.75
	b)	~~Draw a line from (2, 5) to (20, 32) using DDA algorithm.~~	5.00
7.	a)	Draw the 8 zones and mention the x, y for each zone for midpoint circle.	1.00
	b)	Suppose we have a point P(5,7) in zone 0 what will be the value of P in zone 5.	1.00
	c)	Find out the pixels required to draw a circle with radius of 15 and centered at (30, 20)	6.75
8.	a)	What is 2D Transformation?	1.00
	b)	What is rotation? Let a point P (4,3) is rotated counterclockwise by angle of 45, find the rotation matrix and the resultant point. [0.7, 4.95]	4.00
	c)	What is Scaling? How many types of scaling we have found? Explain with diagram.	3.75

Note: Include the necessary table, steps & diagram in detail.

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6b)

6b) If a line is drawn from (2,3) to (6,15) with use of DDA. How many points will needed to generate such line?

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Department: CSE

Student ID: 1938520113 Session 2018-2019

Date of Examination 03-04-23

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Mark	
1	8.75
2	7.25
3	8.75
5	8.75
6	8.75
8	5.75
Total	48

Answer to the Q no-1 (a)

Computer graphics refers to the creation manipulation, transformation and representation of graphical components through computer on screen, printer or plotter.

1.75

It is a very wide field of representing and creating various types of ~~com~~ graphics like CGI, deep fake, animation etc.

Ans to the Q no-1 (b)

Computer graphics application can be seen in various sectors ~~at~~ as it is used to represent all sorts of visual data in a manner which are easily understandable. The application sectors

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of Computer graphics are —

1. Educational Sector:- The application is huge. To teach students more precisely computer aided graphical representation of various theory helps to better understand the scenario.

2. Medical Application:- Visualizing various components of human body and other living organisms in form of 3-dimentional models, capability of practicing various surgical operations on various graphical character etc has helped to better understand and faster completion of understanding the theory.

3. Simulation: By creating simulation of operating vehicles like aerospace vehicles, land or water

the learner can practice all in real life.

4. Business : Visualization and Presentation of various components helps to understand the business people on what they should provide more emphasis on.

5. ~~Animation~~ Entertainment : Creating visual effects, making use of green screens etc has helped people get more use of their imagination to create more

6. Animation : Using 3D modeling and other more graphical components the animators can create more lifelike creations.

7. Gaming :- More effective visualization can be done for better gaming experienc

8. Virtual Reality: Creating a dimension which has only avaters of people and people can interect with anyone through it. VR gaming and simulations are also a vast dimension still ready to explore.

So, these are some applications of computer graphics.

Ans to the Qno-1(d)

There are several Color models in computer graphics. These are explained below-

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1. RGB: Red, green and blue color each with a range of 0 to 255. Here, ther range denote ~~wat~~ what amount of color will fall in the

combination effect.

2. HSV : Hue, Saturation and Value.
Hue is the of range 0 to 360° in range. Here what amount of color degree will be in the ~~image~~ image will be determined. Saturation is of 0% to 100% in range it denotes the hardness of the color. Value denotes to the brightness of the color, it also ranges from 0% to 100%

3. HSL : Hue and Saturation same as the HSV color scheme. L stands for lightness of the screen color. 0% means dark & 100% means white

4. CYM : Cyan, Yellow and Magenta color combination. each ranges from 0 to 255. value. if all core 0 then indicated white & all 255 indicates black

5. CMYK: Cyan, Magenta and Yell
same as CMY scheme. K stan
for key value : It's 0 or 1
indication No black or black

So, these are some color models in computer graphics.

Ans to the Q no – 2(a)

CRT stands for Cathod Ray tube

1.75 It uses a electrode to throw electron beam through a tube on a phosphon plate to display color on it.

Ans to the Q no-2(b).

The Parts of CRT monitor —

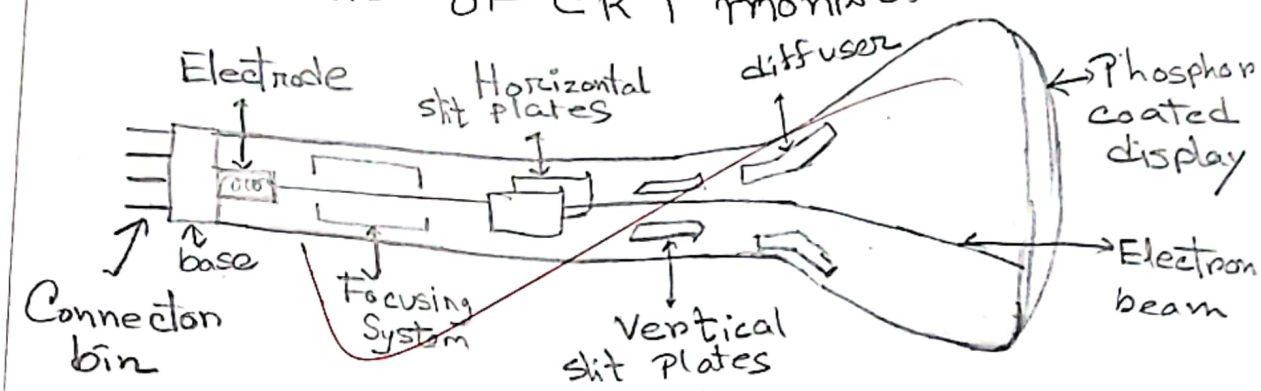

Figure: Components of CRT monitor

The parts:-

2.5

1. Connector pin
2. base
3. Electrode
4. Focusing system
5. Horizontal plates
6. Vertical plates
7. Diffuser
8. Phosphore Coated display.

Ans to the Q no-2 ©.

The CRT. monitor works in the following method -

At first the electron beam which denotes the color black on which gets its instruction from base which ~~gets~~ is connected with the connector pins. The electron beam is then released. The focusing system keeps the beam is ~~the~~ place and directs it to the plates. There are two plates the horizontal plates and the vertical plates. Horizontal plate keeps ~~da~~ the beam in position horizontally and sets its angle across ~~in~~ on which horizontal phorshor coat its ~~goni~~ going to hit. The vertical

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slits also defines on which position along vertical lines the electron beam will hit. Then on the phosphore coating the electron beam hits. This increases the phosphors energy and it illuminates. This is the mechanism of CRT.

Fig?.

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Ans to the Qno-3 (a)

~~Liqu~~ LCD stands for Liquid Crystal ~~Diode~~ Display

2

It uses a sort of semi-solid, semi-liquid compound called liquid crystals which ~~is~~ to make non-emmusive flat ~~a~~ panel displays

Ans to the Qno-3 (b)

The attributes of a good display device-

1. Better Resolution: A good display device must provide a good resolution. The density of pixel will be good enough.

3.75

2. Greater viewing angle: The higher viewing angle provides more ease of viewing component

3. Heat tolarent: The display must be heat resistent

4. Sharpness of Image :- Image should not be blurry. ~~So~~ ~~the~~ ~~D~~ for better quality of image the sharpness must be maintained.

5. Proper placing of ~~image~~ pixel :- The pixel must be set at accurate position ~~for~~ ~~better~~ according to the direction

Ans to the Qno - 3(c)

Liquid crystal display working principle -

When the system is in off state then the liquid crystals don't change their position and ~~lests~~ lets light pass straight

When the system is in on state then the liquid crystals lets the light change there Are horizontal slits and vertical ~~slid~~ slits that lets the light beam to bend and transform as necessary.

The layers -

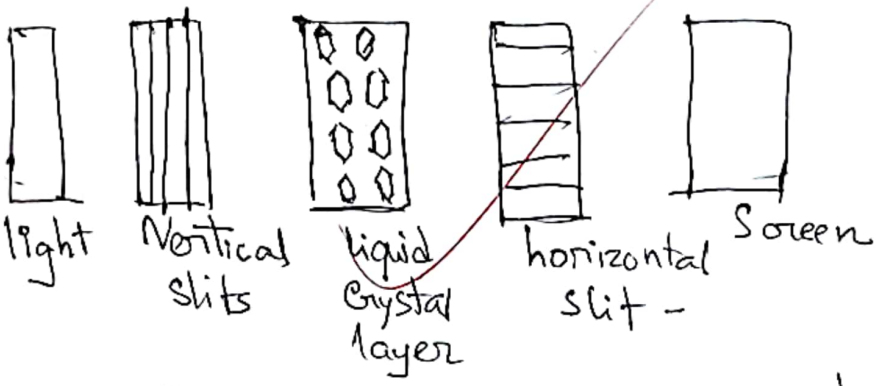

Figure: Blocks of components of LCD display.

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The light gets transformed as required through the plates and the liquid crystal screen as per required. the light beams then hits on the surface of screen and then that pixel will illuminate the ~~big~~ color. it that came from the combination

Ans to the Q no-5 (a)

DDA is a line drawing algorithm which draws the line by detecting value of the slope of the line. ~~Direct Differential Algo~~

~~There are~~ Direct Differential Analysis breaks the line in small partitions and then the line is drawn with respect to its slope value.

3.75

The algorithm -

(1) Determine value of $\Delta y = y_n - y_0$, $\Delta x = x_n - x_0$ & $m = \Delta y / \Delta x$.

(2) If $-1 < m < 1$

$$x_{n+1} = x_n + 1$$

$$y_{n+1} = y_n + m$$

Else

$$y_{n+1} = y_n + 1$$

$$x_{n+1} = x_n + \frac{1}{m}$$

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Example: $(0, 0)$ = starting vertex.
$(2, 5)$ = ending vertex.

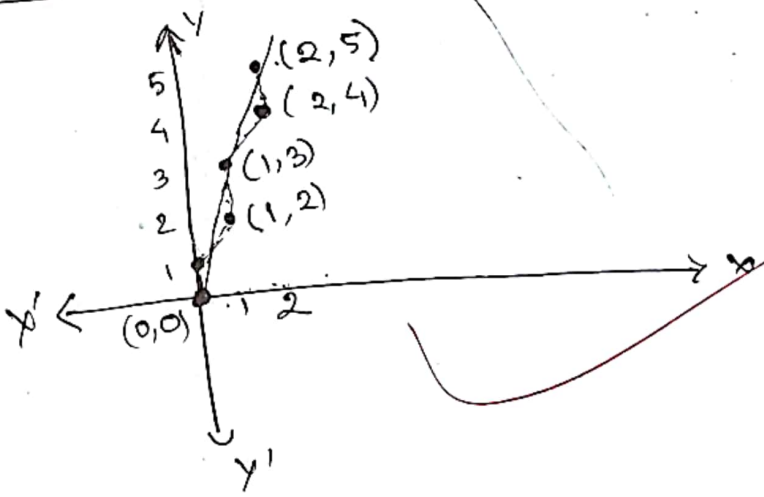
$\therefore m = \frac{\Delta y}{\Delta x} = \frac{5-0}{2-0} = \frac{5}{2} = 2.5 > 1$.

$\because -1 < m < 1$ condition is false

So, $\frac{1}{m} = 0.4$.

x	y	Round	Pixel (x, y)
0	0	0	(0, 0)
0.4	1	0	(0, 1)
0.8	2	1	(1, 2)
1.2	3	1	(1, 3)
1.6	4	2	(2, 4)
2	5	2	(2, 5)

Although this algorith is easy but still precise drawing of line can not be done



Ans to the Qno-5 (b)

Given, $x_0 = 2$, $y_0 = 5$

$x_n = 20$, $y_n = 32$

$\Delta x = 20 - 2 = 18$, $\Delta y = 32 - 5 = 27$.

5

$m = \frac{\Delta y}{\Delta x} = \frac{27}{18} = 1.5 > 1$

$\therefore x_{n+1} = x_n + \frac{1}{m}$

$y_{n+1} = y_n + 1$

$\therefore \frac{1}{m} = 0.67 \approx 0.7$

x	y	round (x)	pixel
2	5	2	2, 5
2.7	6	3	3, 6
3.4	7	3	3, 7
4.1	8	4	4, 8
4.8	9	5	5, 9
5.5	10	6	6, 10
6.2	11	6	6, 11
6.9	12	7	7, 12
7.6	13	8	8, 13
8.3	14	8	8, 14
9	15	9	9, 15
9.7	16	10	10, 16
10.4	17	10	10, 17

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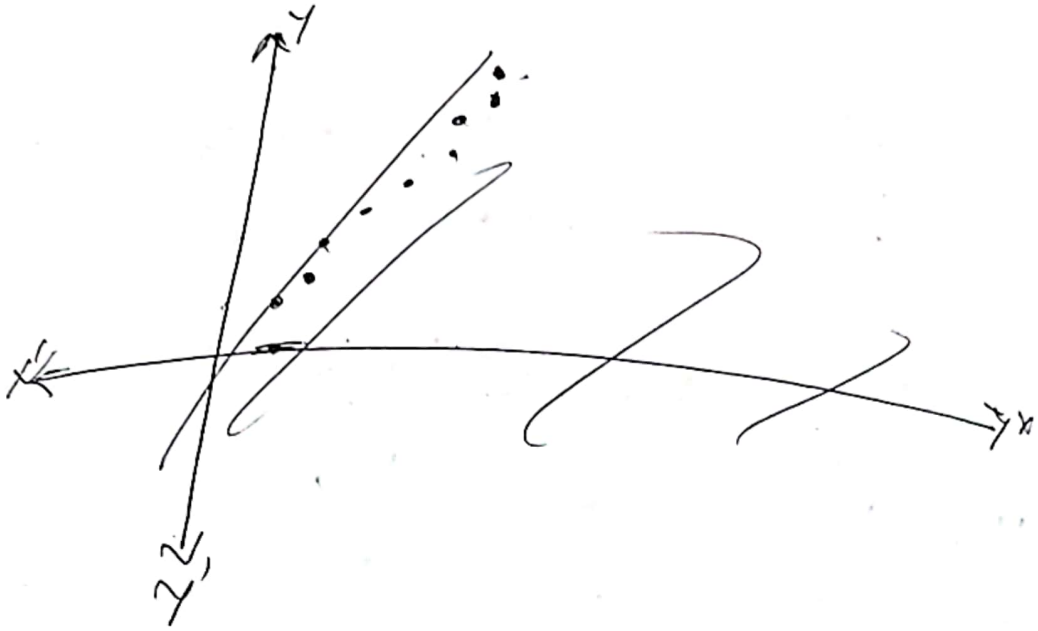
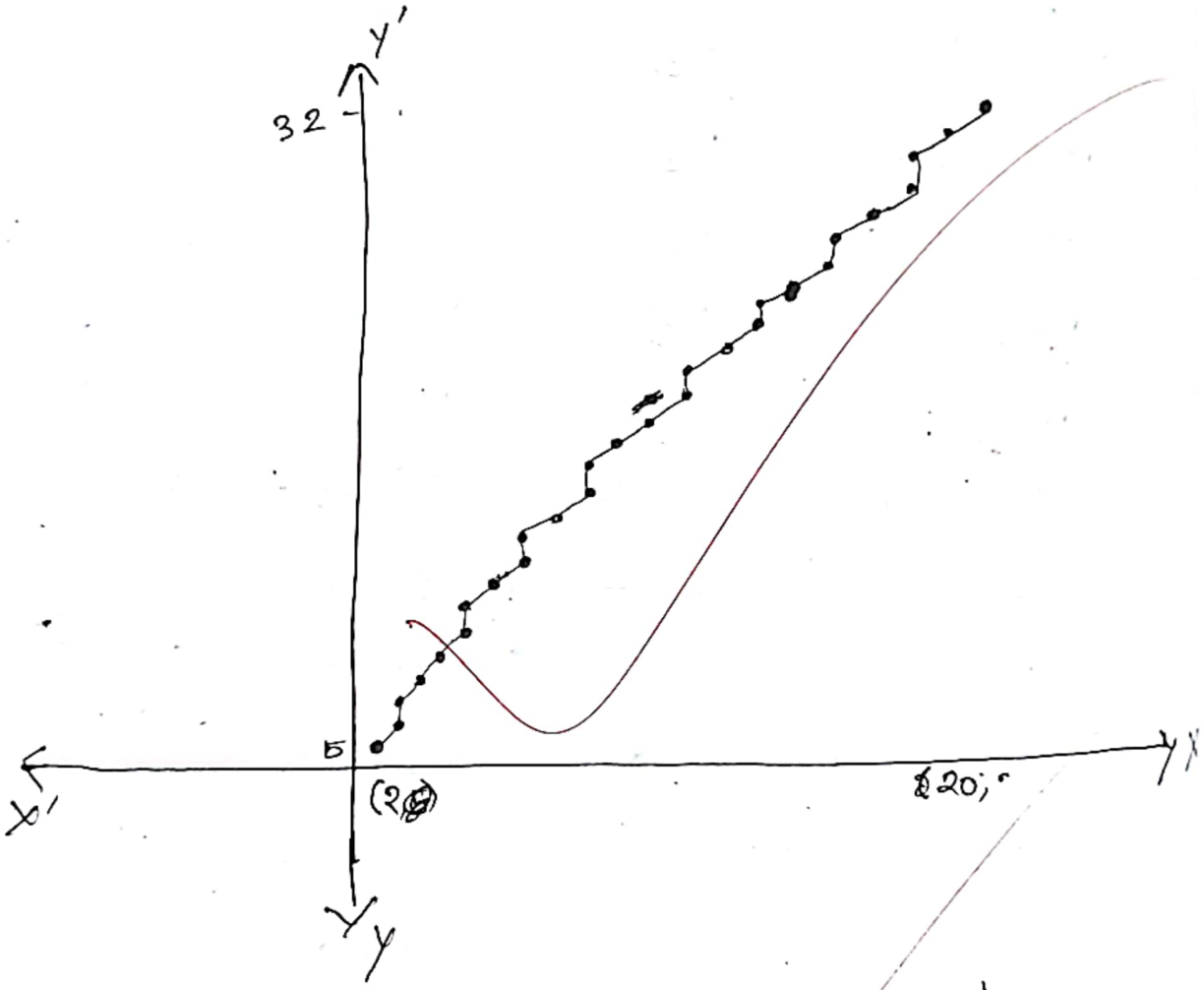
x	y	Round (x)	Pixel
11.1	18	11	11, 18
11.8	19	12	12, 19
12.5	20	13	13, 20
13.2	21	13	13, 21
13.9	22	14	14, 22
14.6	23	15	15, 23
15.3	24	15	15, 24
16	25	16	16, 25
16.7	26	17	17, 26
17.4	27	17	17, 27
18.1	28	18	18, 28
18.8	29	19	19, 29
19.5	30	20	20, 30
20.2	31	20	20, 31
20.9	32	—	(20, 32)





27 points needed to generate the line. + 2 = 29 including starting & ending.

Ans to the Qno-6(a)

Bresenham's line drawing algorithm applys only multiplication ad addition of the values. So, there is no floating point number problem in the ~~prest~~ algorithm this provides more precise data for calculation of the points.

- Let, (x_0, y_0) = starting vertex

(x_k, y_k) = ending vertex.

$\Delta y = y_k - y_0$, $\Delta x = x_k - x_0$

$\therefore P_k = 2\Delta y - \Delta x$

3.75

$P_k \geq 0$ then $P_{k+1} = P_k + 2\Delta y - 2\Delta x$

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

$y_{k+1} = y_k + 1$

$P_k < 0$ then $P_{k+1} = P_k + 2\Delta y$

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

$y_{k+1} = y_k$

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Example: $(0,0)$, $(5,5)$

$\Delta y = 5$, $\Delta x = 5$

$P_k = 2 \times \Delta y - \Delta x = 2 \times 5 - 5 = 5$

$2\Delta y - 2\Delta x$
$= 2 \times 5 - 2 \times 5$
$= 10 - 10$
$= 0$

$2\Delta y$
$= 2 \times 5 = 10$

x	y	P_k	P_{k+1}
0	0	—	—
1	1	5	0
2	2	0	0
3	3	0	0
4	4	0	0
5	5	0	0

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Ans to Qno-6 (b)

$x_0, y_0 = (2, 3)$ $\Delta y = 15 - 3 = 12$

$x_n, y_n = (6, 15)$ $\Delta x = 6 - 2 = 4$

$m = \frac{\Delta y}{\Delta x} = \frac{12}{4} = 3 > 1 \therefore \frac{1}{m} = 0.33$
$= 0.3$

x	y	round	pixel
2	3	2	2, 3
2.3	4	2	2, 4
2.6	5	3	3, 5
2.9	6	3	3, 6
3.2	7	3	3, 7
3.5	8	4	4, 8
3.8	9	4	4, 9
4.1	10	4	4, 10
4.4	11	4	4, 11
4.7	12	5	5, 12
5	13	5	5, 13
5.3	14	5	5, 14
5.6	15	5	6, 15
		6	

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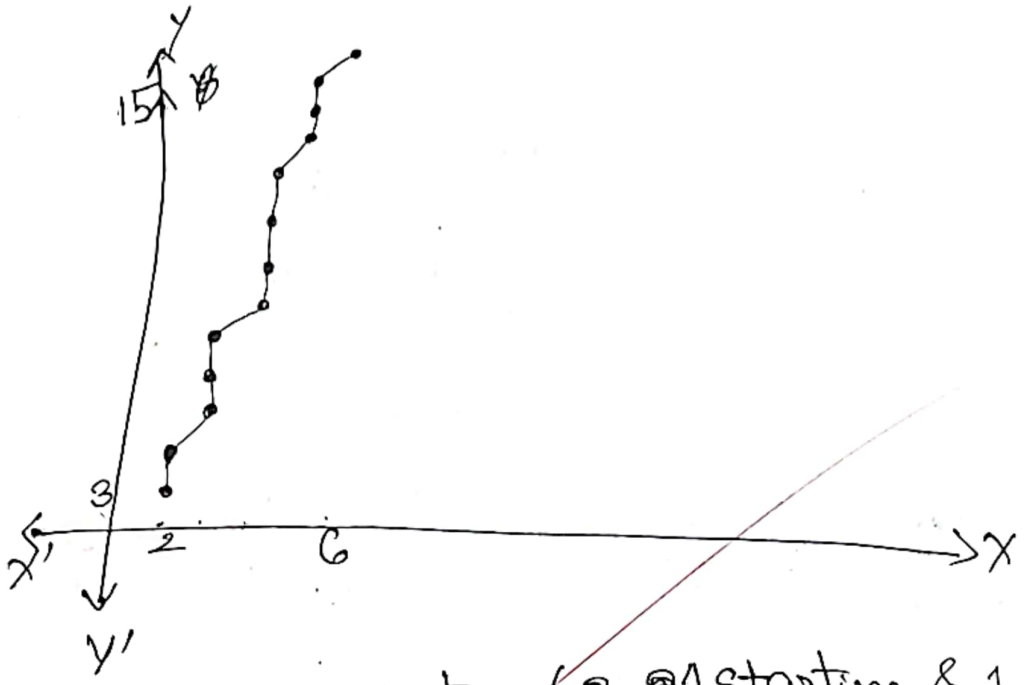


Total 14 points (1 starting & 1 ending point) required.

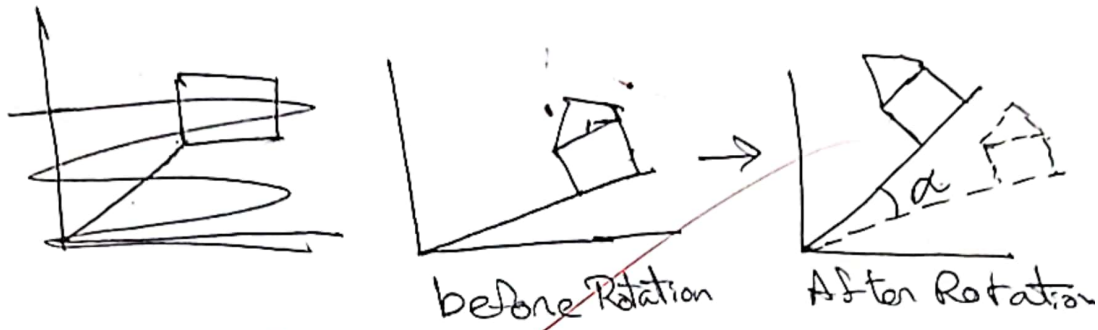
— x —

Ans to the Q no- 8 (a)

2 Dimentional transformation is the visualization of components in a graphical interface along x-axis and y-axis. These are - translation, rotation, scaling.

Ans to the Q.no-8(b)

Rotation: The transformation of the object along an angle α with respect to the x-y plane



The object itself remains same is shape only its orientation changes for α angle. along its plane

3 point: $x = [4 \quad 3]$, $R = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$

$$x' = [4 \quad 3] \times \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix} \qquad \text{angle} = 45^\circ$$

$$= [4 \quad 3] \begin{bmatrix} \cos 45 & \sin 45 \\ -\sin 45 & \cos 45 \end{bmatrix} = \text{value}$$

$$= \begin{bmatrix} 4\cos 45 + 3(-\sin 45) & 4\sin(45) + 3\cos(45) \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{7}{\sqrt{2}} \end{bmatrix}$$

$$= \begin{bmatrix} 0.70 & 4.9 \end{bmatrix}$$

$$\approx \begin{bmatrix} 1 & 5 \end{bmatrix}$$

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Ans to the Q no-8 (c)

Scaling:- The process of extending the size of a component by means of either x-plane, y-plane or both xy-plane.

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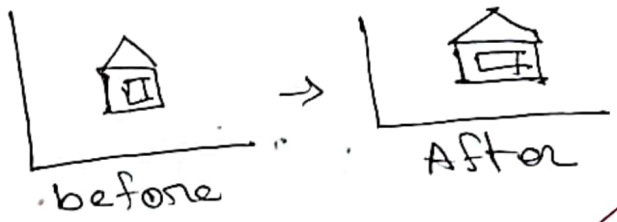

scaling along x-axis.

Scale along x-axis:- To extend the components of the image of x-axis. It holds the initial position as it is, And pulls th

Components to X-axis extended point :

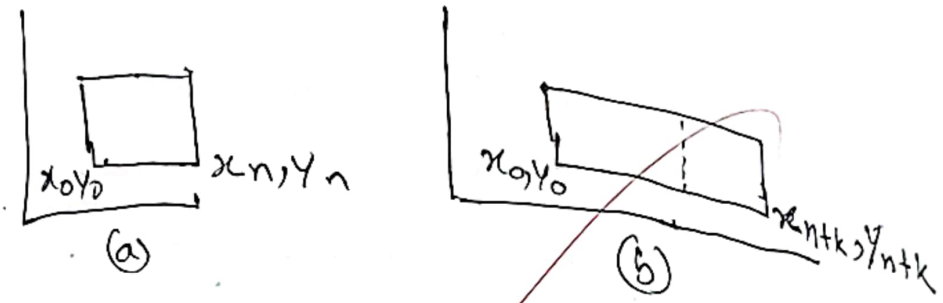

figure: a) Before scale
b) After scale

Y-Axis Scale:-

to extend along Y-axis

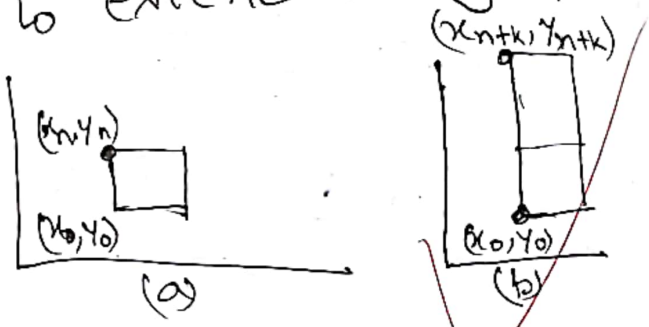

figure: a) Before scale
b) After scale

XY-Plane Scale:- To scale all components of diagram along both direction

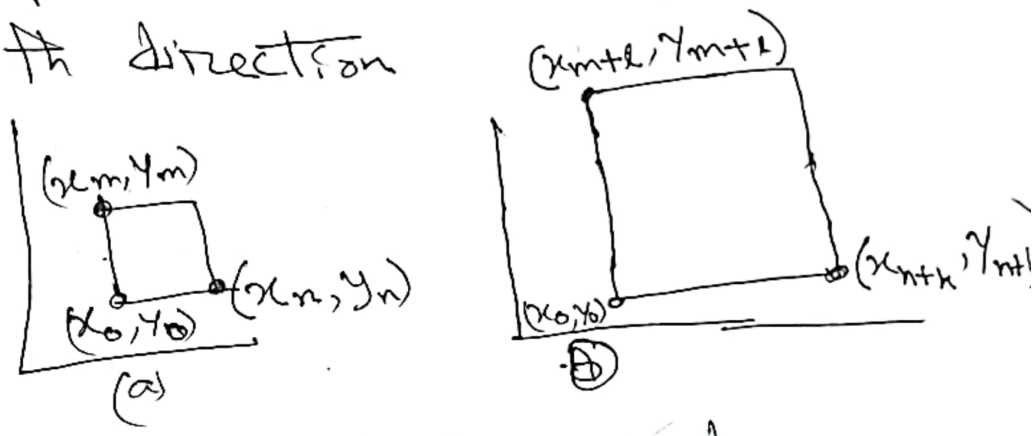

Figure: a) Before scale
b) After scaling

along x-axis with k ~~unit~~ unit
along y-axis with l unit.

Uniform ?
Un-uniform ?