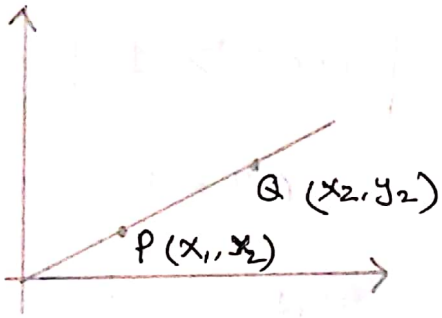
* Direct Line Equation

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

case-1



$\boxed{|m| < 1}$

To draw line PQ Line

$x = x++$

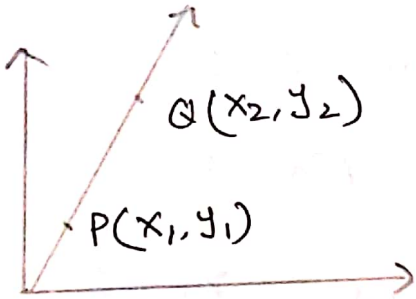
$y = mx+b$

$y = round(y)$

do untill

$x_1 < x_2$

case-2



$\boxed{|m| > 1}$

To draw PQ Line

$y = y++$

$x = \frac{y-b}{m}$

$x = round(x)$

do untill

$y_1 < y_2$

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DDA Algorithm
(Digital Differential Aanalyzer Algorithm)

$\Delta x = x_n - x_0$
$\Delta y = y_n - y_0$
$m = \frac{\Delta y}{\Delta x}$

$P = (x_0, y_0)$
$Q = (x_n, y_n)$

case-1

$\boxed{|m| \leq 1}$

$\Delta x = 1$

$x_{(i+1)} = x_i + 1$

$y_{(i+1)} = y_i + m$

while $(x_0 \leq x_n)$ {

$x_{i+1} = x_i + 1$

$y_{i+1} = y_i + m$

$y_{i+1} = \cancel{\#}$ floor$(y_{i+1} + 0.5)$

case-2

$\boxed{|m| > 1}$

$\Delta y = 1$

$y_{(i+1)} = y_i + 1$

$x_{(i+1)} = x_i + \frac{1}{m}$

while $(y_0 \leq y_n)$ {

$y_{i+1} = y_i + 1$

$x_{i+1} = x_i + \frac{1}{m}$

$x_{i+1} =$ floor$(x_{i+1} + 0.5)$

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Bresenham's Line drawing Algorithm

$P(x_0, y_0)$ $Q(x_n, y_n)$

$\Delta x = x_n - x_0$

$\Delta y = y_n - y_0$

To draw PQ

Base case $d_1 = 2\Delta y - \Delta x$

Then if

$\boxed{d_i \geq 0}$

$d_{i+1} = d_i + 2\Delta y - 2\Delta x$

$x_{i+1} = x_i + 1$

$y_{i+1} = y_i + 1$

do until $x_0 \leq x_n$

$\boxed{d_i < 0}$

$d_{i+1} = d_i + 2\Delta y$

$x_{(i+1)} = x_i + 1$

$y_{(i+1)} = y_i$

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DDA

Advantage

- → simple
- → easy to implement
- → avoids using multipication operation

disadvantage

- → extra round off overhead
- → line is not smooth /accurate due to round()

Bresenham Line

Advantage

- → faster but not as DDA
- → more accurate than DDA
- → use fix points only

disadvantage

- → still not smoth
- → only suitable for basic line drawing

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Q/ calculate the point (5,6) to (8,12) using DDA

$$m = \frac{12-6}{8-5} = \frac{6}{3} = \cancel{\frac{1}{3}}\ \frac{2}{1} = 2$$

$\boxed{m > 1}$

$$y_{i+1} = y_i + 1$$
$$x_{i+1} = \text{round}\left(x_i + \frac{1}{m}\right)$$

step-1

$x_0 = 5,\ y_0 = 6$

$\therefore y_{0+1} = y_0 + 1$

$\therefore y_1 = 6 + 1 = 7$

$$x_{0+1} = x_0 + \frac{1}{m}$$
$$= 5 + \frac{1}{2}$$
$$= 5.5$$
$$= 6$$

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step-nest

donot go forward with round up value

i	$y_{i+1} = y_i + 1$	$x_{i+1} = \text{round}(x_i + \frac{1}{m})$	(x, y)
1	7	$5.5 \cong 6$	(6, 7)
2	7+1 = 8	$(\overset{5.5}{\cancel{6}} + \frac{1}{2}) \cong 6\cancel{5}$ $= \cancel{7}6$	$(\cancel{6}\,7, 8)$
3	9	$6+.5$ $\cancel{7.5} = \cancel{8}\,6.5 = 7$	$(\overset{7}{\cancel{8}}, 9)$
4	10	$6.5+.5$ $\cancel{8.5} = \cancel{9}\,7$	$(\overset{7}{\cancel{9}}, 10)$
5	11	$7+.5$ $\cancel{9.5} = \cancel{10}\,7.5$ $= 8$	$(\overset{8}{\cancel{10}}, 11)$
6	12	$7.5+.5$ $\cancel{10.5} = \cancel{11}$ 8	$(\overset{8}{\cancel{11}}, 12)$

do round after all calculation

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Q Apply Brsenham's to draw a line from (2,3) → (8,12) show steps and resulting pixels

$\Delta x = 8-2 = 6$

$\Delta y = 12-3 = 9$

$\therefore d_0 = 2\Delta y - \Delta x$

$= 2.9 - 6 = 12$

$x_0 = 2, \; x_0 = 3$

step-1

$d_0 \geq 0$

$d_1 = d_0 + 2\Delta y - 2\Delta x$

$= 12 + 18 - 12 = 18$

$x_1 = x_0 + 1 = 2+1 = 3$

$y_1 = y_0 + 1 = 3+1 = 4$

$d_1 \geq 0$

S-2 $d_2 = d_1 + 2\Delta y - 2\Delta x$

$= 18 + 18 - 12$

$= 24$

$x_2 = 3+1 = 4$

$y_2 = 4+1 = 5$

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$d_2 \geq 0$

S-3| $d_3 = d_2 + \cancel{\Delta 2y - 2\Delta} \; 2\Delta y - 2\Delta x$

$= 24 + 18 - 12 = 30$

$x_3 = 4+1 = 5$

$y_3 = 5+1 = 6$

S-4| $d_3 \geq 0$

$d_4 = 30+18-12 = 36$

$x_4 = 6$

$\cancel{7}\, y_4 = 7$

S5| $d_4 \geq 0$ $d_5 = 36+18-12$

$x_5 = 7$

$y_5 = 8$

S6| $d_5 \geq 0$

$d_6 = 42+18-12$

$x_6 = 8$

$y_6 = 9$

$x_6 = x_n \rightarrow$ breaks

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Bresenham's Circle Drawing algorithm

center of circle (x, y) and radius r

$$x^2 + y^2 = r^2$$

step-1

$x = 0$

$y = r$

$\therefore$ intial decision $= d_0 = 3 - 2r$

starting $(x, y) = (0, r)$

while $(x \le y)$ {

setpixel (x, y)

if $\boxed{d_i < 0}$

$d_{i+1} = d_i + 4x + 6$

$x_{i+1} = x_i + 1, \quad y_{i+1} = y_i$

$\boxed{d_i \ge 0}$

$d_{i+1} = d_i + 4(x - y) + 10$

$x_{i+1} = x_i + 1$

$y_{i+1} = y_i - 1$

increment x in every step but decrease y when $d_i > 0$

∴ Here

(x_c, y_c) will be given central points of circle

∴ setpixel(x, y) {

$(x^c + x, y^c + y)$

$(x^c - x, y^c + y)$

$(x^c + x, y^c - y)$

$(x^c - x, y^c - y)$

$(y_c + y, x_c + x)$

$(y_c - y, x_c + x)$

$(y_c + y, x_c - x)$

$(\cancel{x_c -}\ y_c - y, x_c - x)$

}

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mid point circle Algorithm

$$x^2 + y^2 = r^2$$

$$\underbrace{(x-15)^2}_{x} + \underbrace{(y-10)^2}_{y} = \underbrace{60}_{r^2}$$

assume, $x = 0$

$y = r$

$d_0 = 1 - r$

while($x \le y$) {

setpixel(x, y)

if $\boxed{d_i < 0}$

$d_{i+1} = d_i + 2x + 3$

$x_{i+1} = x_i + 1$

$y_{i+1} = y_i$

if $\boxed{d_i \ge 0}$

$d_{i+1} = d_i + 2(x - y) + 5$

$x_{i+1} = x_i + 1$

$y_{i+1} = y_i - 1$

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Q given circle center point cordinates (10,10) and radius 10 and generates all the point of circle

$x = 0$
$y = 10$

$d_0 = 3 - 2r$
$= 3 - 20 = -17$

do first

step-1

$d_0 < 0$; $x_0 \cdot y_0 = (0, 10)$

then

$d_1 = d_0 + 4x_0 + 6$

$= \cancel{-17+6=-11}$

$= -17 + 4 + 6$
$= -7$

$x_1 = x_0 + 1 = 1$
$y_1 = y_0 = 10$

$\boxed{(1, 10)}$

~~as center is (10,10)~~

~~$= (1+10), (10+10) = (11, 20)$~~

~~seting octal pixel~~

~~(11, 20)~~
~~(-11, 20)~~
~~(-11, -20)~~
~~(11, -20)~~

~~(20, 11)~~
~~(-20, -11)~~
~~(-20, 11)~~
~~(20, -11)~~

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PVC

$x_c = 10,\ y_c = 10$ (central points given)

$(x, y) = (1, 10)$

$(x_c + x)\ (y_c + y) =$

$(x_c - x)\ (y_c + y) =$

$(x_c + x)\ (y_c - y) =$

$(x_c - x)\ (y_c - y) =$

$(y_c + y)\ (x_c + x) =$

$(y_c - y)\ (x_c + x) =$

$(y_c + y)\ (x_c - x) =$

$(y_c - y)\ (x_c - x) =$

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step-2

$x_1, y_1 = 1, 10$

$d_1 < 0$

$d_2 = d_1 + 4x_1 + 6 = \overset{-7}{\cancel{-1}} + 4 \cdot 2 + 6 = \cancel{-1}$ 7

then

dofirst

$x_2 = x_1 + 1 = 2$

$y_2 = y_1 = 10$

$(2, 10) \longrightarrow$ Now do PVC

step-3

$d_2 \geq 0$

$\cancel{d_2 < 0}$

$x_3 = x_2 + 1 = 2 + 1 = 3$

$y_3 = y_2 - 1 = 10 - 1 = 9$

$(3, 9) \rightarrow$ do PVC

$d_3 = d_2 + 4(3 - 9) + 10$

$= -7 - 24 + 10 = -7$

$\boxed{\text{do untill } x \leq y}$

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Q Indicate which raster locations would be chosen by mid point circle Algorithm

$(x-15)^2 + (y-10)^2 = 60$

$(x-h)^2 + (y-k)^2 = r^2$

$x = 0$

$y = r$

center

$x_c = 15$

$y_c = 10$

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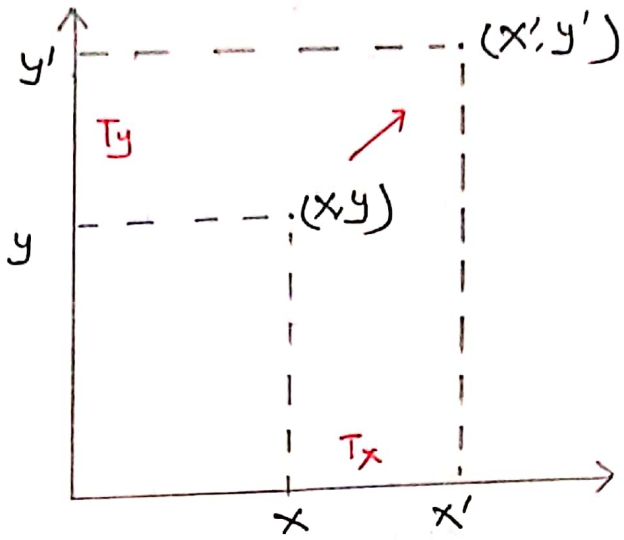
chapter-4

Translation



⊛ Geometric Transformation

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} T_x \\ T_y \end{bmatrix}$$

T_x, T_y shift vector

⊛ Coordinate Transformation

$$\begin{bmatrix} x' \\ y' \\ 1 \end{bmatrix} = \underbrace{\begin{bmatrix} 1 & 0 & T_x \\ 0 & 1 & T_y \\ 0 & 0 & 1 \end{bmatrix}}_{T_v} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

$$\bar{T}_v = \begin{bmatrix} 1 & 0 & -T_x \\ 0 & 1 & -T_y \\ 0 & 0 & 1 \end{bmatrix}$$

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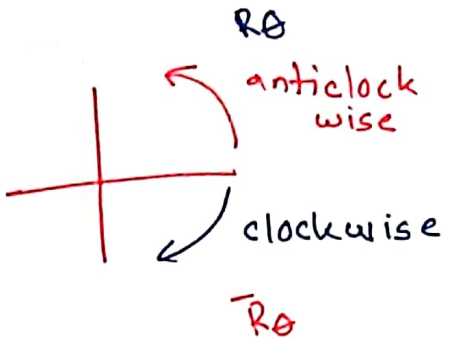
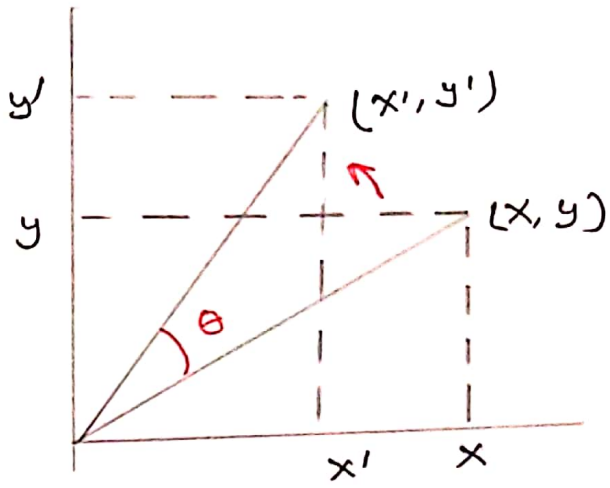
② ~~Scaling~~ Rotation





$\boxed{\text{2x2 matrix}}$

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

$\boxed{\text{3x3}}$

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

$$\bar{R}_\theta = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

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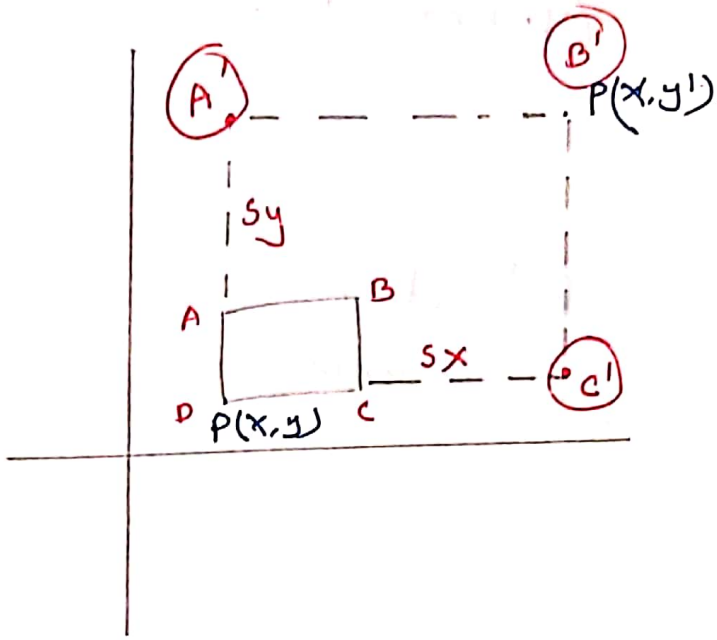
③ scaling

$S > 1$: increased

$S < 1$: decreased



$\boxed{2\times2}$

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

$\boxed{3\times3}$

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

$$\bar{S}_{x,y} = \begin{bmatrix} \frac{1}{S_x} & 0 & 0 \\ 0 & \frac{1}{S_y} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

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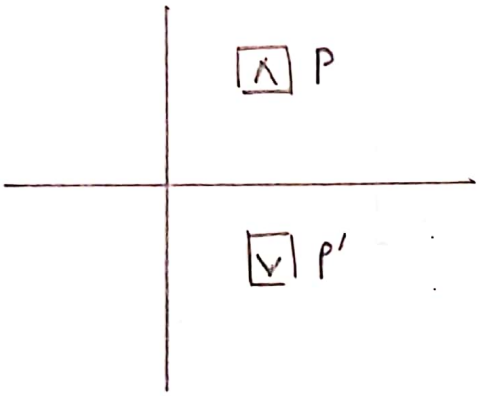
(4) Reflection

Reflection x axix

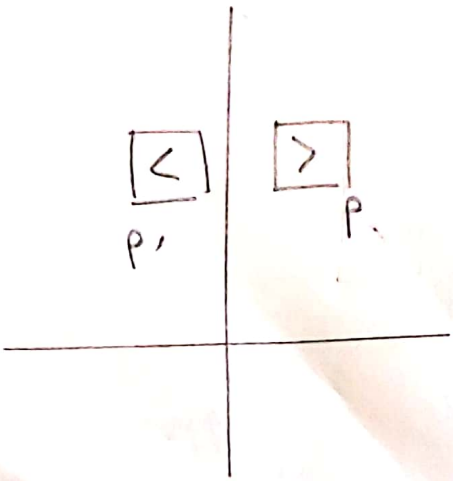


$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \underbrace{\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}}_{m_x} \begin{bmatrix} x \\ y \end{bmatrix}$$

$$\boxed{\bar{m}_x = m_x}$$

$$m_x = \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Reflection Y axis



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

$$\boxed{\bar{m}_y = m_y}$$

$$m_y = \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

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① Perform a 45° rotation of traingle

A(0,0) B(1,1) C(5,2)

ⓐ aboot origin

Given $\theta = 45°$

$$\Delta ABC = \begin{bmatrix} 0 & 1 & 5 \\ 0 & 1 & 2 \\ 1 & 1 & 1 \end{bmatrix}$$

$$R_\theta = \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \cos 45 & -\sin 45 & 0 \\ \sin 45 & \cos 45 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} & 0 \\ 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\boxed{\Delta A'B'C' = R_\theta * \Delta ABC}$$

$$= \begin{bmatrix} \frac{1}{\sqrt{2}} & -1/\sqrt{2} & 0 \\ 1/\sqrt{2} & 1/\sqrt{2} & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 & 1 & 5 \\ 0 & 1 & 2 \\ 1 & 1 & 1 \end{bmatrix}$$

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

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A = 0,0

B = 0, $\sqrt{2}$

C = $3\sqrt{2}$, $7\sqrt{2}$

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(b) $\boxed{\text{about a point } P(-1,-1)}$

(h, k)

$\theta = 45^\circ$

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

$$= \begin{bmatrix} 1 & 0 & h \\ 0 & 1 & k \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -h \\ 0 & 1 & -k \\ 0 & 0 & 1 \end{bmatrix}$$

$$= \underbrace{\begin{bmatrix} 1 & 0 & -1 \\ 0 & 1 & -1 \\ 0 & 0 & 1 \end{bmatrix}}_{B} \times \underbrace{\begin{bmatrix} \cos 45^\circ & -\sin 45^\circ & 0 \\ \sin 45^\circ & \cos 45^\circ & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & \end{bmatrix}}_{A}$$

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

$$\Delta A'B'C' = R_\theta \cdot P * \Delta ABC$$

$$= \begin{bmatrix} & & \\ & & \\ & & \end{bmatrix} * \begin{bmatrix} 0 & 1 & 5 \\ 0 & 1 & 2 \\ 1 & 1 & 1 \end{bmatrix}$$

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

NT:- if floating point values come round up them in final calculation

A = ( )

B =

C =

② magnify a traingle with vertices $A(0,0)$ $B(1,1)$ $C(5,2)$ to twice its size while keeping $C(5,2)$ fixed

$$\Delta ABC = \begin{bmatrix} 0 & 1 & 5 \\ 0 & 1 & 2 \\ 1 & 1 & 1 \end{bmatrix}$$

Given

$S_x = S_y = 2$

keeping fix $C(5,2)$ $\quad h = 5,\ k = 2$

$$S_{S_x, S_y, C} = T_V * S_{S_x, S_y} * T_V^{-1}$$

$$= \underbrace{\begin{bmatrix} 1 & 0 & h \\ 0 & 1 & k \\ 0 & 0 & 1 \end{bmatrix}}_{B} * \underbrace{\begin{bmatrix} S_x & 0 & 0 \\ 0 & S_y & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -h \\ 0 & 1 & -k \\ 0 & 0 & 1 \end{bmatrix}}_{A}$$

$$= \begin{bmatrix} 2 & 0 & -5 \\ 0 & 2 & -2 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\Delta A'B'C' = S_{S_x, S_y, C} * \Delta ABC$$

$$= \begin{bmatrix} 2 & 0 & -5 \\ 0 & 2 & -2 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 & 1 & 5 \\ 0 & 1 & 2 \\ 1 & 1 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} -5 & -3 & 5 \\ -2 & 0 & 2 \\ 1 & 1 & 1 \end{bmatrix}$$

$A' = (-5, 2)$

$B' = (-3, 0)$

$C = (5, 2)$ ans

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Q Reflect a diamond shape polygon where vertices

A(-1,0) B(0,-2) C(1,0) D(0,2)

(A) line $y = 2$

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

$\theta = 0^\circ$
$h,k = (0,2)$

$\theta = 0^\circ \; (y = 2)$

$(\overset{h}{x = 0}, \; \overset{k}{y = 2})$

$$M_L = T_V \cdot R_\theta \cdot M_x \cdot R_{\bar{\theta}} \cdot T_V^{-1}$$

$$= \begin{bmatrix} 1 & 0 & h \\ 0 & 1 & k \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} \cos\theta & -\sin\theta & 0 \\ \sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 0 & -h \\ 0 & 1 & -k \\ 0 & 0 & 1 \end{bmatrix}$$

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

$$V' = M_L \times V$$

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 4 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} -1 & 0 & 1 & 0 \\ 0 & -2 & 0 & 2 \\ 1 & 1 & 1 & 1 \end{bmatrix} = \begin{array}{c} \begin{array}{cccc} A' & B' & C' & D' \end{array} \\ \begin{bmatrix} -1 & 0 & 1 & 0 \\ 4 & 6 & 4 & 2 \\ 1 & 1 & 1 & 1 \end{bmatrix} \end{array}$$

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(b) $\boxed{\text{line } y = x + 2}$

$y = mx + c$

$\therefore m = 1$

if $(x = 0)$

$y = 0 + 2 = 2$

$x, y = (0, 2)$

$m = \tan\theta$

$\theta = \tan^{-1}(m) = \tan^{-1}(1) = 45^\circ$

$\theta = 45^\circ \quad (h, k) = (0, 2)$

$M_L = T_V R_\theta M_X R_{\bar{\theta}} T_{\bar{V}}$

$=$

$=$

$\Delta A'B'C'D' = M_L * \Delta ABCD$

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

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

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common θ

Reflect any 2D accross $y = -x$ where

$P(2,3)$

$y = -x$

$y = mx + c$

$\therefore m = -1$

$\theta = \tan^{-1}(-1)$

$= -45^\circ$

we know

Reflection on line $y = -x$

$$M_R = \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$$

if Reflection on $y = x$

$$M_R = \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$$

$P' = M_R \cdot P$

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

$$= \begin{bmatrix} -3 \\ -2 \end{bmatrix}$$

$(-3, -2)$ Ans

$\boxed{\text{(c) line } x = 2}$

$x = 2$

$\theta = 90^\circ$

$(x, y) = (2, 0)$

$M_L = T_v \cdot M_y \cdot T_{\bar{v}}$

$=$

$\therefore \Delta A'B'C'D' = M_L \cdot \Delta ABCD$

$=$

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Q. Traingle $A(-1,-3)\ B(-4,-1)\ C(-6,-4)$

→ translation 10 units right

→ then reflection in x axis

① $\Delta ABC = \begin{bmatrix} -1 & -4 & -6 \\ -3 & -1 & -4 \\ 1 & 1 & 1 \end{bmatrix}$

translation 10 units right $= \begin{bmatrix} 10 \\ 0 \\ 0 \end{bmatrix}$

$\cancel{\Delta A'B'C'} = \cancel{\begin{bmatrix} -1 & -4 & -6 \\ -3 & -1 & -4 \\ 1 & 1 & 1 \end{bmatrix} \begin{bmatrix} 10 \\ 0 \\ 1 \end{bmatrix}}$

$= \cancel{\begin{bmatrix} \quad \end{bmatrix}}$

$A' = \begin{bmatrix} -1 \\ -3 \end{bmatrix} + \overset{TV}{\begin{bmatrix} 10 \\ 0 \end{bmatrix}} = \begin{bmatrix} 9 \\ -3 \end{bmatrix}$

$A'' = M_x \cdot A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} 9 \\ -3 \end{bmatrix} = \begin{bmatrix} 9 \\ 3 \end{bmatrix}$

do this for B.C

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Q

~~show~~ show that

$$S_{a,b} \cdot S_{c,d} = S_{c,d} \cdot S_{ab} = S_{ac} S_{bd}$$

$$S_{a,b} \times S_{c,d} = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix} \begin{bmatrix} c & 0 \\ 0 & d \end{bmatrix} = \begin{bmatrix} ac & 0 \\ 0 & bd \end{bmatrix}$$

$$S_{c,d} \times S_{a,b} = \begin{bmatrix} c & 0 \\ 0 & d \end{bmatrix} \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix} = \begin{bmatrix} ac & 0 \\ 0 & bd \end{bmatrix}$$

$$S_{ac} \cdot S_{bd} = \begin{bmatrix} ac & 0 \\ 0 & bd \end{bmatrix}$$

Q show that the rotation of vector $\pi = 180°$ has the same result as multipication of the vector by Invension matrix

$$m = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$$

$$m' = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \quad \theta = 180°$$

$$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$P = M \cdot M^{-1} = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} & \end{bmatrix} = 1$$

$$= \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$M' = P$ showed

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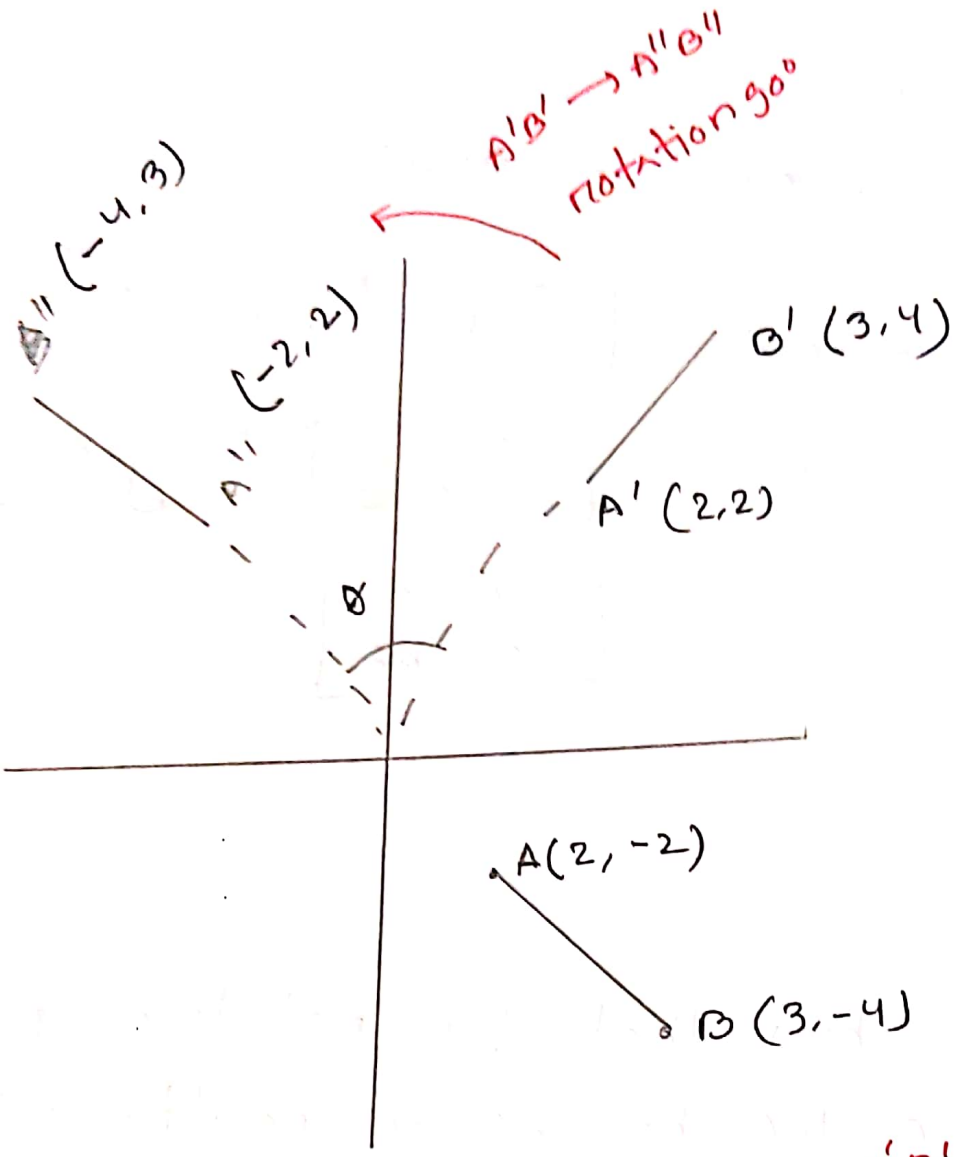
Q



AB → A'B'

MX mirror

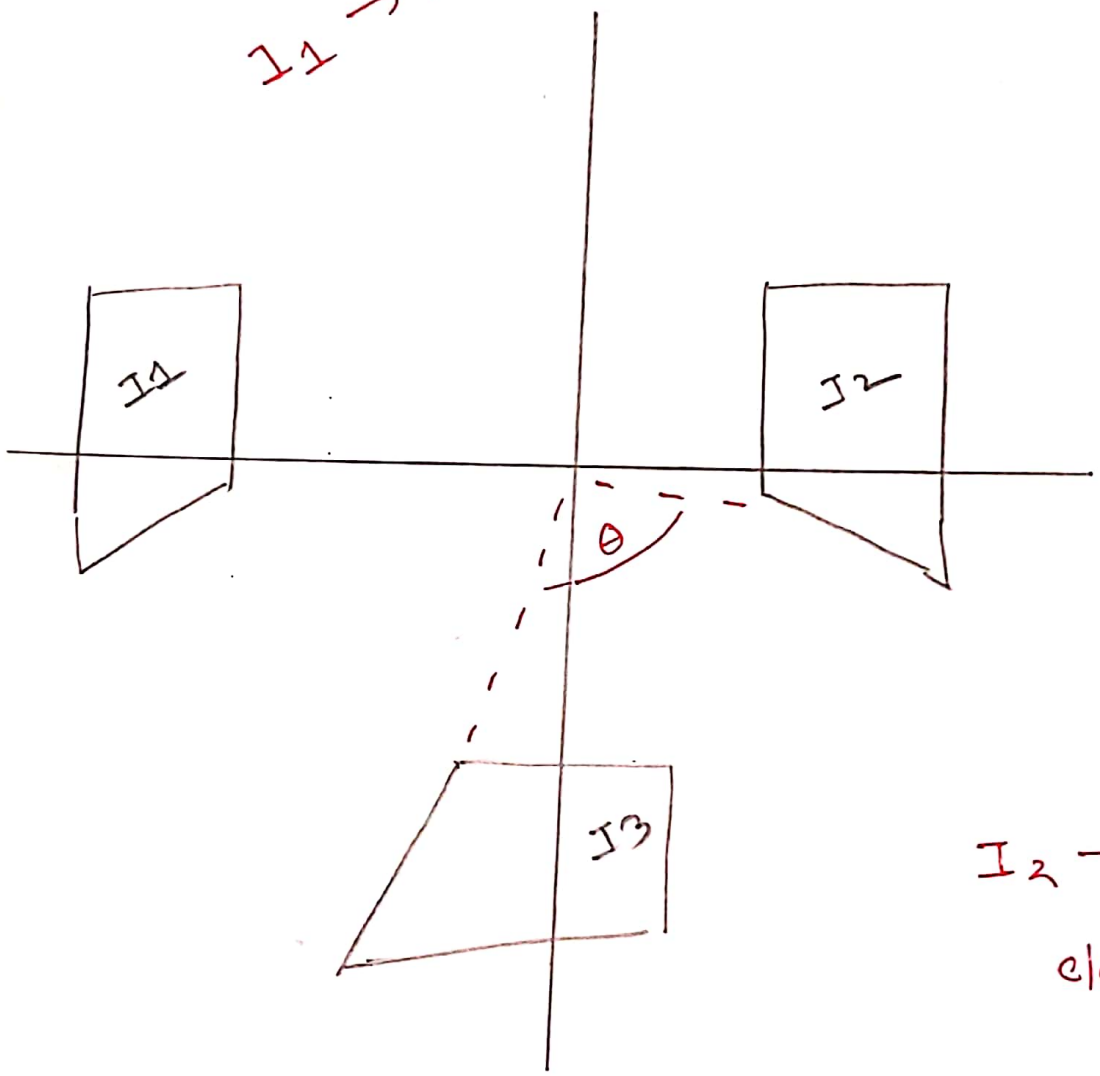
~~m = -1~~

(x, y) → (-y, x) Anticlockwise 90°

(x, y) → (y, -x) clockwise 90°

$\emptyset$

$I_1 \rightarrow I_2$ mirror y



$I_2 \rightarrow I_3$

clockwise

$90°$

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1. what is computer graphics?
2. what is resolution of image?
3. what is pixels?
4. what is image?
5. if we use direct coding with 8 bits RGB color, How many possible colors do we have for each pixels?
6. 1024X768 inch image at a resolution of 300 ppI what would be the pixel count?
7. How Look Table reduce size than direct coding?
8. what is scan conversion / Rasterization?
9. what are steps of scan converting a point?
10. Direct Line Equation Algorithm
11. DDA Line Algorithm
12. Bresenham's Line drawing Algorithm

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(13) Difference between Direct Line VS DDA

(14) Difference between DDA vs Bresenham Line

(15) Difference between Direct Line Vs Bresenham Line

— . —

(16) what is 8 way symmentric of circle?

(17) Bresenham's circle Algorithm

(18) Midpoint circle Algorithm

(19) Difference between Bresenham's VS midpoint circle

(20) plot a dashed circle using Bresenham's and midpoint circle

(21) proof that S & T are not equally far from the circle

(22) what are 4 connected and 8 connected pixels example & diagram

(23) what is circle symmetry property?

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(24) what is translation ? and it types

(25) what is Rotation ?

(26) what is Scaling ?

(27) what is Reflection ?

(28) what is composite transformation? Explain with ans

(29) Give two real life example of scaling transformation?

(30) Give real life example of coordinate transformation ?

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