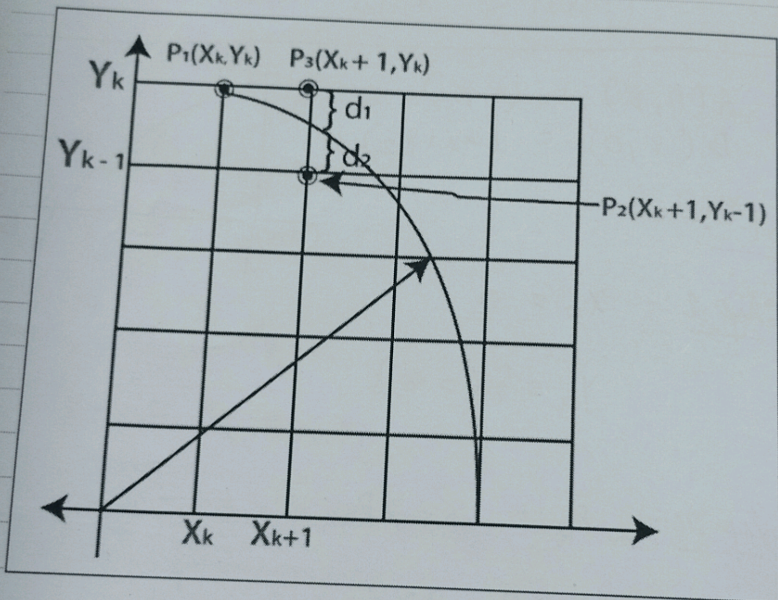
1

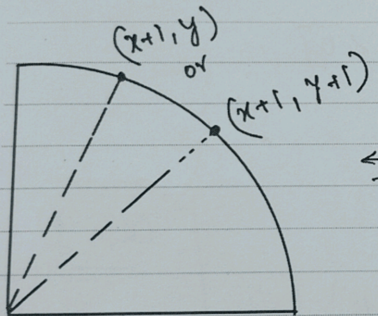
Bresenham's Circle Drawing Algorithm

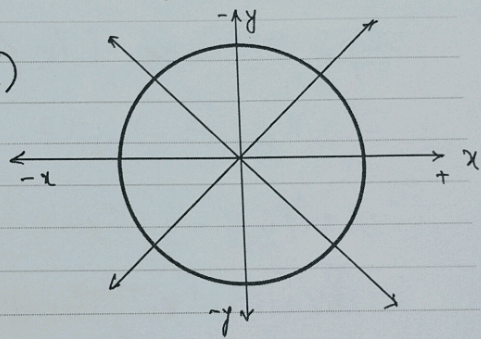


↳ It is introduced by Jack. E Bresenhams in 1962.

↳ It is disegn for integer Data.

- The circle is divided into 4 quadrants.
- Each quadrant is divided into 2 Octants.
- Calculate any one octant and rest of the octant is replicated.





Mathematical Formula:-

$$\boxed{x^2 + y^2 = r^2}$$

Algorithm:-

step 1:- x_0 = Initial x-axis value.

y_0 = 'r' = radius of circle.

(3)

Step 2:- Decession Parameters.

$$\boxed{P_K = 3 - 2R}$$

Here, we get $[P_K \geq 0]$ and $[P_K < 0]$

Step 3:- if $[P_K < 0]$

$$\left.\begin{aligned} x_{K+1} &= x_K + 1 \\ y_{K+1} &= y_K \\ P_{K+1} &= P_K + 4x_{K+1} + 6 \end{aligned}\right\} \text{Case 1}$$

plot $(x + P_x, \; y + P_y)$

if $[P_K \geq 0]$

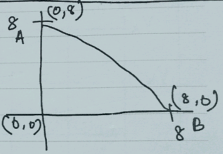
$$\text{case II} \left\{\begin{aligned} x_{K+1} &= x_K + 1 \\ y_{K+1} &= y_K - 1 \\ P_{K+1} &= P_K + 4(x_{K+1} - y_{K+1}) + 10 \end{aligned}\right.$$

plot $(x + P_x, \; y + P_y)$

Step 4 :- ~~stop the~~ Generation

$[x_{k+1} \leq y_{k+1}]$ ~~stop~~.

Q. $A(0,8) = (x_1, y_1)$
$B(8,0) = (x_2, y_2)$



Sol^n :-

Step 1 :- $x_0 = 0$

$y_0 = \{r = 8\}$

Step 2 :- $P_k = 3 - 2R$

$P_k = 3 - 2 \times 8$
$\Rightarrow 3 - 16 \Rightarrow -13$

Step 3 :- ① Here $\{\underline{P_k < 0}\}$

$x_{k+1} = x_k + 1 \Rightarrow 0 + 1 = 1$

$y_{k+1} = y_k \Rightarrow 8$

5

$$P_{k+1} = P_k + 4x_{k+1} + 6$$
$$= -13 + 4\times 1 + 6$$
$$= -13 + 4 + 6$$
$$= -3$$

(2) Here, $\{P_k < 1\}$

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

$$y_{k+1} = y_k = 8$$

$$P_{k+1} = P_k + 4x_{k+1} + 6$$

$$= -3 + 4\times 2 + 6$$

$$= -3 + 8 + 6$$
$$= 11$$

(3) Here $\{P_k \geq 1\}$

$$x_{k+1} = x_k + 1 = 2+1 = 3$$

$$y_{k+1} = y_k - 1 = 8-1 = 7$$

$$P_{k+1} = P_k + 4(x_{k+1} - y_{k+1}) + 10$$

6

$= 11 + 4(3-7) + 10$
$= 11 - 16 + 10$
$= \underline{\underline{5}}$

(4) Here, $\{P_K \geq 1\}$

$x_{K+1} = x_K + 1 = 3 + 1 = 4$

$y_{K+1} = y_K - 1 = 7 - 1 = 6$

$P_{K+1} = P_K + 4(x_{K+1} - y_{K+1}) + 10$
$= 5 + 4(4-6) + 10$
$= 5 - 8 + 10$
$= 7$

(5) Here, $\{P_K \geq 1\}$

$x_{K+1} = x_K + 1 = 4 + 1 = 5$

$y_{K+1} = y_K - 1 = 6 - 1 = 5$

$P_{K+1} = P_K + 4(x_{K+1} - y_{K+1}) + 10$
$= 7 + 4(5-5) + 10 = \underline{\underline{17}}$

step 4:- stop the process.

$\{ x_{k+1} \leq y_{k+1} \}$ generate all the remaining points.

First Octant		Second Octant	
	(x, y)		(x, y)
0	(0, 8)	6	(5, 5)
1	(1, 8)	7	(6, 4)
2	(2, 8)	8	(7, 3)
3	(3, 7)	9	(8, 2)
4	(4, 6)	10	(8, 1)
5	(5, 5)	11	(8, 0)

2nd Quadrant (-x, y)		3rd Quadrant (-x, -y)		4th Quadrant (x, -y)	
3rd oct	4th oct	5th oct	6th oct	7th oct	8th oct
(-0, 8)	(-5, 5)	(-0, -8)	(-5, -5)	(0, -8)	(5, -5)
(-1, 8)	(-6, 4)	(-1, -8)	(-6, -4)	(1, -8)	(6, -4)
(-2, 8)	(-7, 3)	(-2, -8)	(-7, -3)	(2, -8)	(7, -3)
(-3, 7)	(-8, 2)	(-3, -7)	(-8, -2)	(3, -7)	(8, -2)
(-4, 6)	(-8, 1)	(-4, -6)	(-8, -1)	(4, -6)	(8, -1)
(-5, 5)	(-8, 0)	(-5, -5)	(-8, 0)	(5, -5)	(8, 0)

(8)

step 1:- Second Method

x = initial x-axis.

y = 'r' radius.

step 2:-

$\boxed{P = 1 - r}$

step 3:-

if $(P < 0)$

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

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

$y_{k+1} = y_k$

if $(P > 0)$ $P_k + 2(x_{k+1} + y_{k+1}) + 1$

$P_{k+1} = \cancel{2(x-y)+1}$ $\cancel{P_k + 2(x_k - y_k) + 1}$

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

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

step4:- if $(x_k \geq y_k)$

Stop the generation

Pixel Generation

1	$P_x + x \,,\ P_y + y$	5 $P_x + y \,,\ P_y + x$
2	$P_x - x \,,\ P_y + y$	6 $P_x - y \,,\ P_y + x$
3	$P_x + x \,,\ P_y - y$	7 $P_x + y \,,\ P_y - x$
4	$P_x - x \,,\ P_y - y$	8 $P_x - y \,,\ P_y - x$