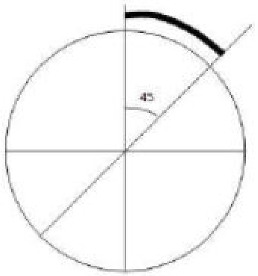
Derivation

To know d_{i+1}, we have to know d_i first.

The initial value of d_i can be obtained by replacing x=0 and y=r in (3).

Thus, we get,



$$d_o = 2 + r^2 + (r - 1)^2 - 2r^2$$

$$d_o = 2 + r^2 + r^2 + 1 - 2r - 2r^2$$

$$d_o = 3 - 2r$$

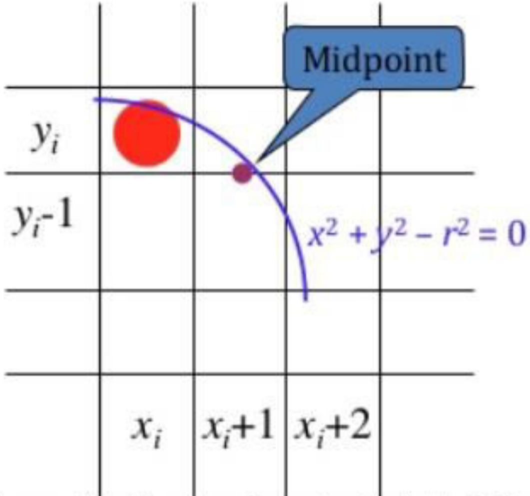
Derivation

Bresenham Circle (Xc, Yc, R):
Description: Here Xc and Yc denote the x – coordinate and y –coordinate of the center of the circle. R is the radius.

```
1. Set X = 0 and Y = R
2. Set D = 3 – 2R
3. Repeat While (X < Y)
4.          Call Draw Circle(Xc, Yc, X, Y)
5.          Set X = X + 1
6.          If (D < 0) Then
7.                    D = D + 4X + 6
8.          Else
9.                    Set Y = Y – 1
10.                   D = D + 4(X – Y) + 10
            [End of If]

      Call Draw Circle(Xc, Yc, X, Y)
            X++
            [End of While]
11. Exit
```

Lecture No 19 Topic: Midpoint Circle Algorithm



Assuming that we have just plotted the pixels at (x_i, y_i).

Which is next? (x_i+1, y_i) OR $(x_i+1, y_i - 1)$.

- The one that is closer to the circle.

- The decision parameter is the circle at the midpoint between the pixels y_i and $y_i - 1$.

$$p_i = f_{circle}(x_i + 1, y_i - \tfrac{1}{2})$$
$$= (x_i + 1)^2 + (y_i - \tfrac{1}{2})^2 - r^2$$

- If $p_i < 0$, the midpoint is inside the circle and the pixel y_i is closer to the circle boundary.
- If $p_i \geq 0$, the midpoint is outside the circle and the pixel y_i - 1 is closer to the circle boundary.

Decision Parameter

- Decision Parameters are obtained using incremental calculations

$$p_{i+1} = f_{circle}(x_{i+1}+1, y_{i+1}-\tfrac{1}{2})$$
$$= (x_i+2)^2 + (y_{i+1}-\tfrac{1}{2})^2 - r^2$$

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

OR

$$p_{i+1} = p_i + 2(x_i+1)^2 + (y_{i+1}^2 - y_i^2) - (y_{i+1} - y_i) + 1$$

where y_{i+1} is either y_i or y_i-1 depending on the sign of p_i