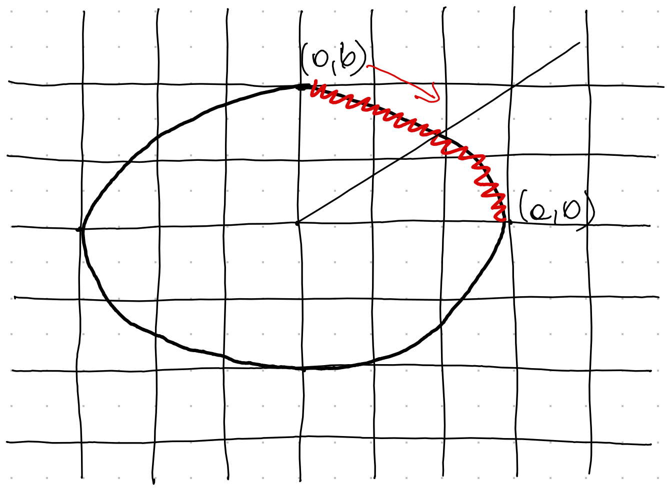
Algorytm Bresenhama rysowania elipsy



$$\frac{x^2}{a^2} + \frac{y^2}{b^2} - 1 = 0$$

$$F(x,y) = a^2 b^2 \left(\frac{x^2}{a^2} + \frac{y^2}{b^2} - 1 \right)$$
$$= b^2 x^2 + a^2 y^2 - a^2 b^2$$

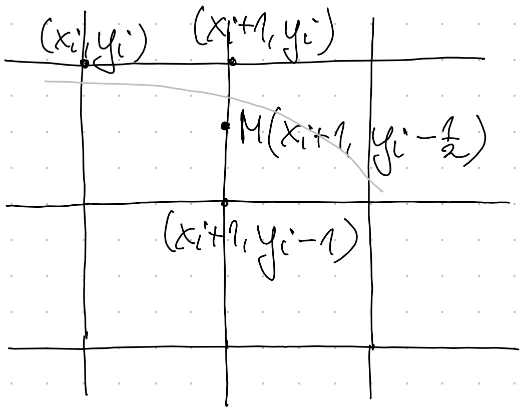
$F(x,y) = 0$ – punkt leży na elipsie

$F(x,y) > 0$ – punkt leży poza elipsą

$F(x,y) < 0$ – punkt leży wewnątrz elipsy

$$dx = \frac{\partial F}{\partial x} = 2b^2 x$$

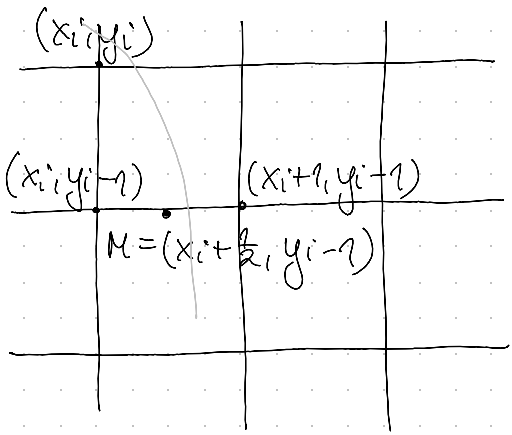
$$dy = \frac{\partial F}{\partial y} = 2a^2 y$$



$$F(M) = F(x_i+1,\ y_i - \tfrac{1}{2})$$

$$F(M) > 0 \Rightarrow (x_{i+1}, y_{i+1}) = (x_i+1, y_i-1)$$
$$F(M) \leq 0 \Rightarrow (x_{i+1}, y_{i+1}) = (x_i+1, y_i)$$

$$d_0 = F(0+1, b-\tfrac{1}{2}) = b^2 + a^2(-b+\tfrac{1}{4})$$
$$F(M) \leq 0 \Rightarrow d_{i+1} = d_i + 2b^2 x_{i+1} + b^2 = d_i + dx_{i+1} + b^2$$
$$F(M) > 0 \Rightarrow d_{i+1} = d_i + 2b^2 x_{i+1} - 2a^2 y_{i+1} + b^2$$
$$= d_i + dx_{i+1} - dy_{i+1} + b^2$$



$$F(M) = F(x_i + \tfrac{1}{2}, y_i - 1)$$
$$F(M) > 0 \Rightarrow (x_{i+1}, y_{i+1}) = (x_i, y_i - 1)$$
$$F(M) \le 0 \Rightarrow (x_{i+1}, y_{i+1}) = (x_i + 1, y_i - 1)$$

$$d_0 = d_0 + b^2(-x_i - \tfrac{3}{4}) + a^2(-y_i + \tfrac{3}{4})$$
$$F(M) \le 0 \Rightarrow d_{i+1} = d_i + 2b^2 x_{i+1} - 2a^2 y_{i+1} + a^2$$
$$= d_i + dx_{i+1} - dy_{i+1} + a^2$$
$$F(M) > 0 \Rightarrow d_{i+1} = d_i - 2a^2 y_{i+1} + a^2$$
$$= d_i - dy_{i+1} + a^2$$

Algorytm naiwny rysowania elipsy

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

$$y^2 = b^2\left(1 - \frac{x^2}{a^2}\right)$$

$$y = \pm b\sqrt{1 - \left(\frac{x}{a}\right)^2}$$