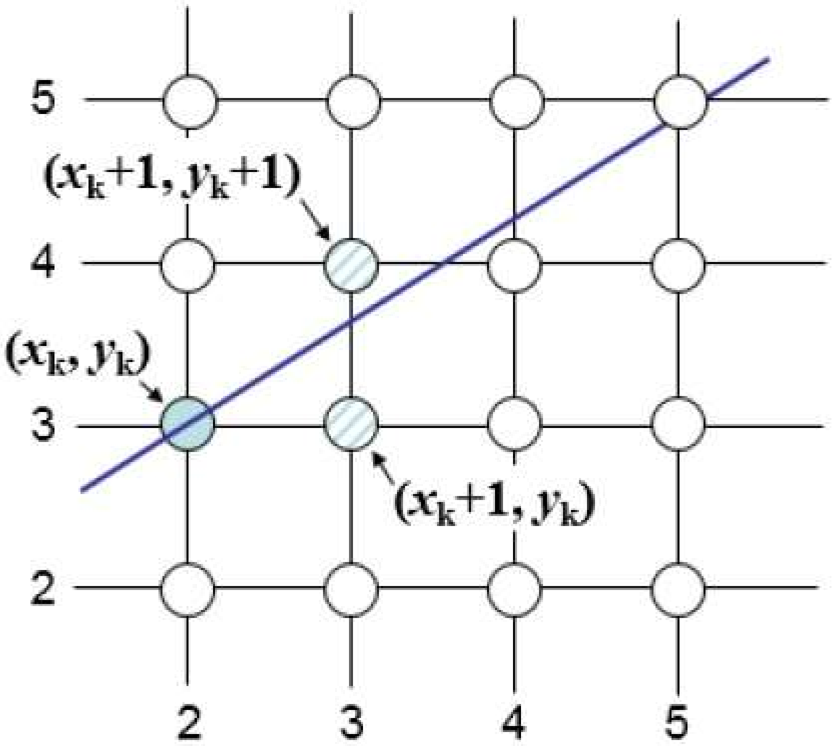
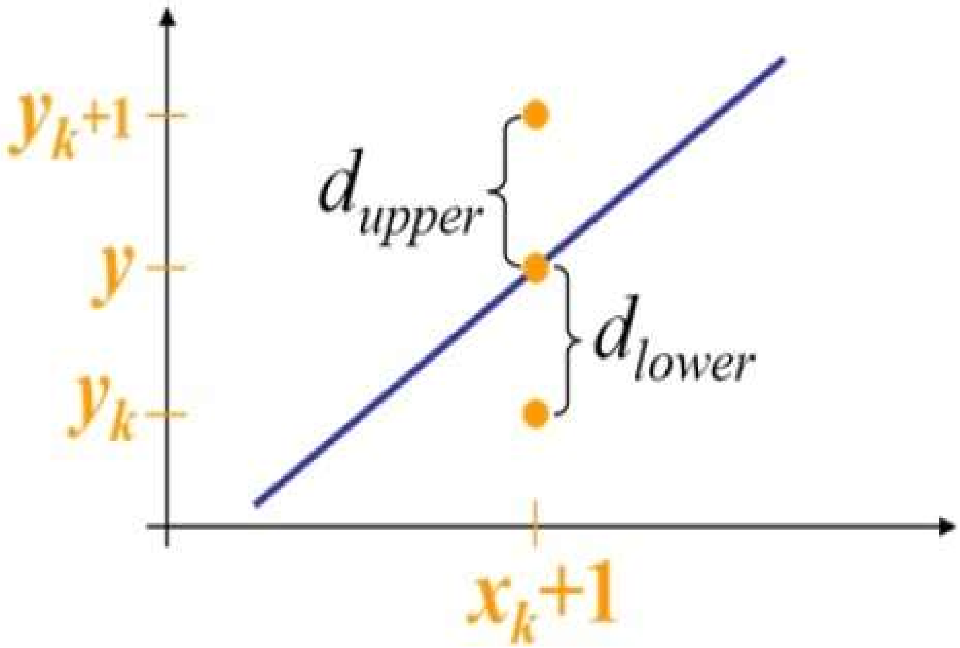
Bresenham's Algorithm

$y = m(x_k+1) + b$ $\quad$ $\boldsymbol{|m| < 1}$





http://www.tutorialspoint.com/computer_graphics/line_generation_algorithm.htm

$$y = m(x_k+1) + b$$

$$d_{lower}=y-y_k$$
$$=m(x_k+1)+b-y_k$$

$$d_{upper}=(y_k+1)-y$$
$$=y_k+1-m(x_k+1)-b$$

$$d_{lower}-d_{upper}=2m(x_k+1)-2y_k+2b-1$$

k^{th} *step decision parameter*

$$p_k=dx(d_{lower}-d_{upper})$$

If p_k *is +ve then we choose* y_{k+1}

-ve then we choose y_k

$$p_k = dx(d_{lower} - d_{upper}) = dx\left(2\frac{dy}{dx}\left(x_k + 1\right) - 2y_k + 2b - 1\right)$$

$$= 2dy.x_k - 2dx.y_k + 2dy + dx(2b - 1)$$

$$= 2dy.x_k - 2dx.y_k + C$$

$$p_{k+1} = 2dy.x_{k+1} - 2dx.y_{k+1} + C$$

$$p_{k+1} - p_k = 2dy\left(x_{k+1} - x_k\right) - 2dx\left(y_{k+1} - y_k\right)$$

$$p_{k+1} = p_k + 2dy\left(x_{k+1} - x_k\right) - 2dx\left(y_{k+1} - y_k\right)$$

$$p_0 = 2dy - dx$$

$$p_k = 2dy.x_k - 2dx.y_k + 2dy + dx(2b - 1)$$

$$b = y_0 - \frac{dy}{dx}x_0$$

Algorithm $y = m(x_k+1) + b$ $|m| < 1$

1. Among two endpoints of a straight line find the left one ,(x_0, y_0)
2. Calculate $p_0 = 2dy - dx$
3. At each x_k starting from K=0,

   If $p_k < 0$ choose $(x_k + 1, y_k)$ as the next point to plot

$$p_{k+1} = p_k + 2dy$$

   Otherwise choose $(x_k + 1, y_k + 1)$ as the next point to plot

$$p_{k+1} = p_k + 2dy - 2dx$$

Comparative study

$$y = m(x_k+1) + b$$

$|m| < 1$

$$x_{k+1} = x_k + 1, \quad y_{k+1} = ?$$

$$p_{k+1} = p_k + 2dy\left(x_{k+1} - x_k\right) - 2dx\left(y_{k+1} - y_k\right)$$

$p_k < 0$ $\qquad x_{k+1} = x_k + 1, \quad y_{k+1} = y_k$

$$p_{k+1} = p_k + 2dy$$

$p_k > 0$ $\qquad x_{k+1} = x_k + 1, \quad y_{k+1} = y_k + 1$

$$p_{k+1} = p_k + 2dy - 2dx$$

$|m| > 1$

$$y_{k+1} = y_k + 1, \quad x_{k+1} = ?$$

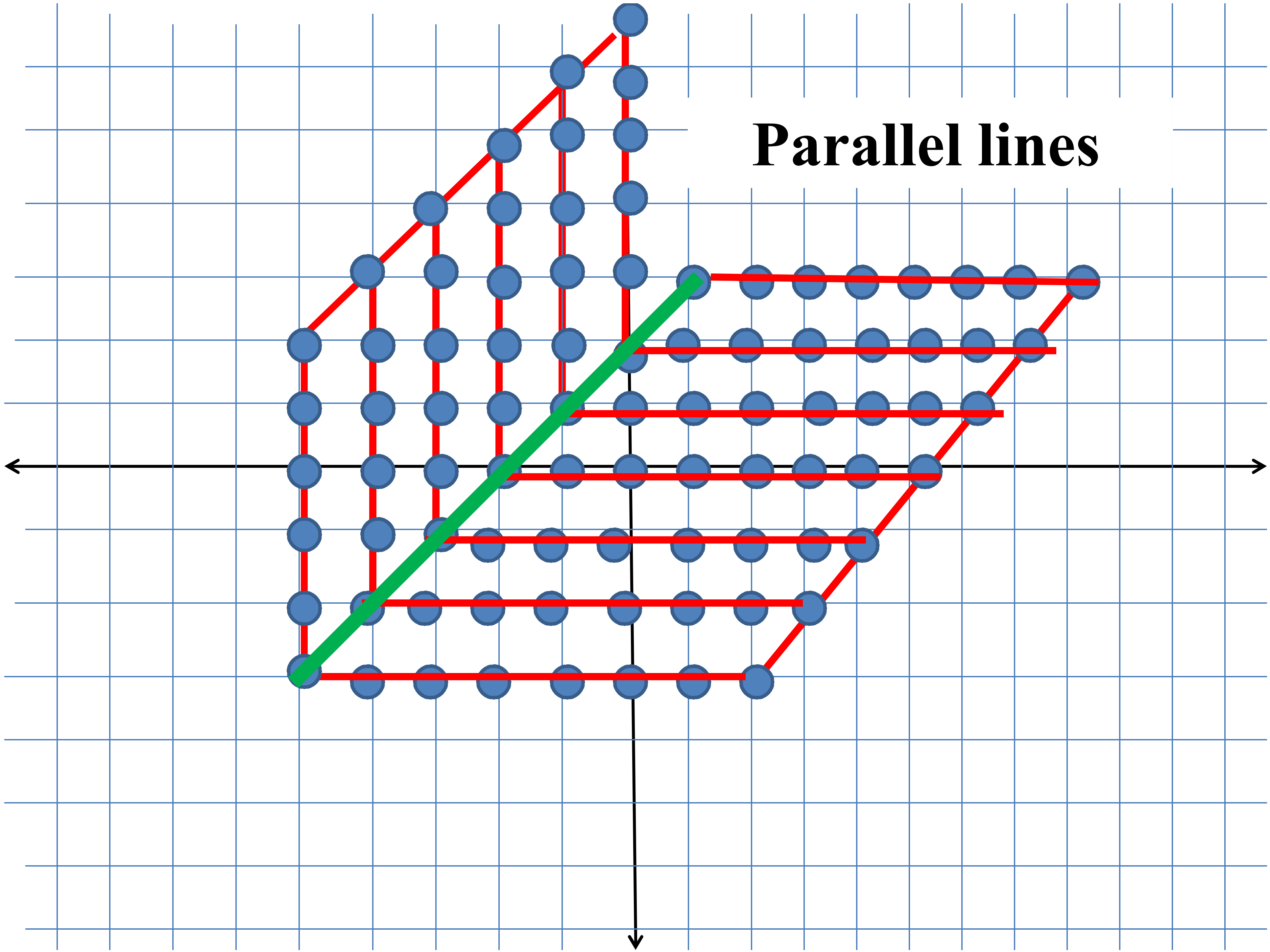
$$p_{k+1} = p_k + 2dx\left(y_{k+1} - y_k\right) - 2dy\left(x_{k+1} - x_k\right)$$

$p_k < 0$ $\qquad x_{k+1} = x_k, \quad y_{k+1} = y_k + 1$

$$p_{k+1} = p_k + 2dx$$

$p_k > 0$ $\qquad x_{k+1} = x_k + 1, \quad y_{k+1} = y_k + 1$

$$p_{k+1} = p_k + 2dx - 2dy$$


Parallel lines