

The Basic Incremental Algorithm (DDA)

$$\text{Slope } (m) = \frac{\Delta y}{\Delta x}, \quad y = mx + b$$

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{dy}{dx}, \quad b = y_1 - m \cdot x_1$$

For $(m < 1)$, inc. x by 1, then $y_i = mx_i + b$ for each x_i .

$$y_{i+1} = mx_{i+1} + b$$

$$= m(x_i + \Delta x) + b \quad (\text{if } \Delta x = 1 \text{ then } y_{i+1} = y_i + m)$$

$$= y_i + m \Delta x \quad \text{and if } x_{i+1} = x_i + 1 \text{ then } y_{i+1} = y_i + m$$

\therefore The values of x & y are defined in terms of their previous value.

A unit change in x , changes y by m which is slope of line.

If $(m > 1)$ a step in x creates a step in y greater than 1.

So, we reverse a role of x & y assigning unit step to y and inc x by Δx .

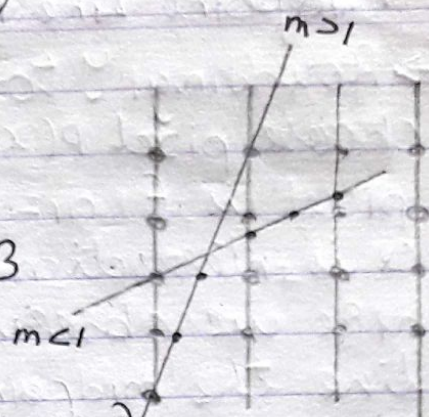
$$\Delta x = \frac{\Delta y}{m} = \frac{1}{m}$$

$$\text{inc } y_i \text{ by } 1 \text{ then } x_i = \frac{1}{m} y_i + b$$

$$\therefore x_{i+1} = \frac{1}{m} y_{i+1} + b = \frac{1}{m} (y_i + \Delta y) + b$$

$$= x_i + \frac{1}{m} \Delta y$$

$$\text{if } \Delta y = 1 \text{ then } x_{i+1} = x_i + \frac{1}{m}$$



DDA or Basic Incremental

1. Read the line end points (x_1, y_1) & (x_2, y_2) .
2. Calculate $\Delta x = |x_2 - x_1|$
 $\Delta y = |y_2 - y_1|$
 $m = \frac{\Delta y}{\Delta x}$.
3. If $(m < 1)$
Then inc x by 1
and inc y by m .
4. Repeat the process ³ from $x = x_0$ to $x \leq x_1$.
~~2~~ Print the round up values.
5. If $(m > 1)$
Then inc y by 1
and inc x by $\frac{1}{m}$.
6. Repeat the process ⁵ from $y = y_0$ to $y \leq y_1$.
print the round up values.
7. Stop.

e.g

Q Rasterized the point $(0,0)$ & $(6,4)$

Ans. $\Delta x = x_2 - x_1 = 6 - 0 = 6$; $\Delta y = y_2 - y_1 = 4 - 0 = 4$; $m = \frac{4}{6} = 0.667$.
Since $(m < 1)$

$$x = x + 1;$$

$$y_0 = y_0 + m;$$

$$y_{i+1} = 0 + 0.667 = 0.667.$$

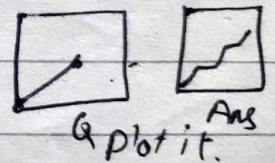
$$x = 0 + 1 \quad y = 0 + 0.667 \quad \text{new point is } (1, 1)$$

$$x = 1 + 1; \quad y = 0.667 + 0.667 = 1.33 \quad \therefore (2, 1)$$

$$x = 2 + 1; \quad y = 1.33 + 0.667 = 1.997 \quad \therefore (3, 2)$$

$$x = 3 + 1; \quad y = 1.997 + 0.667 = 2.66 \quad \therefore (4, 3)$$

$$(5, 3)$$
$$(6, 4)$$



$$Q \quad (0,0) \longrightarrow (6,7)$$

$$\Delta x = x_2 - x_1 = 6 - 0 = 6, \Delta y = y_2 - y_1 = 7 - 0 = 7$$

$$m = \frac{\Delta y}{\Delta x} = 7/6 = 1.16$$

$$(m > 1) \quad \text{inc } y \text{ by } 1 \quad x \text{ by } \frac{1}{m}$$

$$y = y + 1 \quad x = x + \frac{1}{m}$$

$$y = 0 + 1 = 1; \quad x = 0 + \frac{1}{1.16} = 0 + 0.862 = 0.862 = 1 \quad (1,1)$$

$$y = 1 + 1 = 2; \quad x = 0.862 + 0.862 = 1.724 = 2 \quad (2,2)$$

$$y = 2 + 1 = 3; \quad x = 1.724 + 0.862 = 2.586 = 3 \quad (3,3)$$

$$y = 3 + 1 = 4; \quad x = 2.586 + 0.862 = 3.448 = 3 \quad (3,4)$$

$$(4,5)$$

$$(5,6)$$

$$(6,7)$$