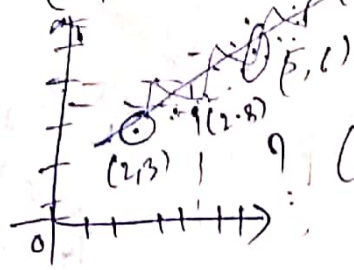
Scan Converting a Straight Line

— (1) Direct Method
(2) Simple DDA
(3) Incremental DDA
(4) ~~Integer DDA~~
(4) Bresenham's Line Drawing

(x_1, y_1) (x_2, y_2) (4)

(2,3) (5,6)



Computer → Only Integers

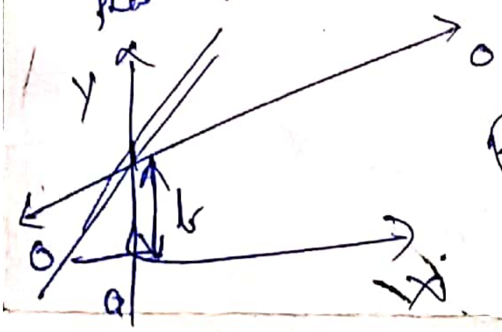
Nearest Integers

2.5 → 3

2.4 → 2

3.6 3.7 → 4

(Pixel are not near that ZigZag seems right.



Final

$y = mx + b$

$(x_1, y_1) = (3, 4)$

$(x_2, y_2) = (9, 5)$

Initial

m = Slope of line

b (y intercept)

x	y
3	4
4	4.17 → 4
5	4.33 → 4
6	4.50 → 5
7	4.66 → 5
8	4.83 → 5
9	5

$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{1}{6} < 1$

$m = \frac{dy}{dx} = \frac{\Delta y}{\Delta x}$

$m \leq 1$	$m > 1$
Increment in x	y increment
$x = 1$	$y = y+1$
$y = mx + b$	$y = mx + b$
	$x = \frac{y - b}{m}$

Simple DDA

$m \leq 1$	$m > 1$
$x = x+1$	$y = y+1$
$y = y + m$	$x = x + 1/m$

$y_1 - mx_1 = b$

$4 - (1/6)2 = b$

$b = 7/2$

$y = \frac{1}{6}(4) + 7/2$

$= 25/6 = 4.17$

Inc:

$m = \frac{y_2 - y_1}{x_2 - x_1}$

$x = x + x\,inc.$
$y = y + y\,inc.$

floating pt.

$m \leq 1$

$Step_n = dx$

$x_{inc} = \frac{dx}{dx} = 1$

$y_{inc} = \frac{dy}{dx} = m$

$m > 1$

$Step_n = dy$

(5)

Bresenham's — which raster location would be chosen by Bresenham's Algo when scan converting a line from $(1,1)$ to $(8,5)$

(x_1, y_1) (x_2, y_2)

For every integer value

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{dy}{dx}$$

P (decision parameter) $= 2dy - dx$

$m < 1$		else
$P < 0$	else $P \geq 0$	$P < 0$ else $P \geq 0$
$x = x + 1$	$x = x+1$	$y = y+1$ $x = x+1$
	$y = y+1$	$y = y+1$
$P = P + 2dy$	$P = P + 2dy - 2dx$	$P = P + 2dx$ $P = P + 2dy - 2dx$

$m = 4/7 < 1$

$dy = 4$, $dx = 7$

$(10, 12)$

$(15, 15)$

P	x	y
	1	1
$2(4) - 7 = 1$	2	2
$(1 + 8 - 7(2) = -5$	3	2
$P = P + 2dy = -5 + 8 = 3$	4	3
$P = P + 2dy - 2dx = -3$	5	3
$P = P + 2dy = 5$	6	4
$P = P + 2dy - 2dx = -1$	7	4
	8	5