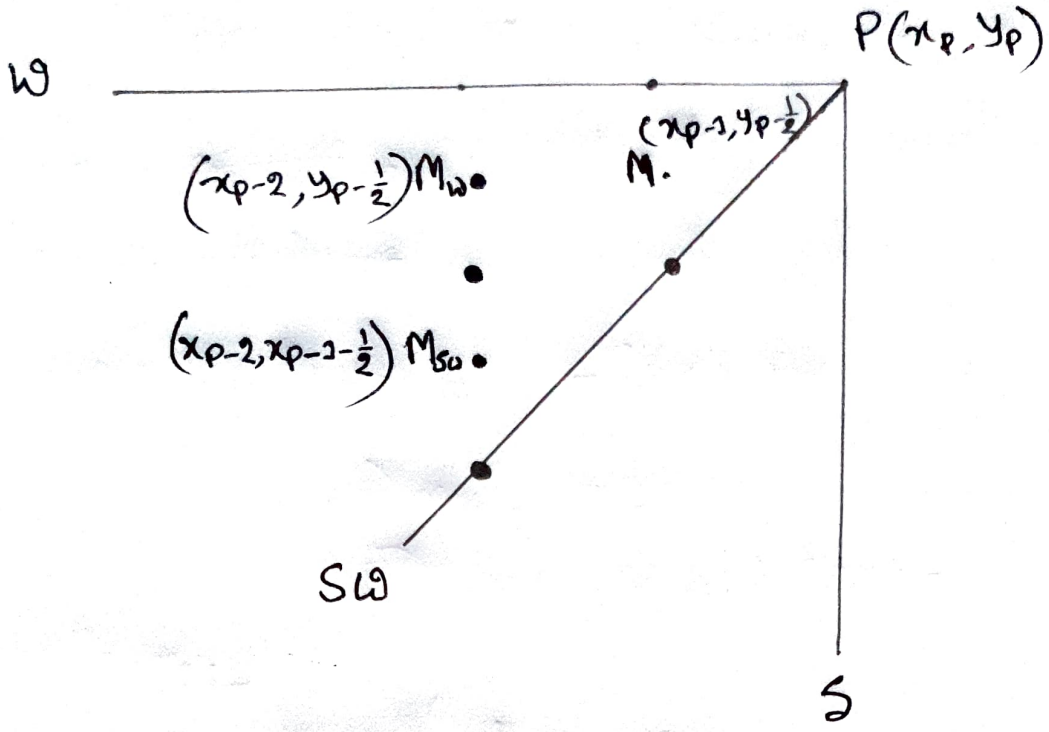
ID: U402-47-18-003



ZONE-4 : $(x_1 < x_0)$ && $(y_1 <= y_0)$

Therefore,

$$F(P) = F(x_p, y_p) = Ax_p + By_p + C$$

$$F(M) = F\left(x_{p-1}, y_p - \tfrac{1}{2}\right) = A(x_{p-1}) + B\left(y_p - \tfrac{1}{2}\right) + C$$

$$F(M_W) = F\left(x_{p-2}, y_p - \tfrac{1}{2}\right) = A(x_{p-2}) + B\left(y_p - \tfrac{1}{2}\right) + C$$

$$F(M_{SW}) = F\left(x_{p-2}, y_{p-1} - \tfrac{1}{2}\right) = A(x_{p-2}) + B\left(y_{p-1} - \tfrac{1}{2}\right) + C$$

Now, Calculating Diviation.

$$D_{init} = F(M) - F(P)$$

$$= A(x_p - 1) + B\left(y_p - \frac{1}{2}\right) + c - Ax_p - By_p - c$$

$$= Ax_p - A + By_p - \frac{B}{2} + c - Ax_p - By_p - c$$

$$= -A - \frac{B}{2}$$

$$= -dy + \frac{dx}{2} \quad [\because A = dy, B = -dx]$$

And,

$$D_{M_W} = F(M_W) - F(M)$$

$$= A(x_p - 2) + B\left(y_p - \frac{1}{2}\right) + c - A(x_p - 1) - B\left(y_p - \frac{1}{2}\right) - c$$

$$= Ax_p - 2A - Ax_p + A$$

$$= -A \quad [\because A = dy]$$

$$= -dy$$

And,

$$D_{M_{SW}} = F(M_{SW}) - F(M)$$

$$= A(x_p - 2) + B\left(y_p - 1 - \frac{1}{2}\right) + c - \left\{A(x_p - 1) + B\left(y_p - \frac{1}{2}\right) + c\right\}$$

$$= Ax_p - 2A + By_p - B - \frac{B}{2} + c - Ax_p + A - By_p + \frac{B}{2} - c$$

$$= -A - B$$

$$= -dy + dx \quad [\because A = dy, B = -dx]$$

There are fraction in deviation. we can Simply ~~reduce~~ remove it by multiply by 2 every deviation.

Therefore,

$$D_{init} = -2dy + dx$$

$$D_{MW} = -2dy$$

$$D_{MSW} = -2dy + 2dx$$

Algorithim.

```
void midpointLine(int x0, int y0, int x1, int y1, int color)
{
    int dx = x1 - x0, dy = y1 - y0;
    int x = x0, y = y0;
    int Dinit = -2*dy + dx, DMW = -2*dy, DMSW = -2*dy + 2*dx;
    writePixel(x, y, color);
    while(x >= x1)
    {
        if (Dinit < 0) Dinit += DMW;
        else { Dinit += DMSW;
               y--;
             }
        x--;
        writePixel(x, y, color);
    }
}
```