Department of Computer Science and Engineering

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UCS1712 - Graphics and Multimedia Lab

Exercise 2: DDA Line Drawing Algorithm in C++ using OpenGL

Objective:

To plot points that make up the line with endpoints (x 0 ,y 0) and (x n ,y n) using DDA line drawing algorithm.

Code:

```
#ifndef LOPENGL_H
#define LOPENGL_H

#include <GL/freeglut.h>
#include <GL/gl.h>
#include <GL/glu.h>
#include <math.h>
```

```
#include <stdio.h>
#include<iostream>
#include<vector>
#include<ctime>
using namespace std;

#endif
```

```
#ifndef LUTIL_H
#define LUTIL_H

#include "Headers.h"

//Screen Constants
const int SCREEN_WIDTH = 640;
const int SCREEN_HEIGHT = 480;
const int SCREEN_FPS = 60;
const int POINT_SIZE=2;
int X0,Y0,Xn,Yn;

const int coords[][4] ={{2, 1, 8, 3},
             {2, 1, 4, 6},
             {-2, 1, -8, 3},
             {-2, 1, -4, 6},
             {-2, -1, -8, -3},
             {-2, -1, -4, -6},
             {2, -1, 8, -3},
             {2, -1, 4, -6},
            };

bool initGL();

void update();

void render();

void selectOctant(int option);

double round_value(double v);

vector<pair<int, int>> DDA();

#endif
```

```
#include "Signatures.h"

```

```
bool initGL(){
    //Initialize Projection Matrix
    glMatrixMode( GL_PROJECTION );
    glLoadIdentity();
    gluOrtho2D(0.0,640.0,0.0,480.0);

    //Initialize Modelview Matrix
    glMatrixMode( GL_MODELVIEW );
    glLoadIdentity();

    glTranslatef( SCREEN_WIDTH / 3.f, SCREEN_HEIGHT / 3.f, 0.f );

    //Initialize clear color
    glClearColor( 0.f, 0.f, 0.f, 1.f );

    glPointSize(POINT_SIZE);
    glEnable(GL_POINT_SMOOTH);

    //Check for error
    GLenum error = glGetError();
    if( error != GL_NO_ERROR )
    {
        printf( "Error initializing OpenGL! %s\n", gluErrorString( error ) );
        return false;
    }

    return true;
}

void update(){

}

void render(){
    // cout<<X0<<" "<<Y0<<" "<<Xn<<" "<<Yn<<endl;
    vector<pair<int, int>> points = DDA();


    glClear(GL_COLOR_BUFFER_BIT);
    glColor3f(1,1,1);
    glBegin(GL_POINTS);
        for(pair<int, int> p: points){
            glVertex2d(p.first, p.second);
        }
    glEnd();
    glFlush();
}

void selectOctant(int option){
    X0 = coords[option-1][0]*20;
    Y0 = coords[option-1][1]*20;
    Xn = coords[option-1][2]*20;
    Yn = coords[option-1][3]*20;
}

double round_value(double v){
  return floor(v + 0.5);
}
vector<pair<int, int>> DDA(void){

  double dx=(Xn-X0);
  double dy=(Yn-Y0);
  double steps;
  double xInc,yInc,x=X0,y=Y0;

  steps=(abs(dx)>abs(dy))?(abs(dx)):(abs(dy));
  xInc=dx/(double)steps;
  yInc=dy/(double)steps;

  vector<pair<int, int>> points;

  points.push_back(pair<int, int>(x, y));

  int k;
  for(k=0;k<steps;k++)
  {
    x+=xInc;
    y+=yInc;

    points.push_back(pair<int, int>(round_value(x), round_value(y)));
  }
  return points;
}
```

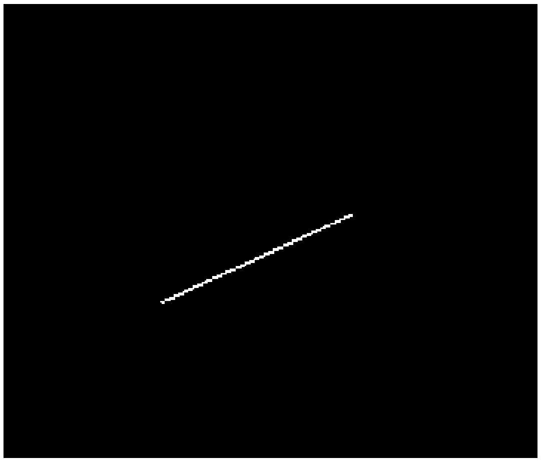
```
#include "Helpers.h"

void runMainLoop(int val);

```

```cpp
int main( int argc, char* args[] ){

    glutInit( &argc, args );

    glutInitContextVersion( 2, 1 );

    glutInitDisplayMode( GLUT_SINGLE|GLUT_RGB );
    glutInitWindowSize( SCREEN_WIDTH, SCREEN_HEIGHT );
    glutCreateWindow( "OpenGL" );

    int option=0;
    cout<<"Choose octant: (1 to 8 both inclusive): ";
    cin>>option;

    selectOctant(option);
    cout<<"Start point: ("<<X0<<", "<<Y0<<")"<<endl;
    cout<<"End point: ("<<Xn<<", "<<Yn<<")"<<endl;

    if( !initGL() )
    {
        printf( "Unable to initialize graphics library!\n" );
        return 1;
    }

    vector<pair<int, int>> points = DDA();
    int count=0;
    cout<<"Points plotted: "<<endl;
    for(pair<int, int> p: points){
        cout<<"("<<p.first<<", "<<p.second<<")"<<" ";
        count++;
        if(count==4){
            count=0;
            cout<<endl;
        }
    }

    glutDisplayFunc( render );

    glutTimerFunc( 1000 / SCREEN_FPS, runMainLoop, 0 );

    glutMainLoop();

    return 0;
}

```

```
void runMainLoop( int val ){
    update();
    render();

    glutTimerFunc( 1000 / SCREEN_FPS, runMainLoop, val );
}
```

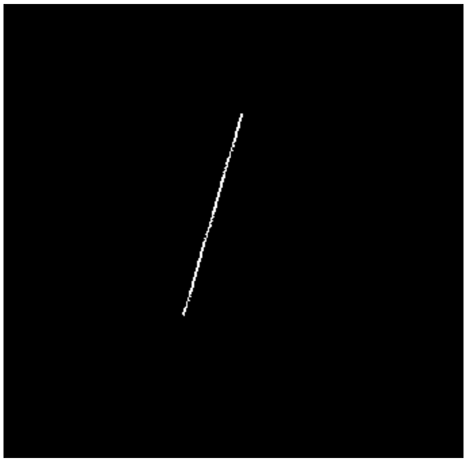
Output:

Octant 1:



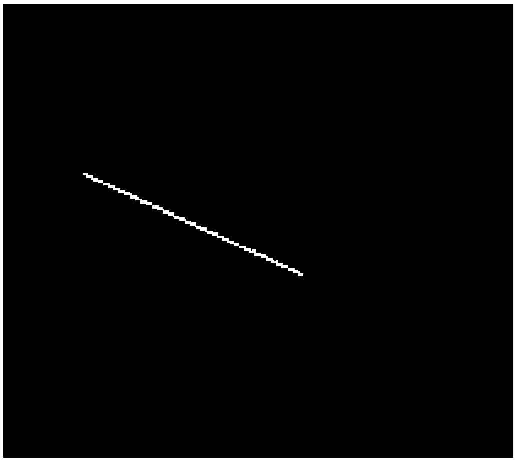
Choose octant: (1 to 8 both inclusive): 1
Start point: (40, 20) **End point:** (160, 60)
Points plotted: (40, 20) (41, 20) (42, 21) (43, 21) (44, 21) (45, 22) (46, 22) (47, 22) (48, 23) (49, 23) (50, 23) (51, 24) (52, 24) (53, 24) (54, 25) (55, 25) (56, 25) (57, 26) (58, 26) (59, 26) (60, 27) (61, 27) (62, 27) (63, 28) (64, 28) (65, 28) (66, 29) (67, 29) (68, 29) (69, 30) (70, 30) (71, 30) (72, 31) (73, 31) (74, 31) (75, 32) (76, 32) (77, 32) (78, 33) (79, 33) (80, 33) (81, 34) (82, 34) (83, 34) (84, 35) (85, 35) (86, 35) (87, 36) (88, 36) (89, 36) (90, 37) (91, 37) (92, 37) (93, 38) (94, 38) (95, 38) (96, 39) (97, 39) (98, 39) (99, 40) (100, 40) (101, 40) (102, 41) (103, 41) (104, 41) (105, 42) (106, 42) (107, 42) (108, 43) (109, 43) (110, 43) (111, 44) (112, 44) (113, 44) (114, 45) (115, 45) (116, 45) (117, 46) (118, 46) (119, 46) (120, 47) (121, 47) (122, 47) (123, 48) (124, 48) (125, 48) (126, 49) (127, 49) (128, 49) (129, 50) (130, 50) (131, 50) (132, 51) (133, 51) (134, 51) (135, 52) (136, 52) (137, 52) (138, 53) (139, 53) (140, 53) (141, 54) (142, 54) (143, 54) (144, 55) (145, 55) (146, 55) (147, 56) (148, 56) (149, 56) (150, 57) (151, 57) (152, 57) (153, 58) (154, 58) (155, 58) (156, 59) (157, 59) (158, 59) (159, 60) (160, 60)

Octant 2:



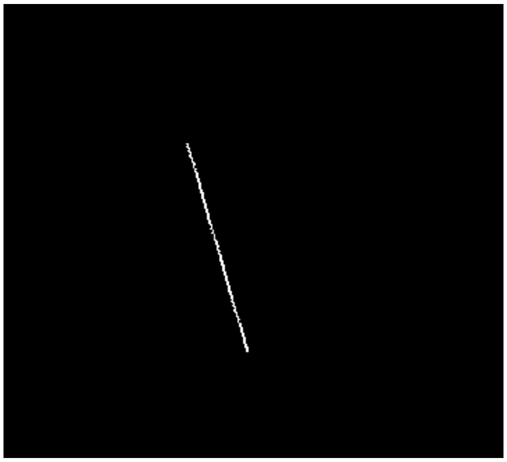
Choose octant: (1 to 8 both inclusive): 2
Start point: (40, 20) **End point:** (80, 120)
Points plotted: (40, 20) (40, 21) (41, 22) (41, 23) (42, 24) (42, 25) (42, 26) (43, 27) (43, 28) (44, 29) (44, 30) (44, 31) (45, 32) (45, 33) (46, 34) (46, 35) (46, 36) (47, 37) (47, 38) (48, 39) (48, 40) (48, 41) (49, 42) (49, 43) (50, 44) (50, 45) (50, 46) (51, 47) (51, 48) (52, 49) (52, 50) (52, 51) (53, 52) (53, 53) (54, 54) (54, 55) (54, 56) (55, 57) (55, 58) (56, 59) (56, 60) (56, 61) (57, 62) (57, 63) (58, 64) (58, 65) (58, 66) (59, 67) (59, 68) (60, 69) (60, 70) (60, 71) (61, 72) (61, 73) (62, 74) (62, 75) (62, 76) (63, 77) (63, 78) (64, 79) (64, 80) (64, 81) (65, 82) (65, 83) (66, 84) (66, 85) (66, 86) (67, 87) (67, 88) (68, 89) (68, 90) (68, 91) (69, 92) (69, 93) (70, 94) (70, 95) (70, 96) (71, 97) (71, 98) (72, 99) (72, 100) (72, 101) (73, 102) (73, 103) (74, 104) (74, 105) (74, 106) (75, 107) (75, 108) (76, 109) (76, 110) (76, 111) (77, 112) (77, 113) (78, 114) (78, 115) (78, 116) (79, 117) (79, 118) (80, 119) (80, 120)

Octant 3:



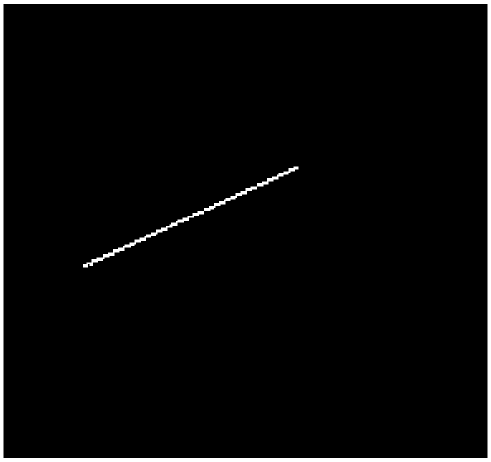
Choose octant: (1 to 8 both inclusive): 3
Start point: (-40, 20) **End point:** (-160, 60)
Points plotted: (-40, 20) (-41, 20) (-42, 21) (-43, 21) (-44, 21) (-45, 22) (-46, 22) (-47, 22) (-48, 23) (-49, 23) (-50, 23) (-51, 24) (-52, 24) (-53, 24) (-54, 25) (-55, 25) (-56, 25) (-57, 26) (-58, 26) (-59, 26) (-60, 27) (-61, 27) (-62, 27) (-63, 28) (-64, 28) (-65, 28) (-66, 29) (-67, 29) (-68, 29) (-69, 30) (-70, 30) (-71, 30) (-72, 31) (-73, 31) (-74, 31) (-75, 32) (-76, 32) (-77, 32) (-78, 33) (-79, 33) (-80, 33) (-81, 34) (-82, 34) (-83, 34) (-84, 35) (-85, 35) (-86, 35) (-87, 36) (-88, 36) (-89, 36) (-90, 37) (-91, 37) (-92, 37) (-93, 38) (-94, 38) (-95, 38) (-96, 39) (-97, 39) (-98, 39) (-99, 40) (-100, 40) (-101, 40) (-102, 41) (-103, 41) (-104, 41) (-105, 42) (-106, 42) (-107, 42) (-108, 43) (-109, 43) (-110, 43) (-111, 44) (-112, 44) (-113, 44) (-114, 45) (-115, 45) (-116, 45) (-117, 46) (-118, 46) (-119, 46) (-120, 47) (-121, 47) (-122, 47) (-123, 48) (-124, 48) (-125, 48) (-126, 49) (-127, 49) (-128, 49) (-129, 50) (-130, 50) (-131, 50) (-132, 51) (-133, 51) (-134, 51) (-135, 52) (-136, 52) (-137, 52) (-138, 53) (-139, 53) (-140, 53) (-141, 54) (-142, 54) (-143, 54) (-144, 55) (-145, 55) (-146, 55) (-147, 56) (-148, 56) (-149, 56) (-150, 57) (-151, 57) (-152, 57) (-153, 58) (-154, 58) (-155, 58) (-156, 59) (-157, 59) (-158, 59) (-159, 60) (-160, 60)

Octant 4:



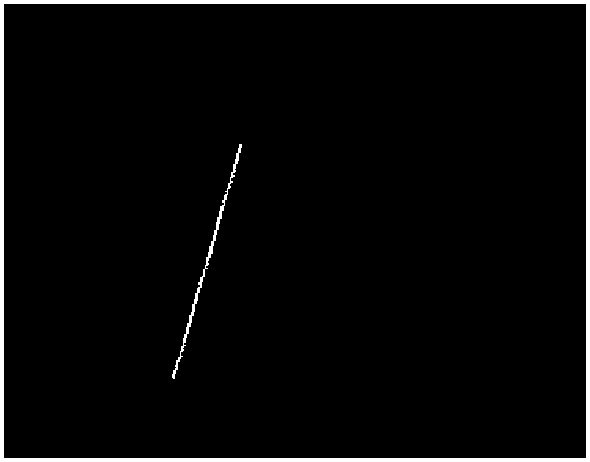
Choose octant: (1 to 8 both inclusive): 4
Start point: (-40, 20) **End point:** (-80, 120)
Points plotted: (-40, 20) (-40, 21) (-41, 22) (-41, 23) (-42, 24) (-42, 25) (-42, 26) (-43, 27) (-43, 28) (-44, 29) (-44, 30) (-44, 31) (-45, 32) (-45, 33) (-46, 34) (-46, 35) (-46, 36) (-47, 37) (-47, 38) (-48, 39) (-48, 40) (-48, 41) (-49, 42) (-49, 43) (-50, 44) (-50, 45) (-50, 46) (-51, 47) (-51, 48) (-52, 49) (-52, 50) (-52, 51) (-53, 52) (-53, 53) (-54, 54) (-54, 55) (-54, 56) (-55, 57) (-55, 58) (-56, 59) (-56, 60) (-56, 61) (-57, 62) (-57, 63) (-58, 64) (-58, 65) (-58, 66) (-59, 67) (-59, 68) (-60, 69) (-60, 70) (-60, 71) (-61, 72) (-61, 73) (-62, 74) (-62, 75) (-62, 76) (-63, 77) (-63, 78) (-64, 79) (-64, 80) (-64, 81) (-65, 82) (-65, 83) (-66, 84) (-66, 85) (-66, 86) (-67, 87) (-67, 88) (-68, 89) (-68, 90) (-68, 91) (-69, 92) (-69, 93) (-70, 94) (-70, 95) (-70, 96) (-71, 97) (-71, 98) (-72, 99) (-72, 100) (-72, 101) (-73, 102) (-73, 103) (-74, 104) (-74, 105) (-74, 106) (-75, 107) (-75, 108) (-76, 109) (-76, 110) (-76, 111) (-77, 112) (-77, 113) (-78, 114) (-78, 115) (-78, 116) (-79, 117) (-79, 118) (-80, 119) (-80, 120)

Octant 5:



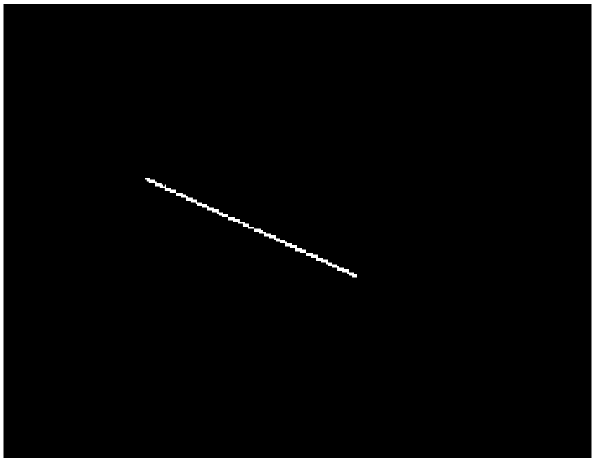
Choose octant: (1 to 8 both inclusive): 5
Start point: (-40, -20) **End point:** (-160, -60)
Points plotted: (-40, -20) (-41, -20) (-42, -21) (-43, -21) (-44, -21) (-45, -22) (-46, -22) (-47, -22) (-48, -23) (-49, -23) (-50, -23) (-51, -24) (-52, -24) (-53, -24) (-54, -25) (-55, -25) (-56, -25) (-57, -26) (-58, -26) (-59, -26) (-60, -27) (-61, -27) (-62, -27) (-63, -28) (-64, -28) (-65, -28) (-66, -29) (-67, -29) (-68, -29) (-69, -30) (-70, -30) (-71, -30) (-72, -31) (-73, -31) (-74, -31) (-75, -32) (-76, -32) (-77, -32) (-78, -33) (-79, -33) (-80, -33) (-81, -34) (-82, -34) (-83, -34) (-84, -35) (-85, -35) (-86, -35) (-87, -36) (-88, -36) (-89, -36) (-90, -37) (-91, -37) (-92, -37) (-93, -38) (-94, -38) (-95, -38) (-96, -39) (-97, -39) (-98, -39) (-99, -40) (-100, -40) (-101, -40) (-102, -41) (-103, -41) (-104, -41) (-105, -42) (-106, -42) (-107, -42) (-108, -43) (-109, -43) (-110, -43) (-111, -44) (-112, -44) (-113, -44) (-114, -45) (-115, -45) (-116, -45) (-117, -46) (-118, -46) (-119, -46) (-120, -47) (-121, -47) (-122, -47) (-123, -48) (-124, -48) (-125, -48) (-126, -49) (-127, -49) (-128, -49) (-129, -50) (-130, -50) (-131, -50) (-132, -51) (-133, -51) (-134, -51) (-135, -52) (-136, -52) (-137, -52) (-138, -53) (-139, -53) (-140, -53) (-141, -54) (-142, -54) (-143, -54) (-144, -55) (-145, -55) (-146, -55) (-147, -56) (-148, -56) (-149, -56) (-150, -57) (-151, -57) (-152, -57) (-153, -58) (-154, -58) (-155, -58) (-156, -59) (-157, -59) (-158, -59) (-159, -60) (-160, -60)

Octant 6:



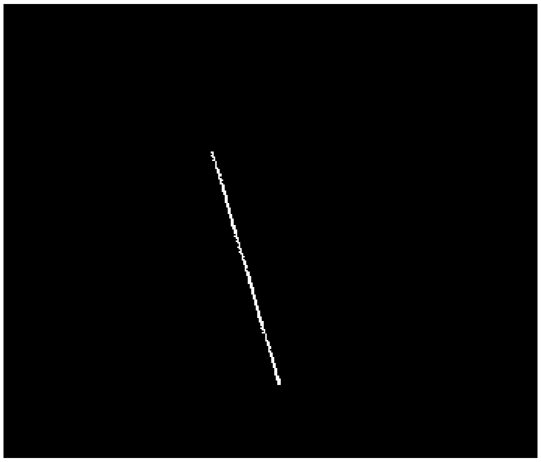
Choose octant: (1 to 8 both inclusive): 6
Start point: (-40, -20) **End point:** (-80, -120)
Points plotted: (-40, -20) (-40, -21) (-41, -22) (-41, -23) (-42, -24) (-42, -25) (-42, -26) (-43, -27) (-43, -28) (-44, -29) (-44, -30) (-44, -31) (-45, -32) (-45, -33) (-46, -34) (-46, -35) (-46, -36) (-47, -37) (-47, -38) (-48, -39) (-48, -40) (-48, -41) (-49, -42) (-49, -43) (-50, -44) (-50, -45) (-50, -46) (-51, -47) (-51, -48) (-52, -49) (-52, -50) (-52, -51) (-53, -52) (-53, -53) (-54, -54) (-54, -55) (-54, -56) (-55, -57) (-55, -58) (-56, -59) (-56, -60) (-56, -61) (-57, -62) (-57, -63) (-58, -64) (-58, -65) (-58, -66) (-59, -67) (-59, -68) (-60, -69) (-60, -70) (-60, -71) (-61, -72) (-61, -73) (-62, -74) (-62, -75) (-62, -76) (-63, -77) (-63, -78) (-64, -79) (-64, -80) (-64, -81) (-65, -82) (-65, -83) (-66, -84) (-66, -85) (-66, -86) (-67, -87) (-67, -88) (-68, -89) (-68, -90) (-68, -91) (-69, -92) (-69, -93) (-70, -94) (-70, -95) (-70, -96) (-71, -97) (-71, -98) (-72, -99) (-72, -100) (-72, -101) (-73, -102) (-73, -103) (-74, -104) (-74, -105) (-74, -106) (-75, -107) (-75, -108) (-76, -109) (-76, -110) (-76, -111) (-77, -112) (-77, -113) (-78, -114) (-78, -115) (-78, -116) (-79, -117) (-79, -118) (-80, -119) (-80, -120)

Octant 7:



Choose octant: (1 to 8 both inclusive): 7
Start point: (40, -20) **End point:** (160, -60)
Points plotted: (40, -20) (41, -20) (42, -21) (43, -21) (44, -21) (45, -22) (46, -22) (47, -22) (48, -23) (49, -23) (50, -23) (51, -24) (52, -24) (53, -24) (54, -25) (55, -25) (56, -25) (57, -26) (58, -26) (59, -26) (60, -27) (61, -27) (62, -27) (63, -28) (64, -28) (65, -28) (66, -29) (67, -29) (68, -29) (69, -30) (70, -30) (71, -30) (72, -31) (73, -31) (74, -31) (75, -32) (76, -32) (77, -32) (78, -33) (79, -33) (80, -33) (81, -34) (82, -34) (83, -34) (84, -35) (85, -35) (86, -35) (87, -36) (88, -36) (89, -36) (90, -37) (91, -37) (92, -37) (93, -38) (94, -38) (95, -38) (96, -39) (97, -39) (98, -39) (99, -40) (100, -40) (101, -40) (102, -41) (103, -41) (104, -41) (105, -42) (106, -42) (107, -42) (108, -43) (109, -43) (110, -43) (111, -44) (112, -44) (113, -44) (114, -45) (115, -45) (116, -45) (117, -46) (118, -46) (119, -46) (120, -47) (121, -47) (122, -47) (123, -48) (124, -48) (125, -48) (126, -49) (127, -49) (128, -49) (129, -50) (130, -50) (131, -50) (132, -51) (133, -51) (134, -51) (135, -52) (136, -52) (137, -52) (138, -53) (139, -53) (140, -53) (141, -54) (142, -54) (143, -54) (144, -55) (145, -55) (146, -55) (147, -56) (148, -56) (149, -56) (150, -57) (151, -57) (152, -57) (153, -58) (154, -58) (155, -58) (156, -59) (157, -59) (158, -59) (159, -60) (160, -60)

Octant 8:



Choose octant: (1 to 8 both inclusive): 8
Start point: (40, -20) **End point:** (80, -120)
Points plotted: (40, -20) (40, -21) (41, -22) (41, -23) (42, -24) (42, -25) (42, -26) (43, -27) (43, -28) (44, -29) (44, -30) (44, -31) (45, -32) (45, -33) (46, -34) (46, -35) (46, -36) (47, -37) (47, -38) (48, -39) (48, -40) (48, -41) (49, -42) (49, -43) (50, -44) (50, -45) (50, -46) (51, -47) (51, -48) (52, -49) (52, -50) (52, -51) (53, -52) (53, -53) (54, -54) (54, -55) (54, -56) (55, -57) (55, -58) (56, -59) (56, -60) (56, -61) (57, -62) (57, -63) (58, -64) (58, -65) (58, -66) (59, -67) (59, -68) (60, -69) (60, -70) (60, -71) (61, -72) (61, -73) (62, -74) (62, -75) (62, -76) (63, -77) (63, -78) (64, -79) (64, -80) (64, -81) (65, -82) (65, -83) (66, -84) (66, -85) (66, -86) (67, -87) (67, -88) (68, -89) (68, -90) (68, -91) (69, -92) (69, -93) (70, -94) (70, -95) (70, -96) (71, -97) (71, -98) (72, -99) (72, -100) (72, -101) (73, -102) (73, -103) (74, -104) (74, -105) (74, -106) (75, -107) (75, -108) (76, -109) (76, -110) (76, -111) (77, -112) (77, -113) (78, -114) (78, -115) (78, -116) (79, -117) (79, -118) (80, -119) (80, -120)