CS410 FALL 2020 **DUE**: 9/28/2020

PROGRAMMING ASSIGNMENT 1P

Purpose

The purpose of this assignment is to give you practice with writing more expressions for evaluation, formatting and using Math library functions.

Problem

There is no starter file provided for this assignment. You MUST submit a file called **points.c**, submitting a file by any other name will fail all your tests. For this submission, Mimir test cases are set up such that there is a "rubric item" for every test case. Test cases t1, t2, t3 use different inputs to test your program. As long as your program compiles without errors and runs you may see that these test cases "pass" even if the results are not accurate. The actual grade for each one of these test cases is set to 0 points since we need to verify your program output before assigning a grade to the corresponding rubric item for that test. You will need to look at the compiler stack trace for each test case and make sure you see the output for accuracy of your results. Results are not tested automatically by Mimir for this assignment but we will be checking them when we grade.

Problem

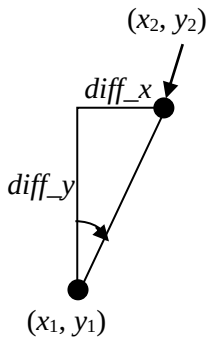
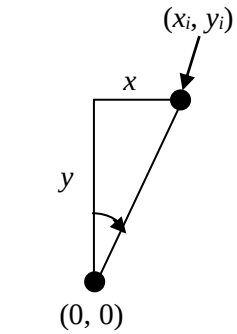
Write a program that prompts the user for the coordinates of two points (x_1, y_1) and (x_2, y_2) in meters, and prints in this order: x1, y1, x2, y2. Each point accepted by the user is a "float" data type variable.
(1) The distance between them
(2) The bearing angle from the first point to the second point
(3) The sweep angle (originating at the origin) swept from the first point to the second point.
Your program must print out 3 separate tables, each intended for audiences that have different requirements for precision, units, and space in which to print their tables. Here are the specifications for those tables in terms of units, characters available for each item, and number of digits required for each item:

	Units distance/angle	**Distance**	**Bearing**	**Sweep**
Table 1	Meters (m) / radians	5 characters, no decimal	6 chars, 3 digits	6 chars, 3 digits
Table 2	Meters (m) / degrees	10 characters, 5 digits	8 chars, 3 digits	6 chars, 2 digits
Table 3	Feet (ft) / degrees	9 characters, 2 digits	4 chars, no decimal	5 chars, 1 digit

Your program needs to use many functions. Here are the ones you need for this progam:

- sqrt(x) – returns the square root of the value of x
- pow(x, n) – returns the value of x raised to the power of n
- atan2(opp, adj) – returns the angle (in radians) of a triangle with sides of length opp and adj lengths

Formulae for computations

	Distance between two points $P(x_1, y_1)$ and $Q(x_2, y_2)$ is given by: $d(P,Q) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
	<u>To calculate the bearing from the first point to the second:</u> For directional bearings, 0º is along the y-axis (instead of along the x-axis for math)—it's like the whole coordinate system is flipped around the diagonal line *y = x.* Therefore, *diff_x* is the "*opp*osite" side of the angle, and *diff_y* is the "*adj*acent" side. You can use the atan2 math function to find the bearing angle by providing the *diff_x* and *diff_y* explained above as arguments i.e. bearing_angle = atan2(diff_x, diff_y) *Note: The bearing angle computed using atan2 gives the angle in radians*
	<u>To calculate the sweep angle from the first point to the second:</u> Find the bearing angle from the **origin** (0, 0) to the second point, then *subtract* the bearing angle from the origin to the first point. The bearing angle from the origin to any point can be computed using atan2 function just the same way as above (since the origin is used as one point, it will just be the x and y values)

Input

The input will come from standard input, that is, from a user at the keyboard. Input prompts must be accurate. You will test input redirected from an input file. Sample input files are available in the public folder.

Two Pairs of (x, y) values – must be able to accept single precision floating point numbers ("float" data type)

- Order of inputs: x1, y1, x2, y2
- (x1, y1) is the first point; (x2, y2) is the second point

Output

Output formatting as specified in the sample output files (one sample is shown below). Output will be sent to standard output (the screen).

```
Points are: (x1,y1)=(9220.30,1971.25), (x2,y2)=(2259.78,-2235.91)
+-------------------------------------------------------------------------------+
|       Distance (meters)|  Bearing Angle (radians)|    Sweep Angle (radians)|
+-------------------------------------------------------------------------------+
|                    8133|                   -2.114|                    0.991|
+-------------------------------------------------------------------------------+

+-------------------------------------------------------------------------------+
|       Distance (meters)|  Bearing Angle (degrees)|    Sweep Angle (degrees)|
+-------------------------------------------------------------------------------+
|              8133.20564|                -121.150|                     56.76|
+-------------------------------------------------------------------------------+

+-------------------------------------------------------------------------------+
|       Distance (meters)|  Bearing Angle (radians)|    Sweep Angle (radians)|
+-------------------------------------------------------------------------------+
|                26683.75|                    -121|                     56.8|
+-------------------------------------------------------------------------------+
```

Testing

On all your assignments, including this one, it is crucial that you test your program thoroughly. Do not add additional features that are not being asked for, since your program may not run against test inputs that I have created.

Grade Key

Name, comments, variable naming convention, appropriate constants defined	**10**
Distance in meters	**25**
Bearing angle in radians	**10**
Bearing angle in degrees	**10**
Sweep angle in radians	**10**
Sweep angle in degrees	**10**
Output Formatting	**25**