ASSIGNMENT - 1
RANDOM WALK

Conclusion

Let us assume that after the drunk man has finished his random walk that consists of 'N' steps he is at a point identified as (x,y) on the graph. The formula used to calculate the Euclidean distance that the man has travelled from the origin (the lamp post or (0,0) on graph) is:

Euclidean Distance = $\sqrt{(x^2 + y^2)}$

After analyzing the data generated by conducting the 'Random Walk' experiment for several values of 'N', we can see that a relationship can be approximated between the values of 'N' and the mean Euclidean Distance travelled from the lamp post.

The concluded approximate relationship between the values of 'N' and the 'Euclidean Distance' is:

Euclidean Distance = $\sqrt{N}$

Evidence

The code (see attached java file) is modified to run the 'Random Walk' experiment multiple times for different values of 'N' (number of steps in a walk).

The code iterates over 'N' starting with a value of 1 and ending at 1000 while it increments by 1at each iteration.

For every value of 'N' the 'Random Walk' experiment is performed 100 times and the average value of the Euclidean Distance is found out.

Hence the 'Random Walk' experiment is run over 1000*100 times and the results are gathered. I modified the output to be of the following format:

Value of N1   Average Euclidean Distance1

Value of N2   Average Euclidean Distance2

Value of Nn   Average Euclidean DistanceN

I then plotted the data onto a graph to look for trends in the results that were generated. It can be seen in the image below which represents the graph where Y-Axis is the Mean Euclidean Distance and the X-Axis is the respective value of N.
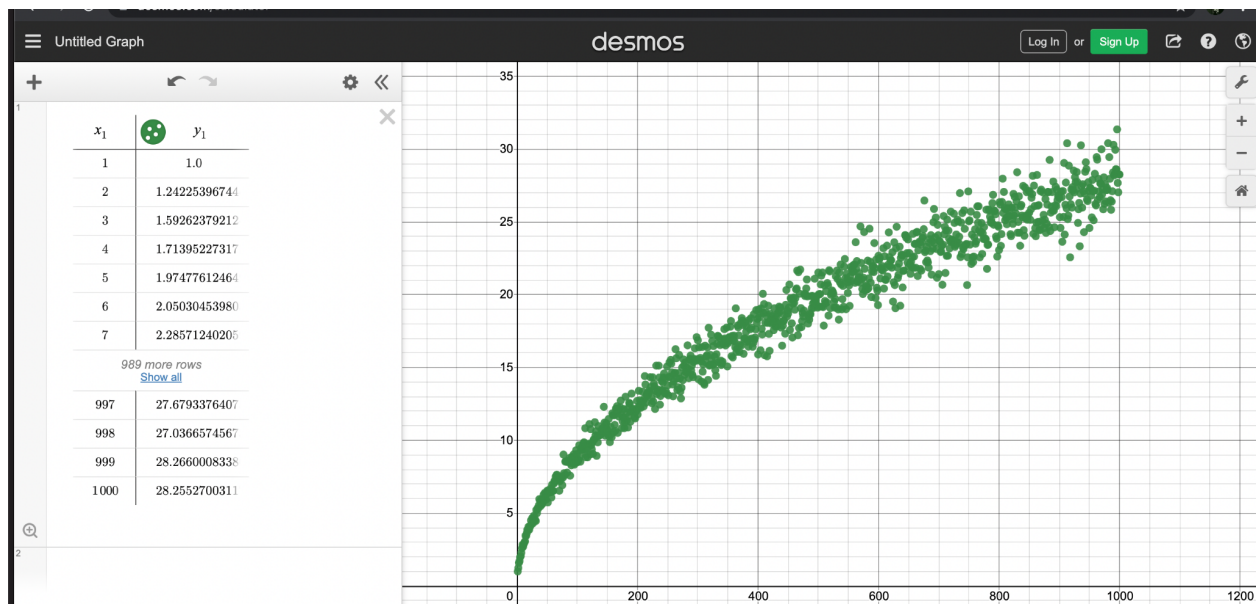

It can be clearly seen that the points follow a pattern similar to the graph of f(x) = √X.

The data that was plotted on the graph can be found in the file DataForGraph.txt.

The graph for the function of the square root of X can be seen in the image below.

It can be concluded that the euclidean distance is approximately the same as the value of $\sqrt{N}$ where 'N' is the number of steps the drunk man took in that specific walk.

$y = \sqrt{x}$
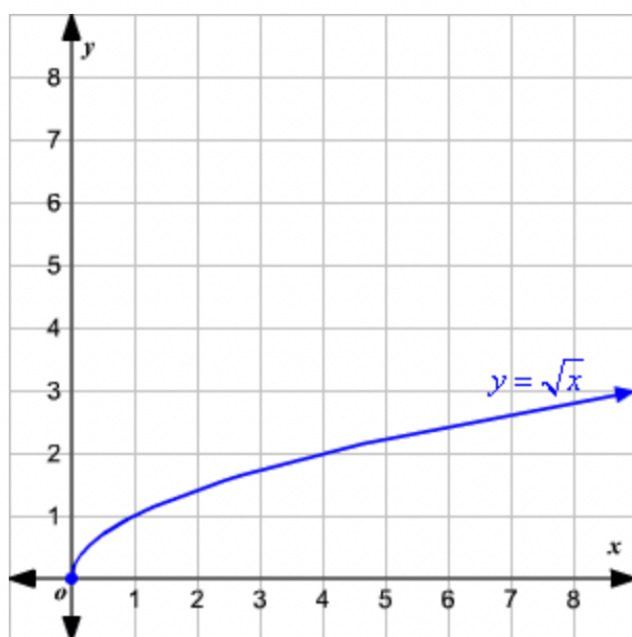
Test Cases

The screenshot below shows that all the test cases have passed.