```
%% Homework 1

% Define the number of random vectors desired.
numberOfVectors = [64 256 4096];

% Compute the final length and expectedLength for each cardinality of
% random vectors.
for iSizes = 1:length(numberOfVectors)
    currentNumberOfVectors = numberOfVectors(iSizes)
    finalLength = sumVectors(numberOfVectors(iSizes))
    expectedLength = numberOfVectors(iSizes)/sqrt(2)
end

function [ finalLength ] = sumVectors( numberOfVectors )
%sumVectors Sums a specified number of random unit vectors that point along
%the arc 0 to pi.
%   numberOfVectors The number of random, unit vectors desired to be summed.
%
%   finalLength The magnitude of the sum of the all the random, unit vectors.

% Create an array of random points from 0 to 1.
randomPoints = rand(1, numberOfVectors);

% Transform the random points in the range 0 to 1 to points along the unit
% arc with angle given by the random value.
randomAngles = (randomPoints*pi/2);

% Break each point down into an x and y component .
xComps = cos(randomAngles);     % r = 1, x = r*cos(angle)
yComps = sin(randomAngles);     % r = 1, y = r*sin(angle)

% Find the total x and y components.
xSum = sum(xComps);
ySum = sum(yComps);

% Use the pythagorean theorem.
finalLength = sqrt(xSum^2 + ySum^2);

end
```

```
currentNumberOfVectors =

    64

finalLength =

   57.1766

expectedLength =

   45.2548

currentNumberOfVectors =

   256

finalLength =

  231.1561

expectedLength =

  181.0193

currentNumberOfVectors =

        4096

finalLength =

  3.6928e+003

expectedLength =

  2.8963e+003
```