Disscussion

1 Random Walk

The walker has freedom to move any direction with equal probability with equal step length. Since the angle of direction is choosen uniformly ($\theta \in [0, 2\pi)$) the expectation of displacement in both x and y direction is zero. In each simulation the average displacement in x and average displacement in y are almost or near to zero though walker is walking more than 1000 steps. Theoretically $R_{rms} \sim \sqrt{N}$, so in the simulation the slope of the plot R_{rms} vs $\sqrt{N}$ has slope $0.955 \sim 1$.

2 Volume of ellipsoid

Suppose a ellipsoid is inscribed in a cuboid of dimension as twice as the semi-axes of the ellipsoid. So if random numbers are projected to the cuboid and the ratio of number of points inside of ellipsoid to total number of random numbers are thrown converges to $\frac{Volume\ of\ ellipsoid}{Volume\ of\ cuboid}$ by law of large numbers. As the number of random number thrown increases the convergence increases in the other words relative error decreases. The ellipsoid plotted with random numbers matches to the analytical one very nicely.