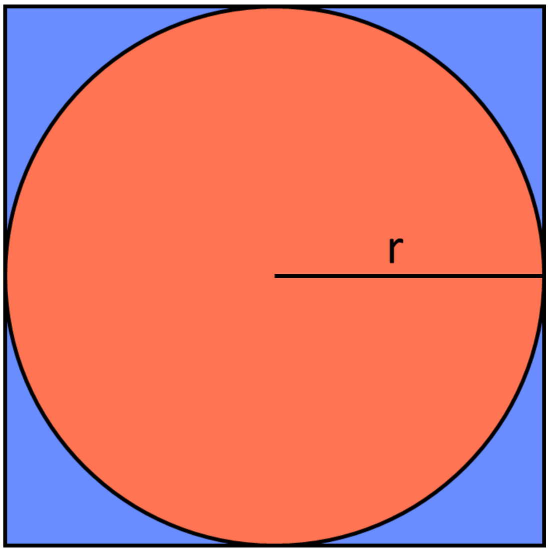
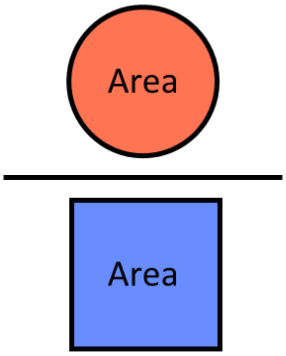
Let's assume we have a circle placed inside a square with its diameter equal to the length of one side of the square

$= \pi r^2$

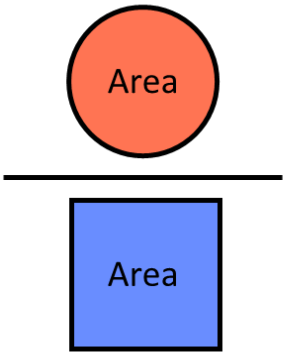
$= (2r)^2 = 4r^2$



Then:



$$= \frac{\pi \cancel{r}^2}{4\cancel{r}^2} = \frac{\pi}{4} \quad \ldots\ldots\ldots (1)$$

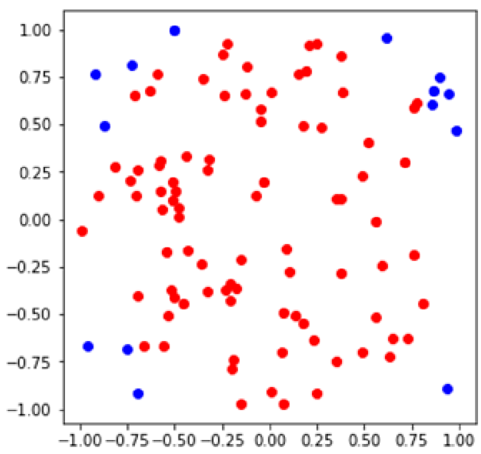
$\therefore \quad 4 \times$ 

$= \pi$

Now let's assume our diagram is a dartboard. If a dart is thrown at the board, the probability of the dart landing inside the circle is equal to $\pi/4$ as shown in equation (1). Therefore, the number of darts that land in the circle multiplied by 4 should approximate Pi.

I created a Monte Carlo Simulation to better visualize this approximation and ran it with various numbers of darts to see how the approximation would be affected!

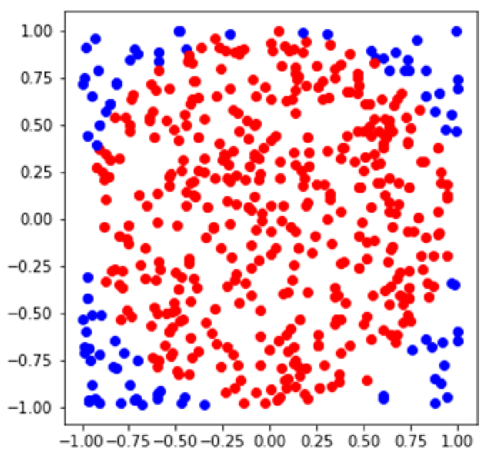
$100\ darts$



$Pi\ Approximaton = 3.48$

$\%\ Error = 10.77$

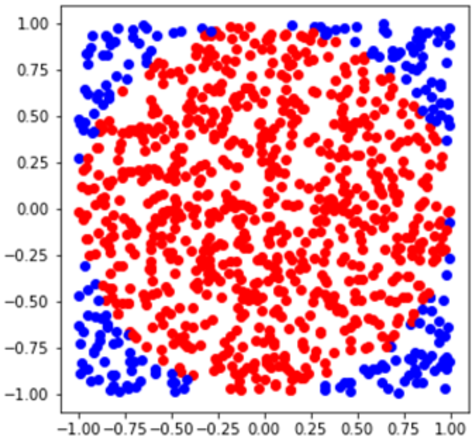
$500\ darts$



$Pi\ Approximaton = 3.28$

$\%\ Error = 4.41$

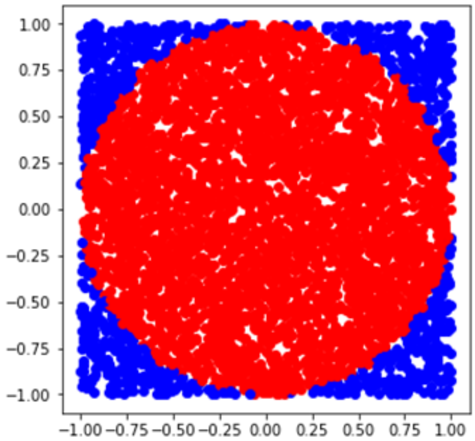
$1000\ darts$



$Pi\ Approximaton = 3.16$

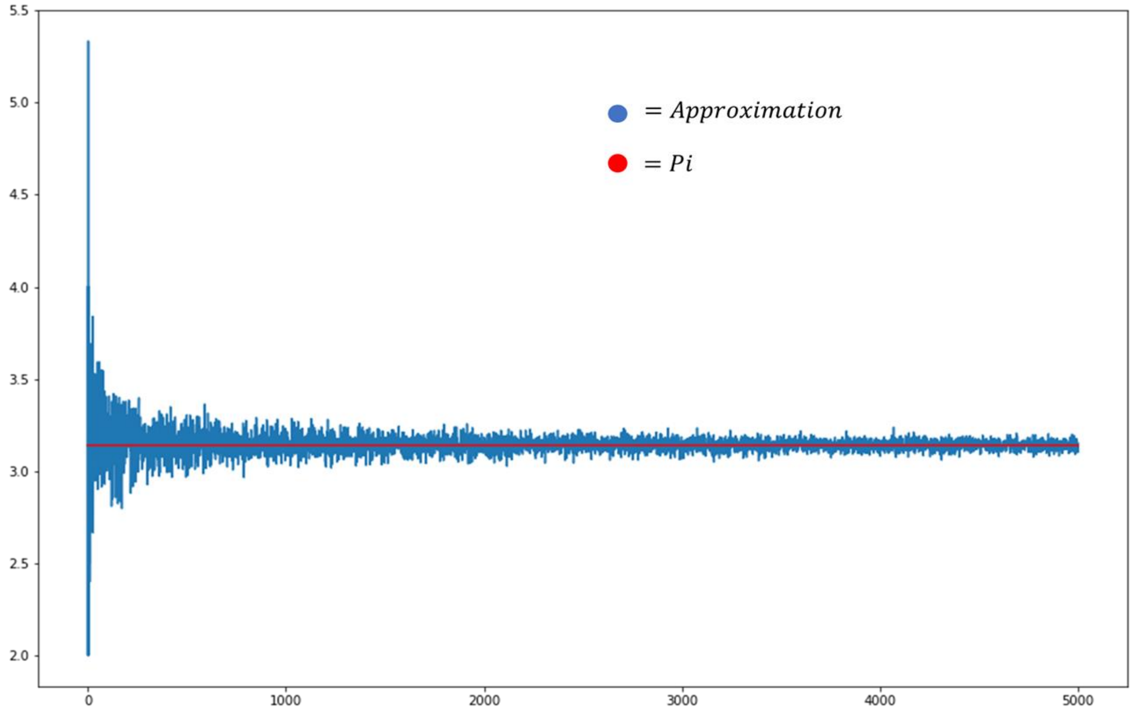
$\%\ Error = 0.59$

$5000\ darts$



$Pi\ Approximaton = 3.18$

$\%\ Error = 1.22$



$Number\ of\ points\ (n)$

What's interesting to note is that the simulation of 1000 points performed better than with 5000 in that particular run, I even noticed some fairly accurate runs with as little as 20 points.