

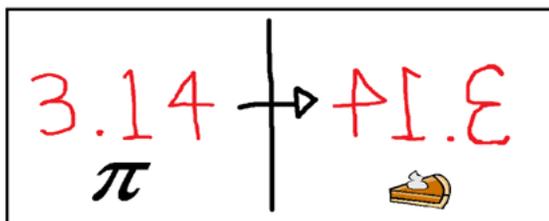
Halloween Math Auction

UW Math Circle

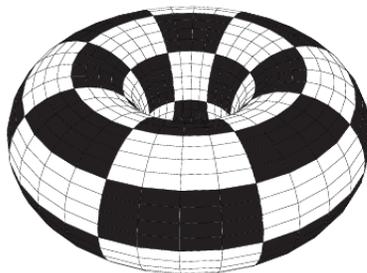
October 29, 2015



1. On a 10×10 grid, place **as many tokens as possible** on the vertices such that no three tokens lie on the same line (that line doesn't have to be one of the grid lines).
2. Find the **best approximation** to π using the digits $0 - 9$ at most once each, as well as only the operations $+$, $-$, \times , \div , $\sqrt{\quad}$, and $!$ as often as you like.



3. Take a positive integer and repeatedly take the sum of the squares of its digits; this is called a *decaying sequence*. For example, the decaying sequence of 31 is $31 \rightarrow 9 + 1 = 10 \rightarrow 1$ at which point it stops. Find $n < 10000$ that produces the **longest possible decaying sequence**.
4. Take a chessboard, and glue the top to the bottom and the left edge to the right edge. This new chessboard is called a *donut chessboard*. Place **as few knights as possible** on a donut chessboard so that all the squares are attacked. A knight does not attack the square it stands on.



5. The figure below has 12 lines of length 3; 24 lines if we count going backwards as well. Label it with 9 distinct letters to get **as many three letter words as possible**.

