MATHEMATICS ENRICHMENT CLUB.[1]

Solution Sheet 3, May 21, 2013

1. The dimensions of the brick are integers

$$a_0 = c_0 \mod 10$$

$$a_1 = \left(\left\lfloor \frac{c_0}{10} \right\rfloor + c_1 \right) \mod 10$$

$$a_2 = \left(\left\lfloor \frac{c_1 + \left\lfloor \frac{c_0}{10} \right\rfloor}{10} \right\rfloor + c_2 \right) \mod 10$$

$$a_3 = \left(\left\lfloor \frac{c_2 + \left\lfloor \frac{c_1 + \lfloor \frac{c_0}{10} \rfloor}{10} \right\rfloor}{10} \right\rfloor + c_3 \right) \mod 10$$

Solving in order from b_0 to b_3 one nds $b_0 = 3$, $b_1 = 5$ or 0. Then if $b_1 = 5$ we nd no solution for b_3, so $b_1 = 0$. Then $b_2 = 0$ or 5, but this time if b_2 , so

Senior Questions

1. Solve using induction, or visit http://en.wikipedia.org/wiki/Squared_triangular_number#Proofs for a cute geometrical representation.
2. $1^2 + 2^2 + \quad + n^2 = \frac{1}{6}(2n^3 + 3n^2 + n)$, so $\lim_{n!1} \frac{1^2+2^2+ \quad +n^2}{n^3} = \frac{1}{3}$.
3. (I could be wrong) Choose one of 13 values for the triplet and one of 4 suits to exclude and there are $13 \quad 4$ possible triplets, then $\begin{matrix}12\\5\end{matrix}$ combinations of the remaining suit are left. So there are $13 \quad 4 \quad \begin{matrix}12\\5\end{matrix}$ possible hands.