

MATHEMATICS ENRICHMENT CLUB.¹
Solution Sheet 3, May 21, 2013

1. The dimensions of the brick are integers

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$$a_0 = c_0 \pmod{10}$$

$$a_1 = \frac{c_0}{10} + c_1 \pmod{10}$$

$$a_2 = \frac{c_1 + \frac{c_0}{10}}{10} + c_2 \pmod{10}$$

$$a_3 = \frac{c_2 + \frac{c_1 + \frac{c_0}{10}}{10}}{10} + c_3 \pmod{10}$$

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

Senior Questions

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