



UK Maths Trust

Mentoring Scheme

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MARKETS

Hypatia

Sample questions

These questions are taken from the first sheet and give a good indication of the level of difficulty and prerequisite knowledge required at the start of the programme.

1. You are given that n is a positive integer with the property that when we add n and the sum of its digits, we obtain the number 313. What are the possible values of n ?
2. A sequence of numbers is defined by the rule that each number is the sum of the one before it and the one after it. The 1st number in the sequence is -5 and the 26th is 2. Find the 12th number.
3. Show that

$$1 + \frac{1}{2} + \left(\frac{1}{3} + \frac{1}{4}\right) + \left(\frac{1}{5} + \frac{1}{6} + \frac{1}{7} + \frac{1}{8}\right) + \left(\frac{1}{9} + \frac{1}{10} + \cdots + \frac{1}{15} + \frac{1}{16}\right) > 3.$$

What happens to the sum of the fractions on the left as the number of terms increases, following the same pattern?