## JMO Sequence Questions

Level: Junior Ref No: J26
Puzz Points: 11

In a sequence, each term after the first is the sum of the squares of the digits of the previous term. Thus if the first term were 12 , the second term would be $1^{2}+2^{2}=5$, the third term $5^{2}=25$, the fourth term $2^{2}+5^{2}=29$, and so on.
(i) Find the first five terms of the sequence whose first term is 25 .
(ii) Find the $2001^{\text {st }}$ term of the sequence whose first term is 25 .

Level: Junior Ref No: J32
Puzz Points: 11

A $3 \times 3$ grid contains nine numbers, not necessarily integers, one in each cell. Each number is doubled to obtain the number on its immediate right and trebled to obtain the number immediately below it.

If the sum of the nine numbers is 13, what is the value of the number in the central cell?


Level: Junior Ref No: J42
Puzz Points: 15

In a sequence of positive integers, each term is larger than the previous term. Also, after the first two terms, each term is the sum of the previous two terms.

The eighth term of the sequence is 390 . What is the ninth term?

In a sequence of six numbers, every term after the second term is the sum of the previous two terms. Also, the last term is four times the first term, and the sum of all six terms is 13.

What is the first term?

The first three terms of a sequence are $\frac{1}{4}, \frac{1}{3}, \frac{1}{2}$. The fourth term is $\frac{1}{2}-\frac{1}{3}+\frac{1}{4}$; henceforth, each new term is calculated by taking the previous term, subtracting the term before that, and then adding the term before that.
(i) Write down the first six terms of the sequence, giving your answers as simplified fractions.
(ii) Find the $10^{\text {th }}$ term and the $100^{\text {th }}$ term, and explain why they have to be what you claim.

## Level: Junior Ref No: J63

Puzz Points: 12

The diagram below is to be completed so that each box contains a whole number, the total of the numbers in the thirteen boxes is 2005 and the sum of the numbers in any three consecutive boxes is always the same.

In how many different ways is it possible to complete the diagram in this way?


