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INVESTIGATION

Halves

I have some wire and I am going to try an experiment.

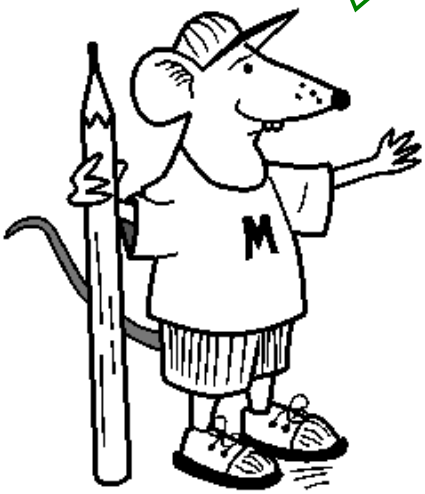
MathSphere

Halves

I have some wire and I am going to try an experiment.

First, I am going to cut off a piece of wire half a metre long.

Next I am going to cut off a piece of wire half as long as the last piece.



Then I am going to cut off a piece of wire half as long as that last piece again.

If I keep doing this for ever and ever and ever and then stick all the pieces together, end to end, how long will the final piece of wire be?

Answer Guide

This investigation investigates the sum of the series

$$^1/_2 + ^1/_4 + ^1/_8 + ^1/_{16} + \ldots$$

Probably the best way to tackle this initially is by using a calculator. This also gives children a lot of practice with changing fractions to decimals and typing numbers into a calculator accurately.

They need to keep a written record of what they are doing or they will soon become hopelessly muddled.

The sequence then becomes:

0.5 + 0.25 + .125 + 0.0625 ...

They will need to type in quite a few terms to begin to see that the sum is approaching 1. Due to the fact that this is the sum of an infinite series, they will not reach 1, but those who persevere should get quite near to it.

Once the children have a good idea of the answer, it is sometimes better to look at what is happening geometrically.

Each time you add on a piece of wire, do not ask the question 'How long is the wire now?' It is better to ask the question 'How much are we now short of 1?' It is then easier to see that the amount short is halving each time:

Cut 0.5m	0.5m remaining
Cut 0.25m	0.25m remaining
Cut 0.125m	0.125m remaining
Etc.	

This can also be shown by drawing a square. Colour half the square. Colour half of what is left. Colour half of what is left again. Keep repeating.....