

In the video at [nrich.maths.org/8054](http://nrich.maths.org/8054), Alison works out the sum of the first twenty terms of the sequence:

$$2, 8, 32, 128, 512 \dots$$

Here are two shots from the video:

Handwritten notes showing the first step of the summing process for the sequence 2, 8, 32, 128, ...

$$\begin{array}{l}
 2, 8, 32, 128, \dots \\
 S = 2 \quad 2 \times 4 \quad 2 \times 4^2 \quad 2 \times 4^3, \dots \quad 2 \times 4^{19} \\
 4S = 2 \times 4 \quad 2 \times 4^2 \quad 2 \times 4^3 \quad 2 \times 4^4, \dots \quad 2 \times 4^{20}
 \end{array}$$

Handwritten notes showing the final step of the summing process, resulting in the formula  $S = \frac{2 \times 4^{20} - 2}{3}$ .

$$\begin{array}{l}
 S = 2 \quad 2 \times 4 \quad 2 \times 4^2 \quad 2 \times 4^3, \dots \\
 4S = 2 \times 4 \quad 2 \times 4^2 \quad 2 \times 4^3 \quad 2 \times 4^4, \dots \\
 \hline
 3S = 2 \times 4^{20} - 2 \\
 S = \frac{2 \times 4^{20} - 2}{3}
 \end{array}$$

**Can you adapt Alison's method to sum the following sequences?**

- 3, 9, 27, 81, 243, ... up to the 15th term
- 5, 10, 20, 40, 80, ... up to the 12th term
- $\sum_{i=1}^{20} (3 \times 2^{i-1})$
- $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \dots$  up to the 10th term

**Can you find an expression for the following sum up to the nth term?**

$$a, ar, ar^2, ar^3, \dots$$