

Section 3: Geometric sequences and series

Exercise level 3 (Extension)

1. Fred has recently bought a new summer house for his garden, at a cost of £3000 in total, including any interest payments. He chooses to pay using the supplier's 'easy terms' Scheme B.

B: Pay £20 in the first month, followed by an increase of 12% (to the nearest penny) in every subsequent month.

- (i) Explain why in scheme B, Fred's payments would form a geometric sequence.
- (ii) Find two formulae for u_n , the figure Fred pays in the n^{th} month, and S_n , the total that Fred has paid after n months.
- (iii) Use your formulae in (ii) to determine in which month Fred has finally fully paid for his purchase. [You will need logarithms to solve the equation directly.]
- (iv) In fact, the final month's payment is too much to cover the remaining debt. Calculate how much Fred should pay in the final month to clear his debt exactly.

2. (i) Consider the series $1 + 2x + 3x^2 + 4x^3 + \dots$

Explain why it is neither an arithmetic or geometric series.

- (ii) If S_n is the sum of the series to n terms, find xS_n and use it to find a formula for S_n .

- (iii) Find suitable values for x and n in the following series, and check your formula from (ii) by summing:

A: $1 + 4 + 12 + 32$

B: $1 + 1 + \frac{3}{4} + \frac{1}{2} + \frac{5}{16}$

3. Marika needs to save £15000 over some years to replace her car. Marika can save a figure of £ M per month, and interest at a rate r is applied at the end of the month.

- (i) Show that the amount saved at the end of the third month is

$$d_3 = \frac{M(1+r)[(1+r)^3 - 1]}{r}$$

- (ii) Show that the amount in her savings after n months is

$$d_n = \frac{M(1+r)[(1+r)^n - 1]}{r}$$

- (iii) Marika must decide whether to save for her car over 3 years or over 4 years, and she can get a monthly interest rate of $\frac{1}{2}\%$ (so that $r = 0.005$) from her bank. Calculate how much Marika must save monthly over both of 3 and 4 years.
- (iv) Marika decides she can afford to save £300 per month. Use a spreadsheet on a computer or a calculator to complete the following table.

Edexcel A level Maths Series 3 Exercise

Period of payment (months)	Monthly payment
36	£379.43
37	
38	
39	
40	
41	
42	
43	
44	
45	
46	
47	
48	£275.86

After how many months can Marika buy her new car?