



Edexcel International AS Maths: Pure 2



Your notes

Modelling with Sequences & Series

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Modelling with sequences & series

How do I model with sequences and series?

- Many real-life situations can be modelled using sequences and series
- If a quantity is changing repeatedly by having a fixed amount **added** to or **subtracted** from it then the use of **arithmetic sequences** and **arithmetic series** is appropriate

e.g. IN JANUARY VINCENT PUTS £100 INTO HIS SAVINGS ACCOUNT.
FOR THE REST OF THE YEAR, IN EACH MONTH HE PUTS IN
£10 MORE THAN THE MONTH BEFORE.
HOW MUCH WILL HE HAVE PUT INTO HIS SAVINGS ACCOUNT
BY THE END OF THE YEAR?

THE TOTAL AMOUNT HE PUTS INTO HIS SAVINGS ACCOUNT IS:

$$100 + 110 + 120 + 130 + \dots$$

THAT IS AN ARITHMETIC SERIES WITH FIRST TERM $a=100$
AND COMMON DIFFERENCE $d=10$. THERE WILL BE 12 TERMS
IN THE SUM SO THE TOTAL IS:

$$S_{12} = \frac{12}{2} (2(100) + (12-1)10) = \text{£}1860$$

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- If a quantity is changing repeatedly by a fixed **percentage**, or by being **multiplied** repeatedly by a fixed amount, then the use of **geometric sequences** and **geometric series** is appropriate



Your notes

e.g. LOWENA'S BUSINESS MAKES £20,000 PROFIT IN ITS FIRST YEAR. SHE EXPECTS THAT DURING THE FIRST TEN YEARS THE BUSINESS' PROFIT WILL INCREASE BY 10% EACH YEAR. IF SHE IS CORRECT THEN WHAT WILL THE TOTAL PROFIT BE OVER THOSE TEN YEARS, TO THE NEAREST THOUSAND POUNDS?

THE TOTAL PROFIT WILL BE:

$$20\,000 + (1.1 \times 20\,000) + (1.21 \times 20\,000) + \dots$$

THAT IS A GEOMETRIC SERIES WITH FIRST TERM $a=20\,000$ AND COMMON RATIO $d=1.1$. THERE WILL BE 10 TERMS IN THE SUM SO THE TOTAL IS:

$$S_{10} = \frac{20\,000(1.1^{10}-1)}{(1.1-1)} = 318\,748.492\dots$$
$$= \text{£}319\,000 \text{ TO THE NEAREST £1000}$$

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Examiner Tips and Tricks

- Remember, an exam question won't always tell you to use sequence and series methods, so you've got to be able to spot 'hidden' sequence and series questions.
- To help you do this, be suspicious of questions about savings accounts, salaries, sales commissions, profits and the like – these are often sequence and series questions in disguise!



Worked Example



Your notes



Anna's grandfather gives her £10 on her first birthday. He says that he will give her £20 on her second birthday, £40 on her third birthday, and so on, doubling his gift each year until she is 18. If he goes through with his plan, then

- How much will he have to give Anna on her eighteenth birthday?
- How much in total will he have given her by (and including) her eighteenth birthday?

a) THIS IS A GEOMETRIC SEQUENCE WITH
 $a=10$ $r=2$

THE EIGHTEENTH TERM IS

$$10 \times 2^{17} = \text{£ } 1\,310\,720$$

$$ar^{n-1}$$

b) THIS IS A GEOMETRIC SERIES WITH
 $a=10$ $r=2$

$$S_{18} = \frac{10(2^{18}-1)}{2-1} = \text{£ } 2\,621\,430$$

$$S_n = \frac{a(r^n-1)}{r-1}$$

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