

Mathematics: analysis and approaches - Standard level

PRACTICE PAPER 2

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Topic 1: Number and algebra

ARITHMETIC SEQUENCES-GEOMETRIC SEQUENCES- PERCENTAGE  
CHANGE - FINANCIAL APPLICATIONS - DEDUCTIVE PROOF

1. [Maximum mark: 5] [with GDC]

Each year, Anna's salary is increased by 4 %. She has been working for her company for 3 years, and she currently earns €44 994.56 per annum.

(a) What was Anna's salary when she joined the company? [3]

(b) If she stays with the company for another 4 years, what will her salary be? [2]

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**2. [Maximum mark: 4] [with GDC]**

(a) What will an investment of €40 000 at 3.6% p.a. interest compounded annually amount to after 7 years? [2]

(b) How much of this is interest? [2]

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**3. [Maximum mark: 4] [without GDC]**

An arithmetic sequence has first term 10 and common difference 4. The sum of the terms of the sequence is 1050. Find the number of terms in the sequence.

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**4. [Maximum mark: 4] [without GDC]**

Five consecutive terms of an arithmetic sequence have a sum of 75. The product of the first, middle, and last terms is 1500. Find the terms of the sequence.

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**5. [Maximum mark: 4] [with GDC]**

A sum of \$ 10 000 is invested at a compound interest rate of 5.2 % per annum. The value of the investment will exceed \$ 18 000 after  $n$  full years. Calculate the minimum value of  $n$ .

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**6. [Maximum mark: 6] [with GDC]**

Dimitris invest € 20 000 at 8% per year, **compounded monthly** and withdraw € 150 at the end of each month.

- (a) Find the amount remaining in his account at the end of 4<sup>th</sup> year. [3]
- (b) Find the month he will receive the last amount remaining. [3]

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**7. [Maximum mark: 6] [with GDC]**

Elena has started renting an apartment. She paid \$ 8000 rent in the first year, and the rent increased by 2% each year.

(a) Find the rent paid by Elena in the 5th year. [2]

(b) Write an expression for the total rent paid by Elena during the first  $n$  years. [2]

(c) How much rent did Elena pay during the first 5 years? [2]

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**8. [Maximum mark: 6] [without GDC]**

(a) Show that  $(x - 1)(x + 1)^3 - 2x(x - 1)(x + 1) = x^4 - 1$  [2]

(b) Given that  $2x^2 + \alpha x + 6 = (bx + 1)(x + c)$  find the values of  $a, b, c$ . [2]

(c) Show that  $\frac{5x-6}{x^2-4} = \frac{1}{x-2} + \frac{4}{x+2}$ . [2]

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**9. [Maximum mark: 4] [without GDC]**

The sum of the first three terms of a convergent infinite geometric series is 14. The sum of the series is 16. Find the first term and the common ratio.

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**10. [Maximum mark: 4] [without GDC]**

A ball bounces from a height of 4 metres and returns to 70% of its previous height on each bounce. Find the total distance travelled by the ball until it stops bouncing.

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**11. [Maximum mark: 6] [with GDC]**

Dimitris is saving to buy a house and needs \$300 000.

(a) Three years ago, he invested a sum of money in an account paying 5 % p.a. interest compounded half-yearly. This investment has just matured at \$ 80 000. How much did Dimitris invest three years ago? [2]

(b) Dimitris decides to reinvest his \$80 000 lump sum into an account for a period of  $n$  years at 10.0% p.a. interest compounded annually. Write a formula for  $V_n$  of Dimitri's investment after  $n$  years in terms of  $n$ . [2]

(c) Dimitris also decides to start an additional saving plan, whereby he deposits \$4000 into a safe at the end of each year. After how many whole years will Dimitris have the \$300000 needed to buy his house? [2]

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**12. [Maximum mark: 6] [with GDC]**

Dimitris is offered a new job, and is given two salary options to choose from:

Option A: \$ 20000 in the first year, and 8% extra each subsequent year.

Option B: \$ 40000 in the first year, and \$2000 more each subsequent year.

(a) If Dimitris believed that she would work for 5 years in this new job, explain which option would be best for him. [2]

(b) Write down an expression for the amount of money earned in the  $n$ th year if she selects: Option A or Option B. [2]

(c) Find the minimum length of time Dimitris would need to work before the amount of money earned per year from Option A exceeds that of Option B. [2]

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