Question 16 (11 marks)

Natalia inherits a sum of money from her grandfather. She wishes to place it in a high-interest savings account.

She is considering the following two options:

Account A: interest rate 4.40% per annum, compounded monthly
Account B: interest rate 4.30% per annum, compounded daily.

(a)   The effective annual interest rate for Account A is 4.49% (correct to two decimal places). Determine the effective annual interest rate for Account B.   (1 mark)

Natalia's bank offers her another account, C, with an interest rate of 4.50% per annum.

(b)   Under what circumstances will this interest rate and the effective annual interest rate be the same?   (1 mark)

(c)   Which account (A, B or C) should Natalia choose to maximise her savings? Explain your reasoning.   (2 marks)

Natalia's sister, Elena, has inherited $25 000 from her grandfather. She decides to invest this money in a high-interest savings account, with interest compounded monthly. Elena also chooses to deposit an additional $250 into this account at the end of each month.

The table below shows Elena's account balance over the first three months.

Month	Account balance at start of month	Interest earned	Deposit	Account balance at end of month
1	$25 000.00	$125.00	$250.00	$25 375.00
2	$25 375.00	$126.88	$250.00	$25 751.88
3	$25 751.88	$128.76	$250.00	$26 130.64

(d)   Show that the annual interest rate that applies to Elena's account is 6%.   (1 mark)

(e)   The amount in Elena's account, A_n at the end of month n, can be expressed as a recursive rule, $A_{n+1} = cA_n + d$, $A_0 = 25\,000$. Determine the values of c and d.   (2 marks)

(f)   After two years, Elena wishes to use the money she has saved as a deposit for a house. An amount of $35 000 will be required. Unfortunately, Elena has realised that by depositing $250 each month she will **not** reach her savings goal.

(i)   If she only deposits $250 each month, by how much will she be short of the required deposit?   (2 marks)

(ii)   What increase in the monthly deposit is required for Elena to save the $35 000 in two years?   (2 marks)