

# Sequences, FM and BT revision *[118 marks]*

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On 1st January 2020, Laurie invests \$ $P$  in an account that pays a nominal annual interest rate of 5.5 %, compounded **quarterly**.

The amount of money in Laurie's account **at the end of each year** follows a geometric sequence with common ratio,  $r$ .

- 1a. Find the value of  $r$ , giving your answer to four significant figures. *[3 marks]*

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1b. Laurie makes no further deposits to or withdrawals from the account. [3 marks]

Find the year in which the amount of money in Laurie's account will become double the amount she invested.

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**In this question, give all answers correct to two decimal places.**

Sam invests \$1700 in a savings account that pays a nominal annual rate of interest of 2.74%, compounded half-yearly. Sam makes no further payments to, or withdrawals from, this account.

5a. Find the amount that Sam will have in his account after 10 years. *[3 marks]*

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David also invests \$1700 in a savings account that pays an annual rate of interest of  $r\%$ , compounded yearly. David makes no further payments or withdrawals from this account.

5b. Find the value of  $r$  required so that the amount in David's account after 10 years will be equal to the amount in Sam's account. *[2 marks]*

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Two friends Amelia and Bill, each set themselves a target of saving \$20 000. They each have \$9000 to invest.

Amelia invests her \$9000 in an account that offers an interest rate of 7% per annum compounded **annually**.

- 8a. Find the value of Amelia's investment after 5 years to the nearest hundred dollars. *[3 marks]*

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- 8b. Determine the number of years required for Amelia's investment to reach the target. *[2 marks]*

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8e. Find the amount Chris needs to deposit initially in order to reach the target after 5 years. Give your answer to the nearest dollar. [3 marks]

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In an arithmetic sequence,  $u_1 = 1.3$ ,  $u_2 = 1.4$  and  $u_k = 31.2$ .

12a. Find the exact value of  $S_k$ .

[2 marks]

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12c. An infinite geometric series is given as  $S_{\infty} = a + \frac{a}{\sqrt{2}} + \frac{a}{2} + \dots$ ,  $a \in \mathbb{Z}^+$  [5 marks]

Find the largest value of  $a$  such that  $S_{\infty} < F$ .

A rectangular box containing 16 horizontal dotted lines for writing the answer.

The first term of an infinite geometric sequence is 4. The sum of the infinite sequence is 200.

13a. Find the common ratio.

[2 marks]

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13b. Find the sum of the first 8 terms.

[2 marks]

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13c. Find the least value of  $n$  for which  $S_n > 163$ .

[3 marks]

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It is known that the number of fish in a given lake will decrease by 7% each year unless some new fish are added. At the end of each year, 250 new fish are added to the lake.

At the start of 2018, there are 2500 fish in the lake.

14a. Show that there will be approximately 2645 fish in the lake at the start [3 marks] of 2020.

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14b. Find the approximate number of fish in the lake at the start of 2042. [5 marks]

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16. The coefficient of  $x^2$  in the expansion of  $(\frac{1}{x} + 5x)^8$  is equal to the coefficient of  $x^4$  in the expansion of  $(a + 5x)^7$ ,  $a \in \mathbb{R}$ . Find the value of  $a$ . [6 marks]

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