SQA Past paper questions

2019 – Paper 2 – Question 4

In a forest, the population of a species of mouse is falling by 2·7% each year.

To increase the population scientists plan to release 30 mice into the forest at the end of March each year.

(a) u_n is the estimated population of mice at the start of April, n years after the population was first estimated.

It is known that u_n and u_{n+1} satisfy the recurrence relation $u_{n+1} = au_n + b$.

State the values of a and b. 1

The scientists continue to release this species of mouse each year.

(b) (i) Explain why the estimated population of mice will stabilise in the long term. 1

(ii) Calculate the long term population to the nearest hundred. 2

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Specimen – Paper 2 – Question 2

A wildlife reserve has introduced conservation measures to build up the population of an endangered mammal. Initially the reserve population of the mammal was 2000. By the end of the first year there were 2500 and by the end of the second year there were 2980.

It is believed that the population can be modelled by the recurrence relation:

$u_{n+1} = au_n + b$,

where a and b are constants and n is the number of years since the reserve was set up.

(a) Use the information above to find the values of a and b. 4

(b) Conservation measures will end if the population stabilises at over 13 000. Will this happen? Justify your answer. 3

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Specimen 1 – Paper 1 – Question 21

A firm cleans the factory floor on a daily basis with disinfectant. It has a choice of two products, either "A" or "B".

Product A removes 70% of all germs but during the next 24 hours, 300 "new" germs per sq unit are estimated to appear.

Product B removes 80% of all germs but during the next 24 hours, 350 "new" germs per sq unit are estimated to appear.

For product A, let u_n represent the number of germs per sq unit on the floor immediately before disinfecting for the nth time.

For product B, let v_n represent the number of germs per sq unit on the floor immediately before disinfecting for the nth time.

(*a*) Write down a recurrence relation for each product to show the number of germs per sq unit present prior to disinfecting. **2**

(*b*) Determine which product is more effective in the long term. **4**

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2002 – Paper 2 – Question 4

A man decides to plant a number of fast-growing trees as a boundary between his property and the property of his next door neighbour. He has been warned, however, by the local garden centre that, during any year, the trees are expected to increase in height by 0·5 metres. In response to this warning he decides to trim 20% off the height of the trees at the start of any year.

(*a*) If he adopts the "20% pruning policy", to what height will he expect the trees to grow in the long run? **3**

(*b*) His neighbour is concerned that the trees are growing at an alarming rate and wants assurances that the trees will grow no taller than 2 metres. What is the minimum percentage that the trees will need to be trimmed each year so as to meet this condition? **3**

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2001 – Paper 2 – Question 3

On the first day of March, a bank loans a man £2500 at a fixed rate of interest of 1·5% per month. This interest is added on the last day of each month and is calculated on the amount due on the first day of the month. He agrees to make repayments on the first day of each subsequent month. Each repayment is £300 except for the smaller final amount which will pay off the loan.

(*a*) The amount that he owes at the start of each month is taken to be the amount still owing just after the monthly repayment has been made.

Let u_n and u_{n+1} represent the amounts that he owes at the starts of two successive months. Write down a recurrence relation involving u_{n+1} and u_n. **2**

(*b*) Find the date and the amount of the final payment. **4**

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