

1. A sequence is defined by the recurrence relation:

$$u_{n+1} = 0.35u_n + 6$$

where $u_0 = 600$.

- (a) Calculate the value of u_2 . 1
- (b) Find the smallest value of n for which $u_n < 10$. 1

2. A village school currently has 100 pupils. The roll is decreasing at a rate of 21% per year. Each year, 12 new pupils start S1.

The Local Authority has decided that the school will have to close if the roll remains below 50 pupils in the long term.

If the current trend continues, will the school have to close? Explain your answer. 4

3. Two sequences are defined by the recurrence relations:

$$u_{n+1} = 0.4u_n + s \quad \text{and} \quad v_{n+1} = tv_n + 5$$

where $u_0 = v_0 = 12$.

- (a) Explain why the sequence defined by $u_{n+1} = 0.4u_n + s$ has a limit. 1
- (b) Given that both sequences have the same limit, express t in terms of s . 3

4. A sequence is defined by:

$$u_n = au_{n-1} + b$$

where $u_0 = 20$ and the first two terms are $u_1 = 16$ and $u_2 = 12$.

Find the values of a and b . 4

FOR QUESTIONS 5 AND 6 PTO

5. Two sequences are defined by $u_{n+1} = \frac{1}{3}u_n + b$ and $v_{n+1} = bv_n + 5$ where b is a constant and $u_0 = v_0 = 1$.
- (a) (i) Explain why the first sequence tends to a limit as $n \rightarrow \infty$.
(ii) Given that the limit of the first sequence is 27, find the value of b . 3
- (b) Does the second sequence tend to a limit as $n \rightarrow \infty$? Explain your answer. 1
6. A rare disease has infected a fish farm.
Initially the manager of the farm discovers that 60 fish have been infected.
He continues to monitor the fish and estimates that the number of fish being infected is increasing each day by 6% of the previous day's total.
- (a) How many fish are infected after 7 days? 3
- (b) The manager only receives the appropriate medicine to treat the disease 9 days after the initial outbreak and adds it to the water immediately.
He notices a significant improvement by the next day and estimates that 18% of the infected fish are recovering and no further infections have occurred.
If the recovery rate continues, how many fish will be infected 14 days after the initial outbreak? 5

26 Marks