

Question 18

(9 marks)

(a) A sequence is defined by  $T_{n+1} = 0.75T_n$ ,  $T_1 = 160$ .

(i) Calculate  $T_4$ . (1 mark)

(ii) Determine how many terms of the sequence are larger than 1. (1 mark)

(iii) State whether the sequence contains at least one negative number, explaining your answer. (2 marks)

(b) The first two terms, in order, of a geometric sequence are  $\frac{1}{2}$  and  $\frac{2}{3}$ .

(i) Calculate the next term of this sequence, leaving your answer as a fraction in simplest form. (2 marks)

(ii) State a rule for the  $n^{\text{th}}$  term of this sequence. (2 marks)

(iii) Determine the minimum number of terms of this sequence that are required to have a sum of at least 10. (1 mark)

Question 2

(7 marks)

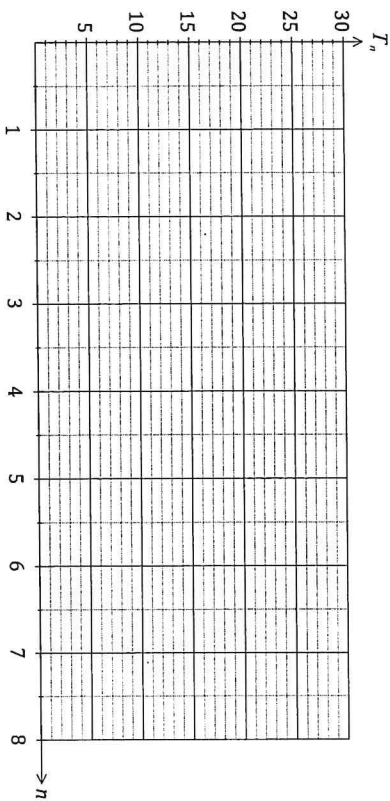
The number of laptop computers,  $T_n$ , that were brought to a school IT department for recharging during week  $n$  of the school year can be described recursively by the rule

$$T_{n+1} = T_n + 3, \quad T_4 = 16$$

(a) Use the rule to complete the table below. (2 marks)

$n$	1	2	3	4	5	6	7
$T_n$							

(b) Display the terms of the sequence from the table on the graph below. (2 marks)



(c) A rule to determine the number of laptops brought for recharging during week  $n$  can also be written in the form  $T_n = an + b$ . Determine the values of  $a$  and  $b$ . (2 marks)

(d) If the pattern continued, determine the number of the week during which the number of laptops brought in for recharging first exceeds 50. (1 mark)

Question 16

(8 marks)

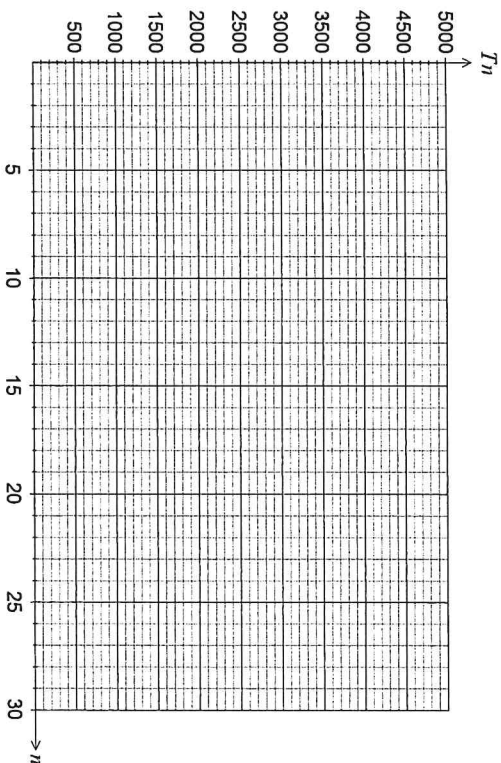
A plantation has 4 800 trees. The plantation manager is interested in modelling what would happen if each year, 10% of the existing trees were cut down for timber and another 250 new trees planted.

The number of trees,  $T_n$ , at the start of year  $n$  can be modelled by  $T_{n+1} = 0.9T_n + 250$ ,  $T_1 = 4800$ .

- (a) Use the recurrence relation to complete the missing values in the following table. (2 marks)

$n$	5	10	15	20	25	30
$T_n$	4009					2608

- (b) Plot the values from the table on the axes below. (2 marks)



- (c) Comment on how the number of trees in the plantation is changing. (2 marks)

- (d) Does the model predict that eventually there will be no trees left in the plantation? Justify your answer. (2 marks)

Question 14

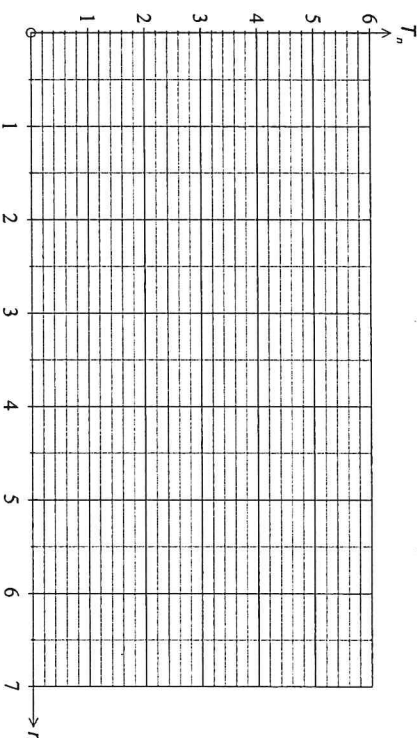
(8 marks)

Sequence A is defined given by  $T_{n+1} = 0.87T_n$ ,  $T_1 = 5$ .

- (a) Use the rule to complete the first five terms of Sequence A in the table below. (2 marks)

$n$	1	2	3	4	5
$T_n$	5				

- (b) Graph the first five terms of sequence A on the axes below. (2 marks)



- (c) How many terms of Sequence A are greater than 1? (1 mark)

- (d) The terms of the sequence can also represent the value of a secondhand car (in thousands of dollars) at the start of each year (year  $n$ ).

- (i) Determine the value of the car at the start of the sixth year. (1 mark)
- (ii) By what percentage is the value of the car decreasing each year? (1 mark)
- (iii) The value of the car is written off when it falls below \$500. At the start of which year will this occur? (1 mark)