

- 1** The number of animals in a population at the start of year t is P_t
The number of animals at the start of year 1 is 400

Given that

$$P_{t+1} = 1.01P_t$$

work out the number of animals at the start of year 3

.....
(Total for Question 1 is 2 marks)

2 At time $t = 0$ hours a tank is full of water.

Water leaks from the tank.

At the end of every hour there is 2% less water in the tank than at the start of the hour.

The volume of water, in litres, in the tank at time t hours is V_t

Given that

$$V_0 = 2000$$

$$V_{t+1} = kV_t$$

write down the value of k .

$k = \dots\dots\dots$

(Total for Question 2 is 1 mark)

3 At the start of year n the population of a species is P_n

At the start of the following year the population of the species is given by

$$P_{n+1} = kP_n \text{ where } k \text{ is a positive constant.}$$

The population of the species at the start of year 1 is 8 million.

The population of the species at the start of year 2 is 6 million.

(a) Work out the population of the species at the start of year 3

..... million
(3)

At the start of year 5 the value of k is increased by 0.3 to a new constant value.

Louise thinks that from the start of year 5 the population of the species would increase year on year.

(b) Is Louise correct?

You must give a reason for your answer.

.....
.....
.....
(1)

(Total for Question 3 is 4 marks)

4 At the start of year n , the number of animals in a population is P_n

At the start of the following year, the number of animals in the population is P_{n+1} where

$$P_{n+1} = kP_n$$

At the start of 2017 the number of animals in the population was 4000

At the start of 2019 the number of animals in the population was 3610

Find the value of the constant k .

(Total for Question 4 is 3 marks)

5 A hot air balloon is descending.

The height of the balloon n minutes after it starts to descend is h_n metres.

The height of the balloon $(n + 1)$ minutes after it starts to descend, h_{n+1} metres, is given by

$$h_{n+1} = K \times h_n + 20 \quad \text{where } K \text{ is a constant.}$$

The balloon starts to descend from a height of 1200 metres at 09 15

At 09 16 the height of the balloon is 1040 metres.

Work out the height of the balloon at 09 18

..... m

(Total for Question 5 is 4 marks)

6 The profit made by a shop increases each year.

The profit made by the shop in year n is $\text{£}P_n$

Given that the profit made by the shop in the next year is $\text{£}P_{n+1}$ then

$$P_{n+1} = aP_n + 800 \text{ where } a \text{ is a constant.}$$

The table shows the profit made by the shop in 2018 and in 2019

Year	2018	2019
Profit	£24 000	£29 600

Work out the profit predicted to be made by the shop in 2021

£.....

(Total for Question 6 is 4 marks)

- 7 The number of rabbits on a farm at the end of month n is P_n
The number of rabbits at the end of the next month is given by $P_{n+1} = 1.2P_n - 50$

At the end of March there are 200 rabbits on the farm.

- (a) Work out how many rabbits there will be on the farm at the end of June.

.....
(3)

- (b) Considering your results in part (a), suggest what will happen to the number of rabbits on the farm after a long time.

.....
.....
(1)

(Total for Question 7 is 4 marks)
