

AQA – Differential equations – A2 Further Mathematics P2**1. June/2021/Paper_7367/2/No.10**

In a colony of seabirds, there are y birds at time t years.

- (a) The rate of reduction in the number of birds due to birds dying or leaving the colony is proportional to the number of birds.

In one year the reduction in the number of birds due to birds dying or leaving the colony is equal to 16% of the number of birds at the start of the year.

If no birds are born or join the colony, find the constant k such that

$$\frac{dy}{dt} = -ky$$

Give your answer to three significant figures.

[4 marks]

- (b) A wildlife protection group takes measures to support the colony.

The rate of reduction in the number of birds due to birds dying or leaving the colony is the same as in part (a), but in addition:

- The rate of increase in the number of birds due to births is $20t$ per year.
- The wildlife protection group brings 45 birds into the colony each year.

Write down a first-order differential equation for y and t

[2 marks]

(c) The initial number of birds is 340

Solve your differential equation from part (b) to find y in terms of t

[5 marks]

(d) Describe two limitations of the model you have used.

[2 marks]

Limitation 1 _____

Limitation 2 _____
