Question 9 **(7 marks)**

A study of a penguin colony on an island was conducted and it found the initial population size of 1200 was dropping by 14% each year due to the introduction of non-native predators.

(a) Explain why the population after n weeks is $1200 \times (0.86)^n$ penguins. (2 marks)

After eight weeks, the Parks and Wildlife Service set traps to reduce the predator numbers. This saw the penguin population increase weekly by 6%.

(b) State the recursive formula that models the new population growth. (2 marks)

(c) How many weeks will it take to get the population back up to the initial size? (1 mark)

Once the population returns to the initial size, it is further helped by the introduction of penguins from a breeding program at the zoo.

The new population growth model can be represented by

$P_{n+1} = -0.25P_n + 3000, P_0 = 1200$.

(d) Discuss the long-term behaviour of the penguin population, now that it is being supported by the breeding program. (2 marks)