4 The size, P, of a population of a certain species of insect at time t months is modelled by the following formula.

$$P = 5000 - 1000\cos(30t)^\circ$$

(a) Write down the maximum size of the population. **[1]**

(b) Write down the difference between the largest and smallest values of P. **[1]**

(c) Without giving any numerical values, describe briefly the behaviour of the population over time. **[1]**

(d) Find the time taken for the population to return to its initial size for the first time. **[2]**

(e) Determine the time on the second occasion when $P = 4500$. **[4]**

A scientist observes the population over a period of time. He notices that, although the population varies in a way similar to the way predicted by the model, the variations become smaller and smaller over time, and P converges to 5000.

(f) Suggest a change to the model that will take account of this observation. **[1]**