3 A circular ornamental garden pond, of radius 2 metres, has weed starting to grow and cover its surface.

As the weed grows, it covers an area of A square metres. A simple model assumes that the weed grows so that the rate of increase of its area is proportional to A.

3 (a) Show that the area covered by the weed can be modelled by

$$A = Be^{kt}$$

where B and k are constants and t is time in days since the weed was first noticed.

[4 marks]

3 (b) When it was first noticed, the weed covered an area of 0.25 m^2. Twenty days later the weed covered an area of 0.5 m^2

3 (b) (i) State the value of B.

[1 mark]

3 (b) (ii) Show that the model for the area covered by the weed can be written as

$$A = 2^{\frac{t}{20} - 2}$$

[4 marks]

3 (b) (iii) How many days does it take for the weed to cover half of the surface of the pond?

[2 marks]

3 (c) State one limitation of the model.

[1 mark]

3 (d) Suggest one refinement that could be made to improve the model.

[1 mark]