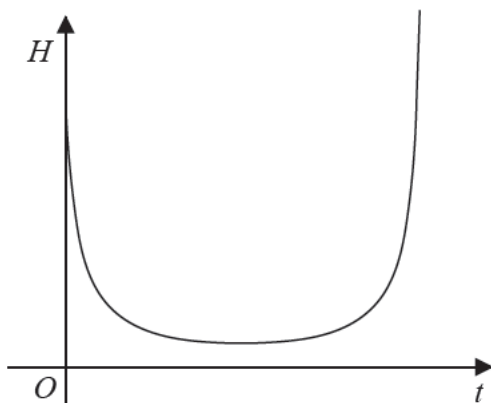**10.**

Figure 4

A scientist is studying the flight of seabirds in a colony.

She models the height above sea level, H metres, of one of the birds in the colony by the equation

$$H = \frac{140}{A + 45\sin 2t° - 28\cos 2t°} \qquad 0 \leqslant t \leqslant T$$

where t seconds is the time after the bird leaves its nest and A and T are constants.

Figure 4 is a sketch showing the graph of H against t.

Given that this seabird's nest is 20 m above sea level,

(a) find a complete equation for H.

(3)

Given that

$$45\sin 2t° - 28\cos 2t° \equiv 53\sin(2t - \alpha)° \qquad 0 < \alpha < 90$$

(b) find the value of α to one decimal place.

(2)

Find, according to this model,

(c) the minimum height of the seabird above sea level giving your answer to the nearest cm,

(2)

(d) the limitation on the value of T.

(2)