

12.

$$f(x) = 12e^{-\frac{x}{3}} \sin x, \quad x \geq 0$$

- (a) Show that the  $x$  coordinates of the turning points of the curve with equation  $y = f(x)$  satisfy the equation  $\tan x = 3$

(4)

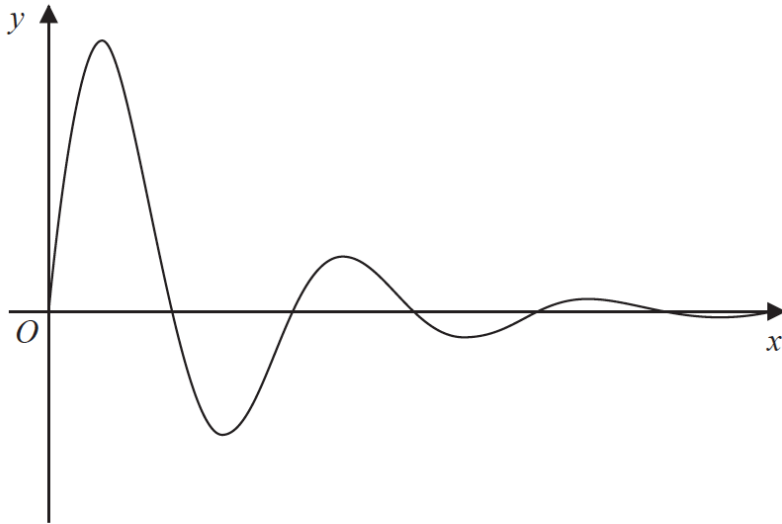


Figure 3

Figure 3 shows a sketch of part of the curve with equation  $y = f(x)$ .

- (b) Sketch the graph of  $H$  against  $t$  where

$$H(t) = \left| 12e^{-\frac{t}{3}} \sin t \right| \quad t \geq 0$$

(2)

The function  $H(t)$  is used to model the height, in metres, of a ball above the ground  $t$  seconds after it has been kicked.

Using this model, find

- (c) the maximum height of the ball above the ground between the first and second bounce. (3)
- (d) Explain why this model should not be used to predict the time of each bounce. (1)

(Total for Question 12 is 10 marks)