6. The curve C has equation

$$x = \left(3\sin 2y - \frac{6y}{\pi}\right)^2$$

Given that

- the point P with y coordinate $\frac{\pi}{4}$ lies on C
- the tangent to C at P cuts the x-axis at the point Q

use calculus to find the x coordinate of Q

(6)

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Question 6 continued

(Total for Question 6 is 6 marks)

7. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

The selling price of a car is monitored over a 15-year period.

The selling price P_C of the car, in thousands of pounds, t years after monitoring began, is modelled by the equation

$$P_C = 7 + 16e^{-0.1t} \qquad 0 \leqslant t \leqslant 15$$

Given that when $t = T$ the selling price of the car is £15 000

(a) find, according to the model, the value of T. Give the answer to 2 decimal places.

(3)

(b) Find the value of $\frac{dP_C}{dt}$ when $t = 5$. Give the answer to 2 decimal places.

(2)

The selling price of a van is monitored over the same 15-year period.

The selling price P_V of the van, in thousands of pounds, t years after monitoring began, is modelled by the equation

$$P_V = 4 + me^{-0.2t} \qquad 0 \leqslant t \leqslant 15$$

where m is a constant.

Use the equations of these models to answer parts (c) and (d).

Given that $P_V = 36$ when $t = 0$

(c) (i) state the value of m

(ii) find the difference between the initial selling price of the car and the initial selling price of the van.

(3)

When $t = \alpha$, the selling price of the car is equal to the selling price of the van.

(d) Find, using algebra and showing your working, the value of α, giving the answer to 3 significant figures.

(4)

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