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

$$f(x) = 3\sin x + 4\cos x$$

(a) Express $f(x)$ in the form $R\sin(x + \alpha)$, where R and α are constants,

$R > 0$ and $0 < \alpha < \frac{\pi}{2}$ giving the value of α to 3 significant figures.

(3)

$$h(x) = \left(4f(2x) - 3\right)^2 \qquad 0 < x < 2\pi$$

(b) Using the answer to part (a),

(i) write down the maximum value of $h(x)$,

(ii) find the largest value of x for which this maximum value occurs.
You must make your method clear.

(3)

(Total for Question 6 is 6 marks)

7.

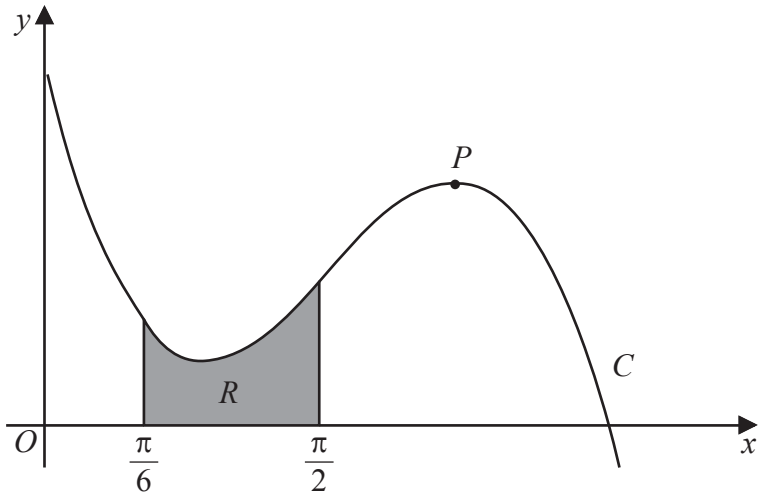

Figure 3

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

Figure 3 shows a sketch of part of the curve C with equation

$$y = 1 - 2x + 5\sin^2\left(\frac{1}{2}x\right) \qquad x > 0$$

where x is measured in radians.

The point P lies on C and is a local maximum, as shown in Figure 3.

(a) Use calculus and a suitable trigonometric identity to find the x coordinate of P.
Give the answer to 3 significant figures.

(4)

The region R, shown shaded in Figure 3, is bounded by C, the x-axis and the lines with equations $x = \frac{\pi}{6}$ and $x = \frac{\pi}{2}$

(b) Use algebraic integration to find the exact area of R.

(4)

(Total for Question 7 is 8 marks)