7. (a) Using the substitution $u = 4x + 2\sin 2x$, or otherwise, show that

$$\int_0^{\frac{\pi}{2}} e^{4x+2\sin 2x} \cos^2 x \, dx = \frac{1}{8}(e^{2\pi} - 1)$$

(5)

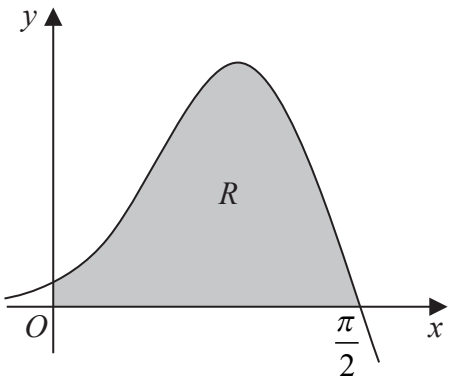


Figure 3

The curve shown in Figure 3, has equation

$$y = 6e^{2x+\sin 2x} \cos x$$

The region R, shown shaded in Figure 3, is bounded by the positive x-axis, the positive y-axis and the curve.

The region R is rotated through 2π radians about the x-axis to form a solid.

(b) Use the answer to part (a) to find the volume of the solid formed, giving the answer in simplest form.

(3)

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Question 7 continued

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Question 7 continued

(Total for Question 7 is 8 marks)

8. Use proof by contradiction to prove that the curve with equation

$$y = 2x + x^3 + \cos x$$

has no stationary points.

(4)

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