7. **Figure 2**

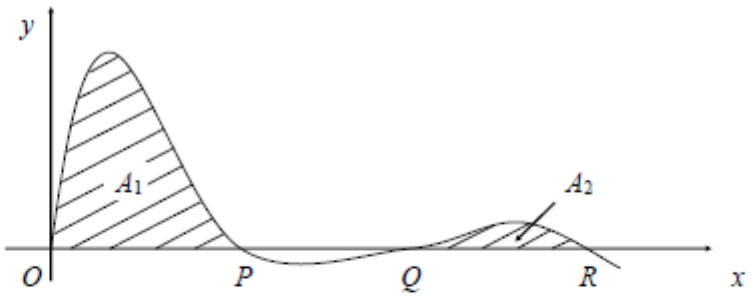

Figure 3 shows a sketch of part of the curve C with question

$$y = e^{-x} \sin x, \quad x \geq 0.$$

(*a*) Find the coordinates of the points P, Q and R where C cuts the positive axis.

(2)

(*b*) Use integration by parts to show that

$$\int e^{-x} \sin x \, dx = -\tfrac{1}{2} e^{-x} (\sin x + \cos x) + \text{constant}.$$

(5)

The terms of the sequence $A_1, A_2, \ldots, A_n, \ldots$ represent areas between C and the x-axis for successive portions of C where y is positive. The area represented by A_1 and A_2 are shown in Figure 3.

(*c*) Find an expression for A_n in terms of n and π.

(6)