# STEP III, 2007, Q14

14 (i) My favourite dartboard is a disc of unit radius and centre $O$. I never miss the board, and the probability of my hitting any given area of the dartboard is proportional to the area. Each throw is independent of any other throw. I throw a dart $n$ times (where $n > 1$). Find the expected area of the smallest circle, with centre $O$, that encloses all the $n$ holes made by my dart.

Find also the expected area of the smallest circle, with centre $O$, that encloses all the $(n-1)$ holes nearest to $O$.

(ii) My other dartboard is a square of side 2 units, with centre $Q$. I never miss the board, and the probability of my hitting any given area of the dartboard is proportional to the area. Each throw is independent of any other throw. I throw a dart $n$ times (where $n > 1$). Find the expected area of the smallest square, with centre $Q$, that encloses all the $n$ holes made by my dart.

(iii) Determine, without detailed calculations, whether the expected area of the smallest circle, with centre $Q$, on my square dartboard that encloses all the $n$ holes made by my darts is larger or smaller than that for my circular dartboard.