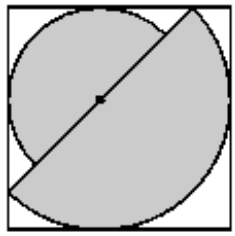
23. The diagram shows two different semicircles inside a square with sides of length 2. The common centre of the semicircles lies on a diagonal of the square.
What is the total shaded area?



A π B $6\pi(3-2\sqrt{2})$ C $\pi\sqrt{2}$ D $3\pi(2-\sqrt{2})$ E $8\pi(2\sqrt{2}-3)$

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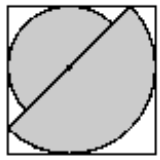
23. B Let r_1 and r_2 represent the radii of the smaller and larger semicircles respectively. A vertical line through the common centre of the semicircles gives $r_1 + r_2 = 2$ … (1). Also, together with the diameter of the larger semicircle, this line forms a right-angled, isosceles triangle giving $\sin 45° = \dfrac{r_1}{r_2}$. Hence $r_2 = \sqrt{2}r_1$ … (2).



Substituting (2) into (1) gives $(1+\sqrt{2})r_1 = 2$ so that $r_1 = 2(\sqrt{2}-1)$.
Therefore $r_2 = 2\sqrt{2}(\sqrt{2}-1)$.
Hence the total shaded area is $\frac{1}{2}\pi(r_1^2 + r_2^2) = \frac{1}{2}\pi\left[4(\sqrt{2}-1)^2 + 8(\sqrt{2}-1)^2\right] = 6\pi(3-2\sqrt{2})$.