

**Stage 4 ★****Mixed Selection 1 - Solutions****1. Circle in a semicircle**

Let the radius of the circle be r . This implies that the radius of the semicircle is $2r$. The area of the semicircle is $\frac{1}{2} \times \pi \times (2r)^2$, which is twice the area of the small circle.

2. Four parts

The circumference of a circle with radius r is $2\pi r$.

Each piece has a quarter of the circle with radius 4 together with two semicircular arcs of radius 2.

The arc of the large circle has length $\frac{1}{4} \times 2 \times \pi \times 4 = 2\pi$.

The semicircular arcs have length $\frac{1}{2} \times 2 \times \pi \times 2 = 2\pi$.

Therefore the overall perimeter is 6π .

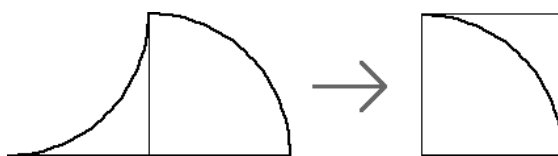
3. Smile

If the semicircle with diameter PQ is rotated through 180° about Q , the new shape formed has the same area as the original shape. It consists of a semicircle of diameter 6cm and a semicircle of diameter 2cm .

So the area of the original shape is $\frac{1}{2} \times \pi \times 3^2 + \frac{1}{2} \times \pi \times 1^2 = 5\pi \text{ cm}^2$.

4. Arc area

As the diagram shows, the figure may be cut into two parts that fit together to form a square measuring $8\text{cm} \times 8\text{cm}$.



These problems are adapted from UKMT Mathematical Challenge problems (ukmt.org.uk)