

Circles and percentages (Intermediate UKMT)

These questions must be attempted **without a calculator**

Topics covered in the questions below may not necessarily be from the topic of the title.

1. S is 25% of 60 60 is 80% of U 80 is $M\%$ of 25.

What is $S + U + M$?

- A 100 B 103 C 165 D 330 E 410

2. **GOOD NEWS!** Accidents in British homes involving tea-cosies went down from three in 1993 to nil in 1994.

What percentage decrease was that?

- A 33.3% B 66.6% C 100% D 300% E Infinite %

3. To make porridge, Goldilocks mixes together 3 bags of oats with 1 bag containing 20% wheat bran and 80% oats. All the bags have the same volume.

What percentage of the volume of Goldilocks' porridge mixture is wheat bran?

- A 5% B $6\frac{2}{3}\%$ C 20% D $26\frac{2}{3}\%$ E 60%

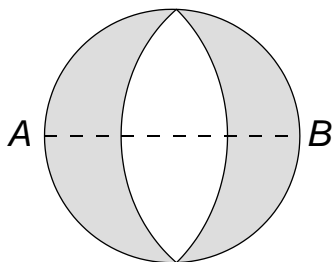
4. A piece of thin card in the shape of an equilateral triangle with side 3 cm and a circular piece of thin card of radius 1 cm are glued together so that their centres coincide.

How long is the outer perimeter of the resulting 2-dimensional shape (in cm)?

- A 2π B $6 + \pi$ C 9 D 3π E $9 + 2\pi$

5. AB is a diameter of a circle of radius 1 cm. Two circular arcs of equal radius are drawn with centres A and B .

These arcs meet on the circle, as shown. What is the shaded area?



- A $\frac{\pi}{2} \text{ cm}^2$ B 1 cm^2 C $(\pi - 1) \text{ cm}^2$ D 2 cm^2 E $\frac{2\pi}{3} \text{ cm}^2$

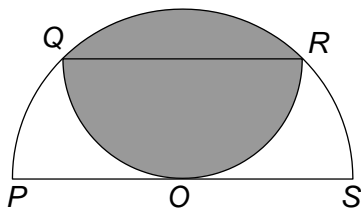
6. A heptagon is a seven-sided polygon. What is the greatest number of the following properties that a single heptagon can possibly possess?

Its interior angles add up to 900 degrees. All its sides are equal. It has exactly four acute interior angles. It has exactly one line of symmetry. It has no obtuse interior angles.

- A 1 B 2 C 3 D 4 E 5

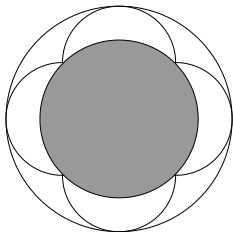
7. The diagram shows two semicircular arcs, $PQRS$ and QOR . The diameters, PS and QR , of the two semicircles are parallel; PS is of length 4 and is a tangent to semicircular arc QOR .

What is the area of the shaded region?



- A $2\pi - 2$ B 3π C π D 4 E $2\pi - 4$

8. The diagram shows two circles and four equal semi-circular arcs. The area of the inner shaded circle is 1.



What is the area of the outer circle?

- A $\sqrt{2}$ B 2 C $1 + \sqrt{2}$ D $\frac{\pi}{2}$ E $\frac{9}{4}$