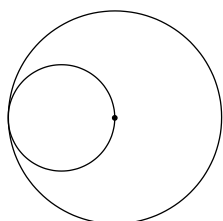# Area of a circle (Senior UKMT)

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. The smaller circle touches the larger circle, and goes through the centre of the larger circle.

    What fraction of the area of the larger circle is outside the smaller circle?

    A $\frac{2}{3}$ B $\frac{3}{4}$ C $\frac{4}{5}$ D $\frac{5}{6}$ E $\frac{7}{8}$

2. A teacher gave a test to 20 students. Marks on the test ranged from 0 to 10 inclusive. The average of the first twelve papers marked was 6.5. What can you conclude from this about the eventual average M for the whole group?

    A $0.325 \le M \le 6.5$ B $3.25 \le M \le 6.5$ C $3.9 \le M \le 6.5$

   D $3.9 \le M \le 7.9$ E $6.5 \le M \le 7.9$

3. Last year Noel bought a number of identically priced Christmas cards. The total cost was £15.60. In a gesture of seasonal goodwill the shopkeeper gave him one extra card free, and this reduced the average cost per card by exactly 1p.

    At their original price how many cards could Noel have bought with £5?

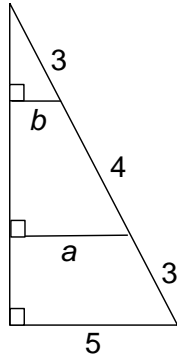   A 8   B 12   C 16   D 20   E 24

4. The diagram shows two concentric circles of radii r and $2r$ respectively.

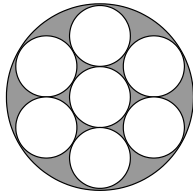   What is the ratio of the total shaded area to the total unshaded area?
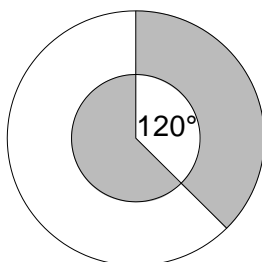
    A 5:7   B 7:5   C 1:1   D 2:3   E 3:2

5. From the information given in the diagram shown below, what is the value of *a* + *b*?

A 3   B 4   C 5   D 6   E 7

6. The diagram shows seven circles of equal radius which fit snugly in the larger circle.

What is the ratio of the unshaded area to the shaded area?

A 7:1   B 7:2   C 2√3 : 1   D 9:2   E 1:1

7. A roll of adhesive tape is wound round a central cylindrical core of radius 3 cm. The outer radius of a roll containing 20 m of tape is 4 cm.

Approximately, what is the outer radius of a roll containing 80 m of tape?

A 5 cm   B 5·5 cm   C 6 cm   D 7 cm   E 12 cm

8. The trunk of a monkey-puzzle tree has diameter 40 cm. As a protection from fire, the trunk of the tree has a bark which makes up 19% of its volume.

On average, roughly how thick is the bark of the trunk?

A 0.4 cm   B 1.2 cm   C 2 cm   D 2.8 cm   E 4 cm

9. A sculpture is made up of 12 wooden cylinders, each of height 2cm. They are glued together as shown. The diameter of the top cylinder is 2cm and each of the other cylinders has a diameter 2cm more than the one immediately above it. The exhibit stands with its base on a marble table.

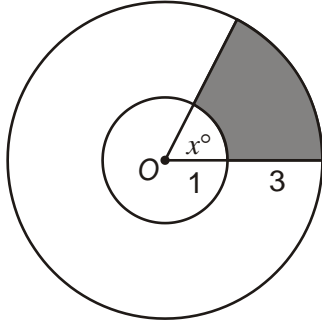What, in cm^2, is the total surface area of the sculpture, excluding the base?

A 456π B 356π C 256π D 156π E 144π

10. The point *O* is the centre of both circles and the shaded area is one-sixth of the area of the outer circle.
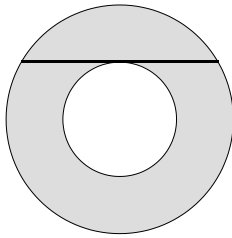
What is the value of *x*?

A 60　　　　　B 64　　　　　C 72　　　　　D 80　　　　　E 84

11. The diagram shows two concentric circles. The chord of the large circle is a tangent to the small circle and has length 2*p*.
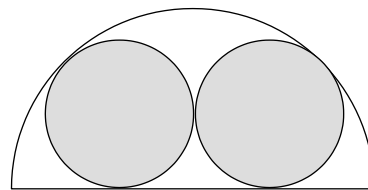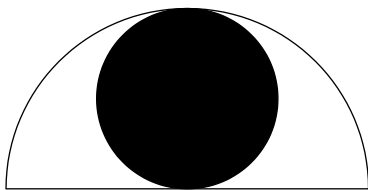
What is the area of the shaded region?

A πp^2　　　B $2\pi p^2$　　　C $3\pi p^2$　　　D $4\pi p^2$　　　E more information needed

12. The area of each large semicircle is 2.

What is the difference between the black and grey shaded areas?

A 0　　　　　B $\dfrac{1}{2}$　　　　　C $1+2\sqrt{2}$　　　　　D $\dfrac{5}{9}$　　　　　E $23-16\sqrt{2}$