

Pythagoras (Senior UKMT)

These questions must be attempted without a calculator

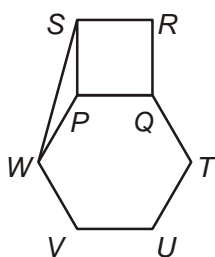
Topics covered in the questions below may not necessarily be from the topic of the title.

1. What is the value of $\sqrt{2^4 + \sqrt{3^4}}$?

- A 4 B $\sqrt{20}$ C 5 D 7 E $\sqrt{97}$

2. The diagram shows square $PQRS$ and regular hexagon $PQTUVW$.

What is the size of $\angle PSW$?



- A 10° B 12° C 15° D 24° E 30°

3. A cube $ABCDEFGH$ has $ABCD$ as square base, with E, F, G, H above A, B, C, D respectively.

What is the cosine of the angle $\angle CAG$?

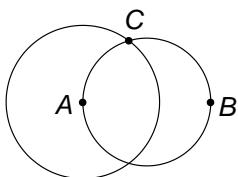
- A $1/\sqrt{3}$ B $\sqrt{2}/3$ C $1/\sqrt{2}$ D $\sqrt{(2/3)}$ E $\sqrt{3}/2$

4. When the following five numbers are arranged in numerical order, which one is in the middle?

- A $4\sqrt{15}$ B $5\sqrt{10}$ C $7\sqrt{5}$ D $9\sqrt{3}$ E $11\sqrt{2}$

5. The smaller circle has radius 10 units; AB is a diameter. The larger circle has centre A , radius 12 units and cuts the smaller circle at C .

What is the length of the chord CB ?



- A 8 B 10 C 12 D $10\sqrt{2}$ E 16

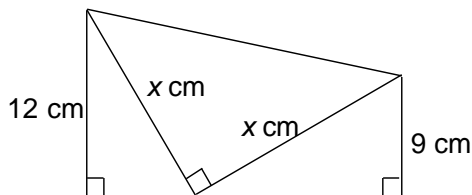
6. In a fit of madness, the bee Zerk left the hive and flew 1m due North, then 1m due East, then 1m vertically up. She then made a beeline for the hive, flying directly home in a straight line.

How far, in m, did she fly altogether?

- A 4 B $3 + \sqrt{2}$ C $3 + \sqrt{3}$ D $5\frac{1}{4}$ E 6

7. The diagram shows three right-angled triangles.

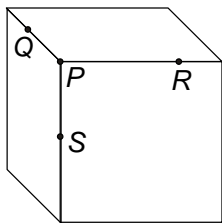
What is the value of x ?



- A 14 B $10\sqrt{2}$ C 15 D $12\sqrt{2}$ E $10\sqrt{3}$

8. P is a vertex of a cuboid and Q , R and S are three points on the edges as shown. $PQ = 2$ cm, $PR = 2$ cm and $PS = 1$ cm.

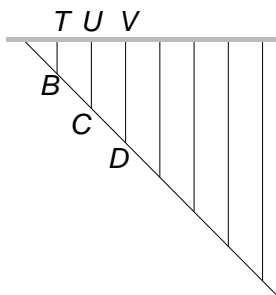
What is the area, in cm^2 , of triangle QRS ?



- A $\sqrt{15}/4$ B $5/2$ C $\sqrt{6}$ D $2\sqrt{2}$ E $\sqrt{10}$

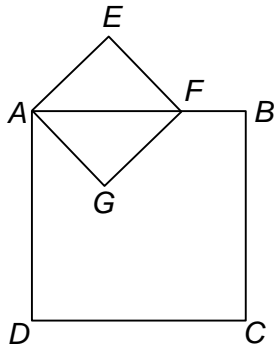
9. A sculpture consists of a row of 2 metre rods each placed with one end resting on horizontal ground and the other end resting against a vertical wall. The diagram shows how the rods BT , CU , DV , ... look from above. The bases of the rods B , C , D , ... lie on a straight line on the ground at 45° to the wall. The top ends of the rods T , U , V ... lie on part of a curve on the wall.

What curve is it?



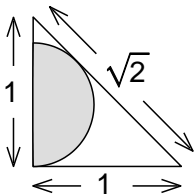
- A a straight line B a parabola C a circle D a sine curve E a quartic curve

10. In the diagram below, square $ABCD$ has side 4cm, and square $AEFG$ has side 2cm.
What, in cm, is the length of CE ?



- A 4 B $4 + \sqrt{2}$ C 6 D 7 E $4 + 2\sqrt{2}$

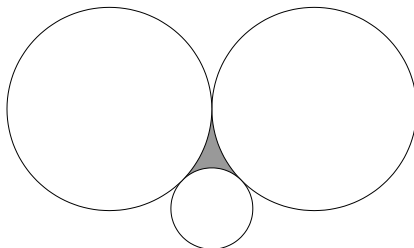
11. What is the radius of the shaded semicircle?



- A $\sqrt{2} - 1$ B $\frac{1}{\sqrt{2}}$ C $3 - 2\sqrt{2}$ D $\frac{1}{2}$ E $2 - \sqrt{2}$

12. The diagram (not to scale) shows two circles of radius 105 which are tangent to each other and to a circle of radius 14.

What is the radius of the largest circle which can be placed in the shaded region?



- A 2 B 3 C 4 D 5 E 6