



OUNDELE SCHOOL

MAIN ACADEMIC SCHOLARSHIP 2007

MATHEMATICS

PAPER 2

2 hours.

CALCULATORS WILL BE NEEDED FOR THIS PAPER.

INSTRUCTIONS TO CANDIDATES.

You are not expected to have time to do all the questions.

You may answer the questions in any order.

Choose those questions which you think you can answer best.

Remember to show your working and clearly show the method you are using.

Take π as either 3.14 or the value on your calculator.

Answers should be given to 3 significant figures where appropriate.

Some questions are longer than others.

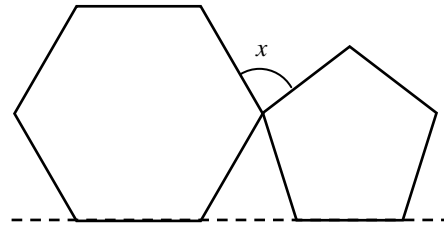
The number of marks for each question is shown in square brackets.



1. a) The bidding price of a sofa on eBay started at £200. On Monday, the price increased by 15%, and during Tuesday the price increased by another 22%.
 - i) What is the new cost?
 - ii) What is the overall percentage increase in the cost of the sofa?
- b) Marty travels 10 years into the future, where he finds that prices have increased by 25%. In 2017, his favourite breakfast cereal costs £2.75 per box. How much does it cost now?

[10]

2. A regular hexagon and a regular pentagon are aligned as shown in the diagram, and touch exactly at a single point.



Find the size of angle x .

[8]

3. Oundle's new SciTec building has been constructed using a crane with a horizontal jib of length 60m, measured to the nearest metre. The tower of the crane is one fifth of the way along the jib.



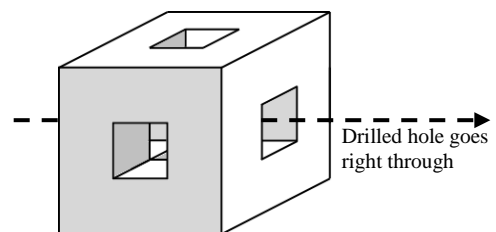
- a) If the jib can turn through a full revolution in 90 seconds, find the maximum speed of the end of the jib.

The rectangular playing field outside SciTec is on a slope. The pitch used to slope downwards over the course of its length by 4 metres. During the building process, the field was filled in with rubble so that it now slopes downwards by just one metre across its length. The field has length 140m and width 90m, measured horizontally.

- b) If the mass of 1 m^3 of rubble is 1200kg, find the total mass of rubble used to fill in the field.

[8]

4. A pendant is made from a $3\text{cm} \times 3\text{cm} \times 3\text{cm}$ cube with a square hole of side 1cm drilled through the centre of each face, and out the other side.



Calculate:

- a) the volume of this pendant
- b) the total surface area (inside and out) of the whole shape.

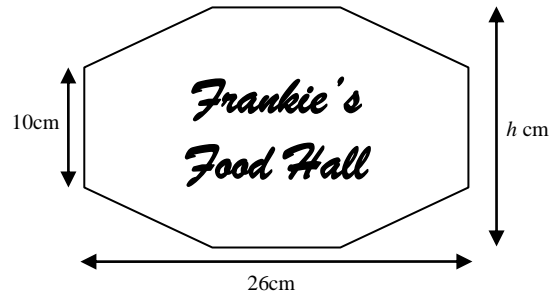
[8]

5. A circle of radius 7 units has its centre at $(-2, 3)$. A square of side 10 units has its centre at $(10, -2)$. Could these shapes overlap?

[10]

6. Square $ABCD$ has side 3. P is on AD such that $AP = 1$. The point Q lies on a side of the square in such a way that the line PQ divides the square into two pieces, the ratio of whose areas is $1 : 3$. Find the possible lengths BQ . [12]

7. Frankie has just ordered some stylish octagonal placemats for his restaurant. Each of the eight sides is 10cm long, however, the placemat is not a regular octagon. Its width is 26cm.

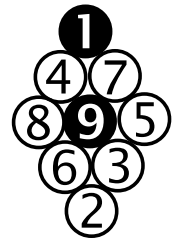


- a) Find its height, h .
b) Find the total area of the placemat.

Frankie now puts a thin circular protective mat underneath so that the octagonal mat just fits on top.

- c) What percentage of the circular mat is not covered by the octagonal mat? [14]

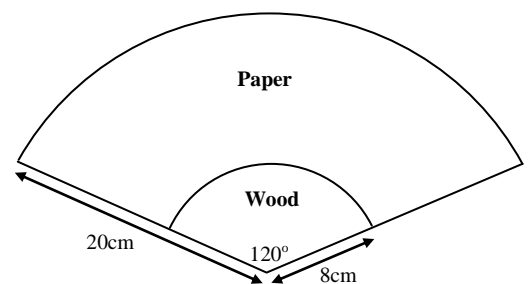
8. Jack is setting up the balls for a game of 9-ball pool in a diamond formation. He places the 1-ball at the front and the 9-ball in the middle. The remaining seven balls can go anywhere in the diamond.



- a) After positioning the ① and the ⑨, In how many positions could Jack place the ②? Having positioned the ②, how many positions would be left for the ③?
b) In how many different ways could he set up all of the balls (with the rules given)?
c) Jack decides to set up every possible formation. If it takes him exactly 2 minutes to set up a particular configuration, and he starts at 8am on 1st June, when will he complete his task?

[10]

9. A Spanish fan opens out to 120° , and can be considered to be part of a circle. It consists of a wooden part in the centre, with a larger, paper part outside.



- a) Calculate the area of the paper part of the fan.

New European fan legislation specifies that the area of the paper part must be at least 80% of the total area of the fan.

- b) If a fan-maker wishes to have a total paper area of 300cm^2 , what is the maximum radius of fan he can make under the new law?

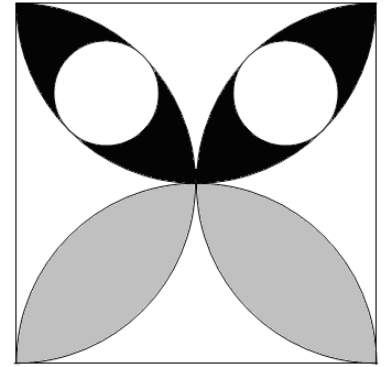
[11]

PLEASE TURN OVER

10. A butterfly badge, shown here, is made up of four semi-circles touching inside a square of side 2cm.

The two white circles are the same width as the black sections, and are located precisely in the centre.

- a) Find the grey area.
b) Find the black area.



[12]

11. The operation \blacktriangle acts on two numbers and means “find the positive difference between twice the larger number and the square of the smaller number”.

Thus: $3 \blacktriangle 4 = (3)^2 - 2(4) = 1$, and $5 \blacktriangle -2 = 2(5) - (-2)^2 = 6$

a) Find:

i) $5 \blacktriangle -3$ ii) $2 \blacktriangle 0.5$ iii) $(-1 \blacktriangle -2) \blacktriangle -3$

b) Find all values x where:

i) $3 \blacktriangle x = 2$ ii) $x \blacktriangle 1 = 7$

[18]

END OF EXAMINATION