

GROUP ROUND

INSTRUCTIONS

- Your team will have 40 minutes to answer 10 questions. Each team will have the same questions.
- Each question is worth 6 points. However, some questions are easier than others!
- You will have to decide your team's strategy for this group competition. Do you split up so that individuals work on a few questions each or do you work in pairs on a greater number of questions? Working all together on all the questions may well take too long. You decide!
- There is only one answer sheet per team. Five minutes before the end of the time you will be told to finalise your answers and write them on the answer sheet. This answer sheet is the only thing that will be marked.

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Question 1

What is the value of

$$0.1^{-2} + 0.4^{-3} + 0.5^{-6} + 0.1^2 + 0.4^3 + 0.5^6 ?$$



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Question 2

Calculate the exact area of the region described in the (x, y) plane by the following inequalities:

$$y > x$$

$$y < \sqrt{3}x$$

$$x^2 + y^2 < 8$$



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Question 3

Given that $\sqrt[3]{4} \times \sqrt[4]{8} \times \sqrt[5]{16} \times \sqrt[6]{32} = 2^3 \times \sqrt[x]{2}$

calculate the value of x .



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Question 4

A sequence is defined for positive integer values of n by

$$u_{n+3} = u_{n+2} + u_{n+1} - u_n$$

$$u_1 = 0$$

$$u_2 = 1$$

$$u_3 = 1$$

What is the sum of the first 100 terms of the sequence?



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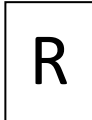
Question 5

All of the letters in the word



are written on cards and placed in a black bag. Four cards are removed from the black bag and placed in a red bag.

Of the 31 different collections of letters that could be in

the red bag, how many do not contain an  ?



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Question 6

A cuboid is made from mnp unit cubes such that the lengths of the edges of the cuboid are m units, n units and p units.

m , n and p are prime numbers and $m < n < p$.

An ant is placed at one vertex of the cuboid. It walks along a circuit crossing the four smallest faces of the cuboid, each time travelling along a diagonal of the face.

By the time the ant returns to the starting vertex, on how many of the cubes has it walked?



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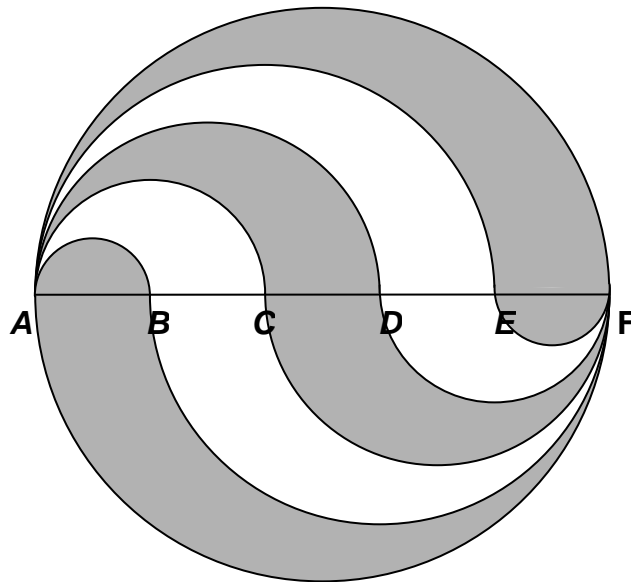
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Question 7

The points A, B, C, D, E and F are equally spaced along the diameter of a circle with A and F at the ends of the diameter.

All of the arcs shown are semi-circles whose diameters have end-points at two of the named points as shown.



What fraction of the circle with diameter AF is shaded?



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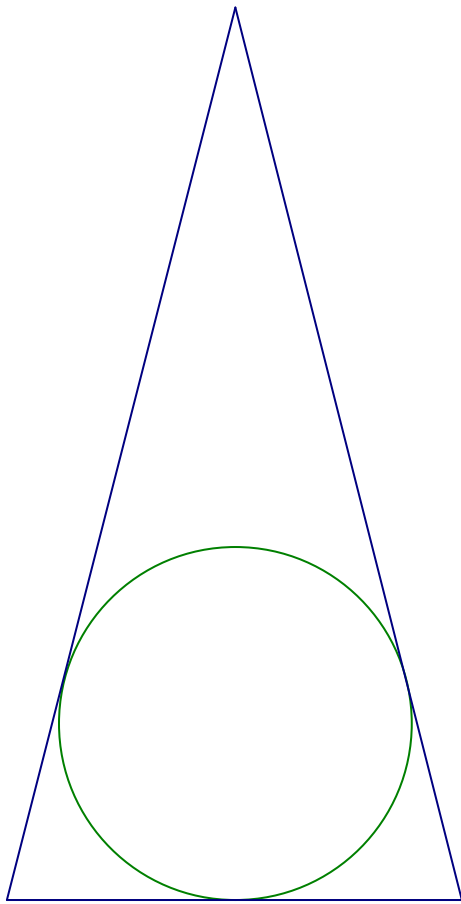


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Question 8

The largest possible circle is drawn inside an isosceles triangle with sides of length 100 units, 100 units and 56 units.

If the area of the circle is written as $a\pi$ units², what is the value of a ?



Not to scale



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Question 9

Solve the equations

$$1122x + 3344y = 12276$$

$$3344x + 1122y = 10054$$



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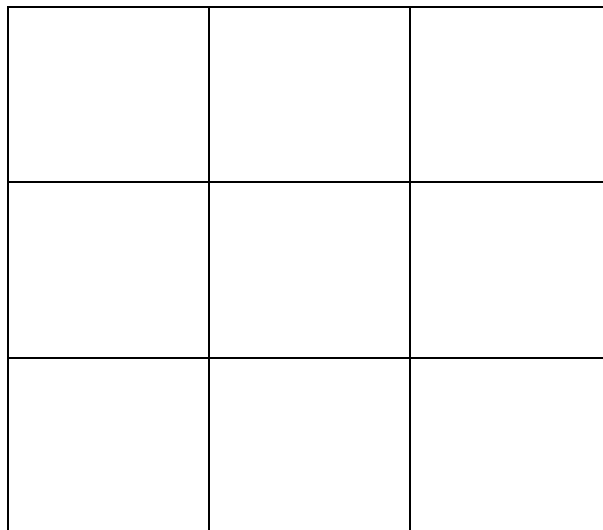


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Question 10

The digits 1, 2, 3, 4, 5, 6, 7, 8 and 9 can be placed in a 3 by 3 grid so that the four three-digit numbers obtained by reading across each of the three rows and also down the diagonal starting in the top left corner, are all squares.

Which digit is in the centre of the grid?



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