

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.

Question 1

The expressions $\frac{1}{3}(x + 3)$ and $\frac{1}{5}(2x - 1)$ represent a pair of consecutive whole numbers.

The expressions $\frac{1}{5}(2y - 1)$ and $\frac{1}{3}(y + 3)$ represent a different pair of consecutive whole numbers.

What is the value of $|x - y|$?



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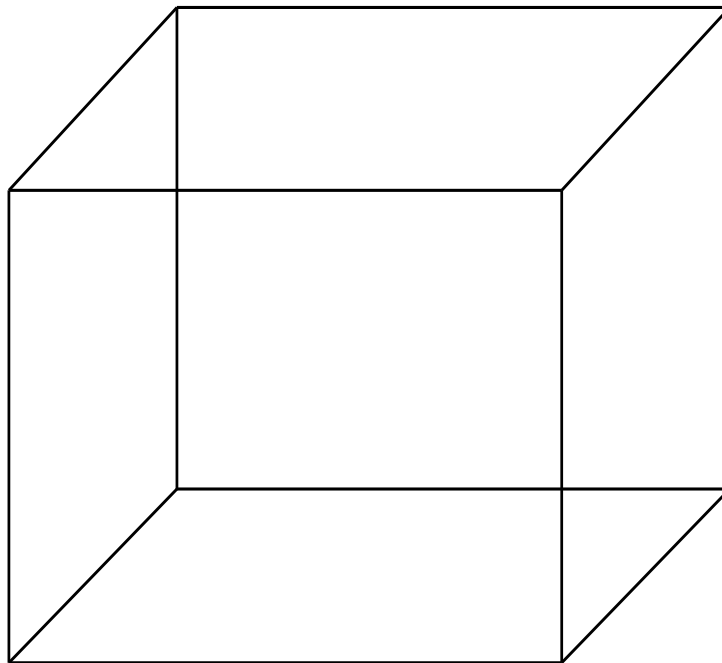
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Question 2

Eight points are placed at the vertices of a cube. In total, how many triangles can be formed by joining three of these points?



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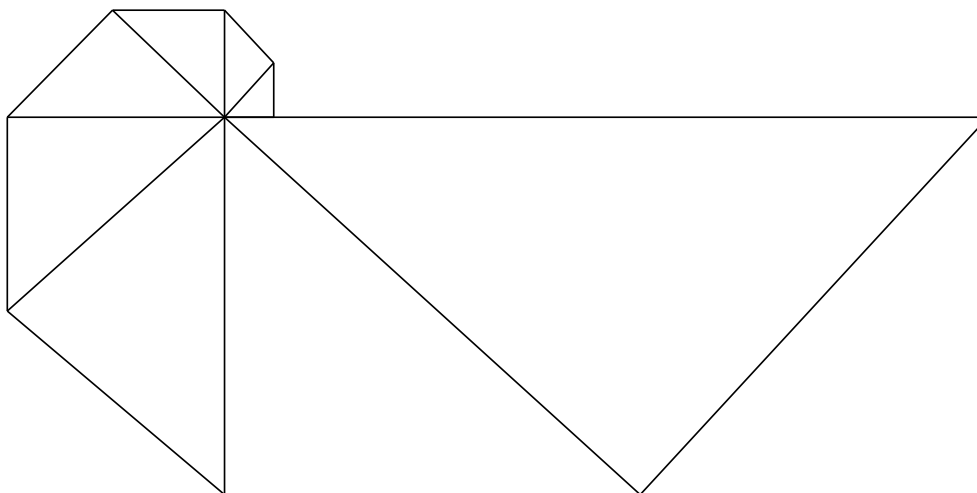
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Question 3

Eight isosceles right-angled triangles, whose sides coincide as shown, form a shape whose perimeter is an irregular nonagon.

The shortest side of the nonagon has length 1 cm.



Calculate the perimeter of the nonagon, giving your answer in the form $a(b + \sqrt{b})$ cm.



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Question 4

In the highest scoring match of the World Cup, Hongeria beat Alduras 19 goals to 9.

If Alduras were never in the lead, how many possible scores could there have been at half time?



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Question 5

Simplify the following expression, giving your answer as an integer.

$$\frac{(10! + 9!)(8! + 7!)(6! + 5!)(4! + 3!)(2! + 1!)}{(10! - 9!)(8! - 7!)(6! - 5!)(4! - 3!)(2! - 1!)}$$

$$n! = n \times (n - 1) \times (n - 2) \times \dots \times 3 \times 2 \times 1$$



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Question 6

The first three terms of a sequence are

$1 + 2$, $3 + 4 + 5 + 6$, and $7 + 8 + 9 + 10 + 11 + 12$.

The n^{th} term is the sum of the next $2n$ natural numbers that have not already been used to form a term.

What is the value of the 10^{th} term?



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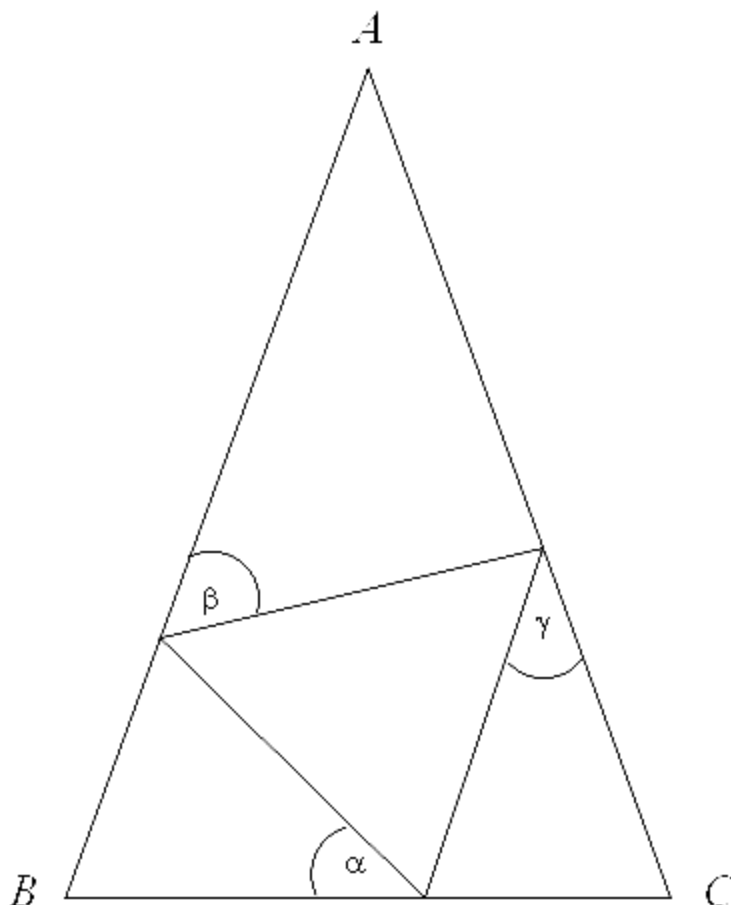
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Question 7

In the diagram, triangle ABC is isosceles, with $AB = AC$.
The inscribed triangle is equilateral.



Not to scale

Find an expression for angle α in terms of angles β and γ .



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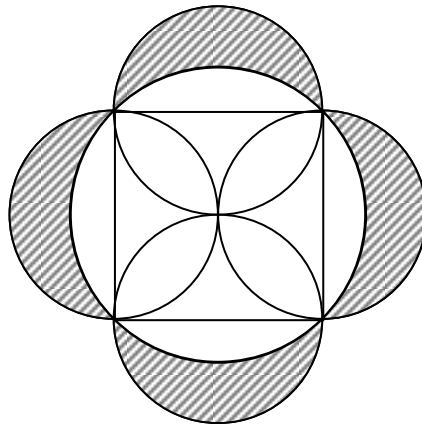
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Question 8

Each side of a square has a circle drawn on it as diameter. The square is also inscribed in a fifth circle as shown.



Find the ratio of the total area of the shaded crescents to the area of the square.



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Question 9

Let

$$ab = 104030$$

$$bc = 304010$$

$$a + c = 808.$$

What is the value of b ?



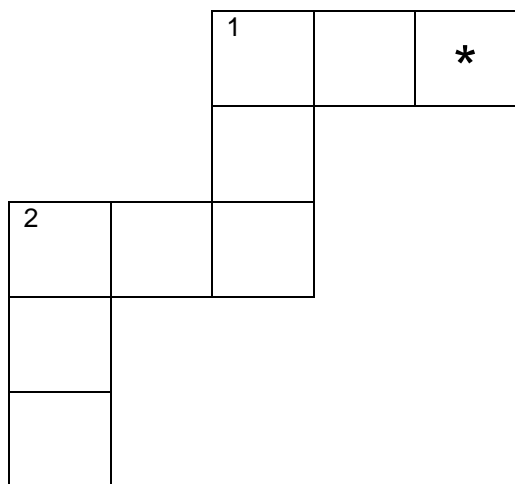
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Question 10



1 Across: a triangular number.

2 Across: both a square and a cube.

1 Down: a square.

2 Down: a square.

Each of the digits 1 to 9 is used exactly once to solve this cross number.

Which digit should be placed in the square marked * ?



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the Further Mathematics network
www.fmnnetwork.org.uk

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Group answer sheet

Team number

Team name

1. value of $ x - y =$	2. number of triangles =
3. perimeter = cm	4. number of possible scores =
5. value =	6. value of the 10 th term =
7. $\alpha =$	8. area of crescents : area of square =
9. $b =$	10. value of digit =

Award 6 points for each correct answer.

TOTAL SCORE = _____



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