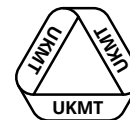


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## Instructions

- 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.
- There is only one RESPONSE SHEET per team. Five minutes before the end of the time you will be told to finalise your answers and write them on the RESPONSE SHEET. Only this RESPONSE SHEET will be marked.



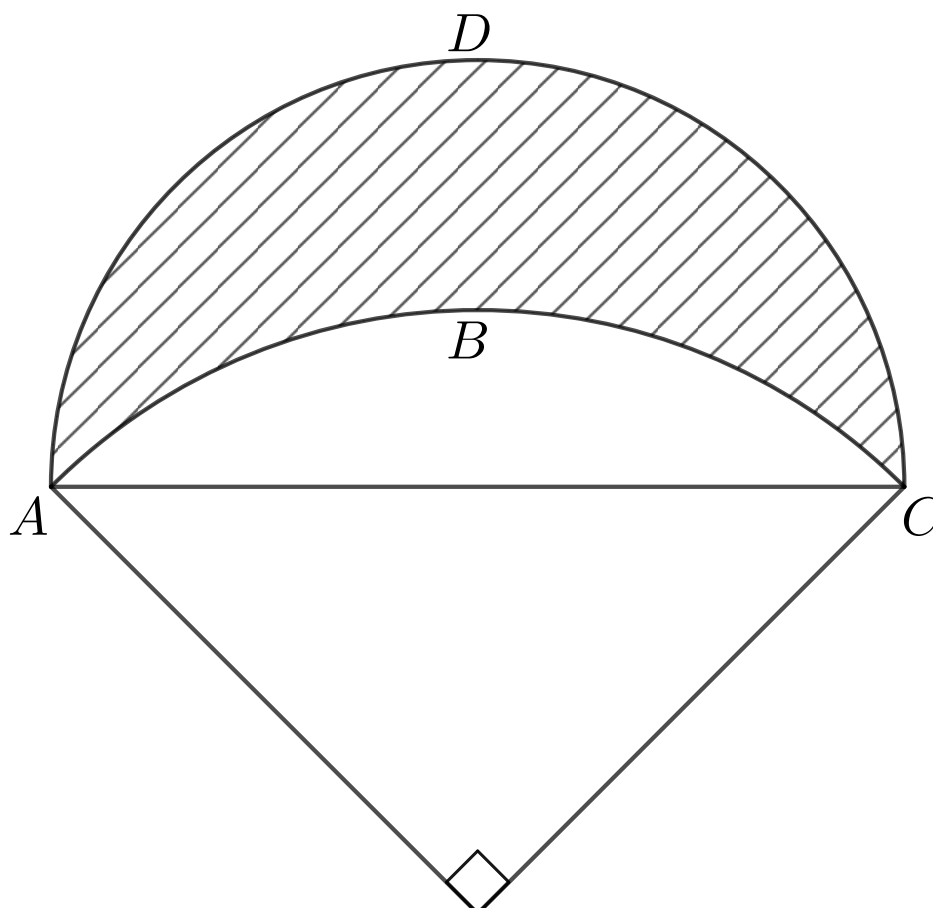
## QUESTION 1

The sum of all the digits in the numbers from 1 to 10 is 46, since  $1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 1 + 0 = 46$ .

What is the sum of all the digits in the numbers from 1 to 100?

[6 marks]

## QUESTION 2



$AC$  is a straight line of length 16. The point  $D$  lies on a semicircular arc that has endpoints  $A$  and  $C$ . The point  $B$  lies on an arc of a quarter circle that also has endpoints  $A$  and  $C$ .

What is the area of the shaded region?

[6 marks]



## QUESTION 3

Barry commutes to work every day by the same route. He leaves the house at the same time every morning.

If his average speed is 30mph, then he arrives at work three minutes early. If his average speed is 20mph, he arrives at work three minutes late.

What speed, in mph, must he average to arrive at work exactly on time?

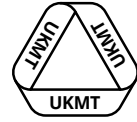
[6 marks]

GROUP ROUND

SENIOR TEAM MATHS  
CHALLENGE  
2020-21  
REGIONAL FINAL



Advanced Mathematics  
Support Programme



United Kingdom  
Mathematics Trust

## QUESTION 4

What is the largest odd factor of  $320^4$ ?

[6 marks]

## QUESTION 5

In Mathland, there are only three different types of coin, each with a different positive integer value of pennies (for example, a 3p, 8p and a 10p).

The minimum number of coins required to make 17p is 3.

The minimum number of coins required to make 18p is 6.

The minimum number of coins required to make 19p is  $x$ .

The minimum number of coins required to make 20p is 4.

The minimum number of coins required to make 21p is 3.

The minimum number of coins required to make 22p is 2.

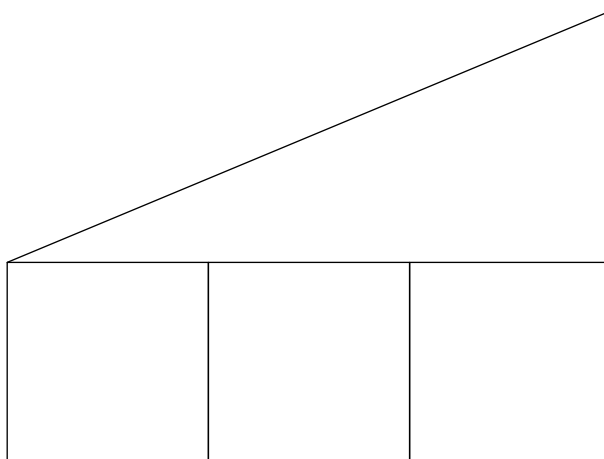
What is the value of  $x$ ?

[6 marks]

## QUESTION 6

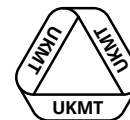
A shape is said to be *equable* if its perimeter, in centimetres, is numerically the same as its area in square centimetres.

The trapezium shown is made up of three equable squares and an equable right-angled triangle.



What is the perimeter, in centimetres, of the trapezium?

[6 marks]



## QUESTION 7

The positive integers  $m$  and  $n$  satisfy the equation

$$\left(\frac{m^2}{2}\right)^2 - \left(\frac{n^2}{2}\right)^2 = 2020.$$

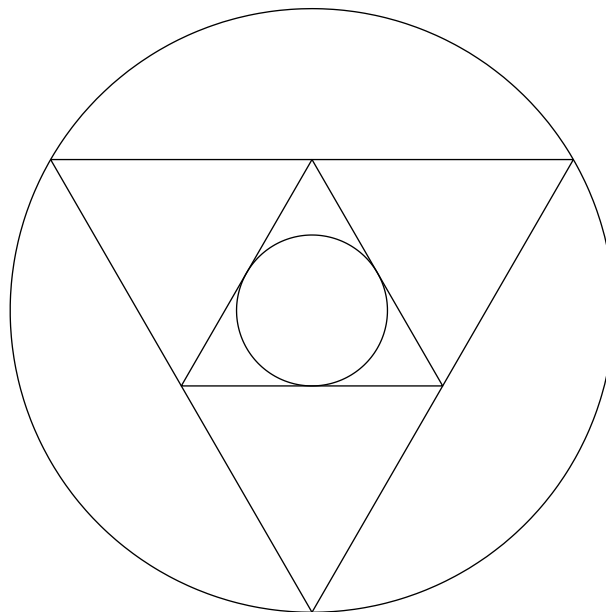
What is the value of  $m + n$ ?

[6 marks]



## QUESTION 8

The midpoints of the three sides of an equilateral triangle are joined up to form a smaller equilateral triangle. A circle is inscribed in the smaller triangle and another circle is circumscribed around the larger triangle.



The ratio of the area of the larger circle to the area of the smaller circle can be written as  $x : 1$ .

What is the value of  $x$ ?

[6 marks]

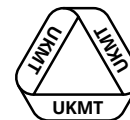


## QUESTION 9

A display board has three coloured lights. Initially when the lights are turned on, the three coloured lights all flash at the same time. The blue light then flashes every 3 seconds, the green light every 5 seconds and the red light every 7 seconds. In the fifth, sixth and seventh seconds, there are three consecutive flashes of three different colours, namely, green, blue and red, in that order.

After how many seconds do the lights first flash red, then blue, then green, in three consecutive seconds? Specify your answer by giving the time, in seconds, when the green flash occurs – this will be a multiple of 5.

[6 marks]




## QUESTION 10

How many numbers, between 1 and 100 inclusive, are multiples of 4 or have at least one digit that is a positive multiple of 4?

[6 marks]

TEAM NUMBER 

SCHOOL NAME 

**1. Sum of the digits**

(0) (6)

**6. Perimeter of trapezium**

centimetres (0) (6)

**2. Shaded area**

(0) (6)

**7. Value of  $m + n$**

(0) (6)

**3. Required speed**

mph (0) (6)

**8. Ratio of Areas of large circle to small circle**

(0) (6)

**4. Largest odd factor**

(0) (6)

**9. Time of green light flashing**

seconds (0) (6)

**5. Value of  $x$**

(0) (6)

**10. Number of numbers**

(0) (6)

Circle the mark awarded for each question and cross out the others.

FINAL SCORE /60 