The Scottish Mathematical Council

www.scot-maths.co.uk

MATHEMATICAL CHALLENGE 2024−2025

Entries must be the unaided efforts of individual pupils.
Solutions must include explanations and answers without explanation will be given no credit.
Do not feel that you must hand in answers to all the questions.

CURRENT AND RECENT SPONSORS OF MATHEMATICAL CHALLENGE ARE
The Edinburgh Mathematical Society, The Maxwell Foundation,
The London Mathematical Society and The Scottish International Education Trust.
The Scottish Mathematical Council is indebted to the above for their generous support and gratefully acknowledges financial and other assistance from schools, universities and education authorities.
Particular thanks are due to the Universities of Aberdeen, Edinburgh Napier, Moray House, St Andrews, Stirling, Strathclyde and to George Heriot's School, Gryffe High School and Kelvinside Academy.

Middle Division: Problems 2

M1. A bag contains 21 balls, each of which is red or blue. The balls are identical except for their colour. Sasha reaches into the bag and removes two balls at random. Each ball in the bag is equally likely to be removed. The probability that two red balls are removed is exactly $\frac{1}{2}$.

How many of the 21 balls are red?

M2. Two joggers live beside a canal. The distance between their houses along the towpath is 5 miles. They each set out at the same time to jog along the towpath to the other's house and back. One jogs at a constant speed of 5 mph and the other is faster with a constant speed of 7 mph.

How far from home will the faster jogger be when they meet for the second time? And how long after they set out is this?

M3. On Saturday I cycled from my home due east to the junction at Aton. I continued due east (though not as far as before) to the junction at Beesley. I returned home via the junction at Ceeborough, which is due north along a straight road from Aton. All the roads are straight and it is a whole number of miles between any neighbouring junctions. My journey was less than 48 miles. What distance did I cycle?

M4. Around the circumference of a circle, mark 21 points, equally spaced, and label them 0, 1, 2, ... , 20 in cyclic order. Mark n of the points with an asterisk (*) so that no two pairs of * points are the same distance apart. What is the maximum value of n? Explain.

M5. Find a set of 4 different positive integers such that the sum of any pair of them divides their product exactly.

Find a set of 6 different positive integers with the same property, or show that it is not possible to find such a set.

END OF PROBLEM SET 2

CLOSING DATE FOR RECEIPT OF SOLUTIONS :

21 February 2025

SEE OVER FOR LINKS TO THE MATHS CHALLENGES ARCHIVES

SMC

Mathematical Challenge Problems 2

MIDDLE DIVISION 2024-2025

PLEASE USE CAPITALS TO COMPLETE

SURNAME

OTHER NAME(S) (underline the one you prefer)

SCHOOL

AGE

YEAR OF STUDY S

FOR OFFICIAL USE

Marker

Marks

1	2	3	4	5

Total

– – – – CUT ALONG HERE – – – –

Please write your solutions on A4 paper and staple the above form to them.

PLEASE WRITE YOUR NAME ON EVERY PAGE.

Send your entry through your school to the section organiser.

For further information on the competition, please see the School Materials which have been distributed to schools. A copy of these Materials can be obtained from

http://www.wpr3.co.uk/MC/materials/index.html

There are separate links for primary and secondary schools. This page also includes a list of authorities in each section and names and addresses of section organisers.

LINKS TO THE MATHS CHALLENGES ARCHIVES

There are archives of previous questions on: **www.wpr3.co.uk/MC-archive/M/index-M.html**

Here is a shortcut for your smartphone or tablet