

The Scottish Mathematical Council

www.scot-maths.co.uk

MATHEMATICAL CHALLENGE 2021–2022

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, Glasgow, St Andrews, Stirling, Strathclyde and to George Heriot's School, Gryffe High School and Kelvinside Academy.

Middle Division: Problems 1

- M1.** At present, the sum of the ages of the parents, P , is five times the sum of the ages of their children, C . Two years ago, the sum of the ages of the husband and wife was eleven times the sum of the ages of the same children. A year from now, it will be four times the sum of the ages of the same children.

Determine the number of children.

- M2.** Two numbers x and y satisfy three of the following equations but do not satisfy the remaining one.

$$x + y = 63$$

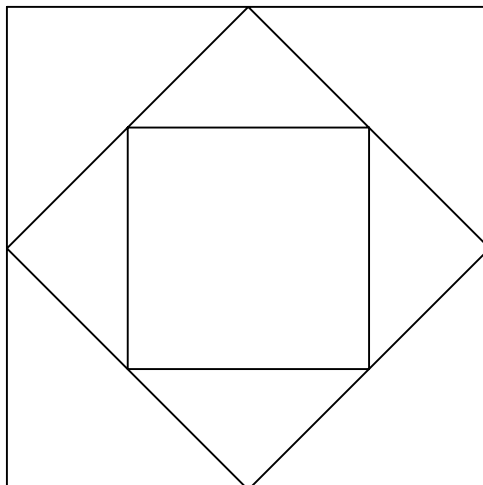
$$x - y = 47$$

$$xy = 392$$

$$\frac{x}{y} = 8$$

What is the value of x ?

- M3.** Let the large square shown have side length 4. A second square is obtained by connecting the mid-points of the sides of the first square (as shown on the diagram).



If this process of forming smaller inner squares by connecting the mid-points of the previous square is continued, what will be the side-length of the 12th square?

SEE OVER FOR QUESTIONS M4 & M5.



Mathematical Challenge Problems 1

MIDDLE DIVISION 2021-2022

PLEASE USE CAPITALS TO COMPLETE

SURNAME

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

SCHOOL

AGE

YEAR OF STUDY

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.

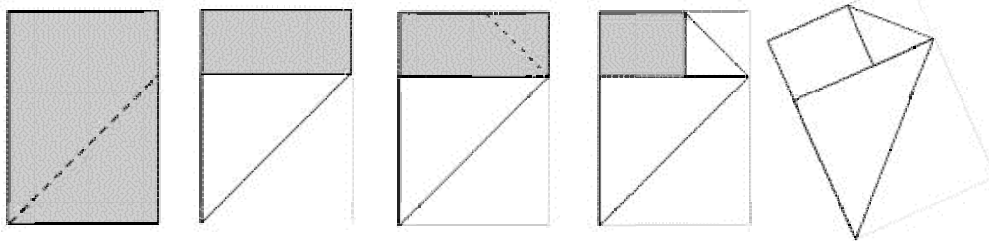
For further information on the competition, please see the School Materials which have been distributed to schools. A copy of these Materials can be obtained from

<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.

M4. A piece of A4 paper remains the same shape when it is folded in half i.e. the ratio of length to breadth remains the same. Show that this ratio is $\sqrt{2} : 1$.

Take a piece of A4 paper and fold as shown below to create a shape.



Prove that this shape is a kite and find its area.

M5. The sum of the cubes of three consecutive integers is 33 times the middle integer. Find the three integers.

END OF PROBLEM SET 1

CLOSING DATE FOR RECEIPT OF SOLUTIONS :

5 November 2021

Look out for Problems 2 in late November!

For information about Mathematical Challenge, look on the SMC web site:

www.scot-maths.co.uk