5. Mona Lisa Leonardo da Vinci (1503)

FRAMING THE MONA LISA

When Leonardo da Vinci completed the Mona Lisa, he instructed his assistant to frame the portrait so that the area of the frame was the same as the area of the portrait. His only measuring device was a piece of string. How could he achieve this?
However Leonardo was not happy with the balance between the frame and the portrait and promised his assistant a bonus if could make the width of the frame the same all round.
Could you do this for a bonus mark?

6. A Sunday Afternoon on the Island of La Grande Jatte
Georges Seurat (1884-6)

But on a Saturday Afternoon on the Isle of Man many years later the first TT race of the season was taking place. The competitors started off in pairs at 10 second intervals. The winner of the race is the competitor who completes six laps of the course in the shortest time, each lap being 37.73 miles long. (The winner does not necessarily have to cross the finishing line first.)

Competitors numbers 1 and 2 started the race at 12.00 noon. The race was won by number 19 whose average speed was 115mph. He crossed the finishing line at exactly the same time as number 6. Number 1's last lap was the fastest in the race, taking 19 minutes and 29 seconds. However, he did not finish the race until 23 seconds after numbers 19 and 6. From this information, discover all you can about this race. (All times are to be taken to the nearest second.)

The competition is promoted by Liverpool Mathematical Society (LivMS) www.livmathssoc.org.uk
The Liverpool Mathematical Society incorporates the Liverpool Branch of the MA and the ATM.
The MA is a Registered Charity (No. 313281). The ATM is a Registered Charity (No. 293125). Drawings by P. H. Ackerley.

(INCORPORATING THE LIVERPOOL BRANCH OF THE MA AND THE ATM)

Open Challenge '22

For Year 13 or below

Rules

1) It should be attempted at home during February half term.
2) Your entry must be your own work.
3) For individual entries only. You should attempt all questions.
4) Entries without any working out at all or written on this sheet will not be marked.
5) It is possible to win a prize even if you have not completed all of the questions, so hand in your entry even if it is not quite finished.
6) **You must print your name, date of birth and school in neat, legible writing on the front sheet.**
7) Pupils under 15 years of age should only attempt this in exceptional circumstances.

Either you or your maths teacher needs to **return your entry by 4 March** to this address:

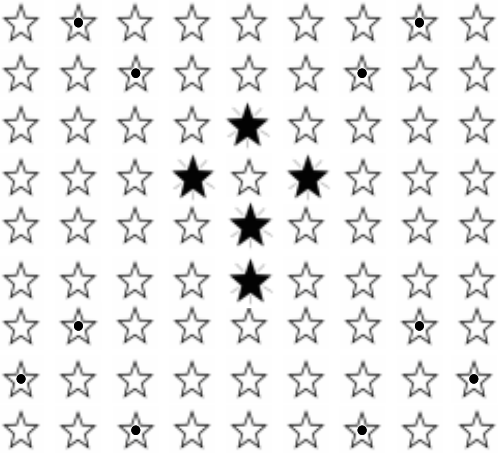
Open Challenge '22 Entries
Mrs A. Carter
Danes Court
Mudhouse Lane
Burton
Neston
CH64 5TS

An evening of online activities will be held in early May during which there will be a virtual prizegiving. Prizes and certificates **will be posted** to schools and colleges.
Solutions will be posted on www.livmathssoc.org.uk shortly afterwards.
We hope that you enjoy the questions.

1. Girl with a Pearl Earring — Johannes Vermeer (1665)

To match her pearl earring Griet also has a string of thirty three pearls. The middle pearl is the largest and most valuable and the others are selected and arranged so that, starting from one end, each successive pearl is worth £100 more than the preceding one, right up to the big pearl. From the other end the pearls increase in value by £150 up to the large pearl. The whole string is worth £65,000. What is the value of that large pearl?

2. The Starry Night — Vincent van Gogh (1889)



In the illustration we have five Planets and eighty one Fixed Stars, five of the latter being hidden by the Planets. It will be found that every Star, with the exception of the ten that have a black spot in their centres, is in a straight line, vertically, horizontally, or diagonally, with at least one of the Planets. Rearrange the Planets so that all the Stars will be in line with one or more of them.

In rearranging the Planets, each of the five may be moved once in a straight line, in any of the three directions mentioned. They will obscure five other Stars in place of those at present covered.

3. Colour Study: Squares with Concentric Circles

Kandinsky (1913)

Anna, a mathematical art teacher, set her class a project to produce a painting on a 5x6 grid in the style of Kandinsky's 'Squares with Concentric Circles'. She stipulated that the background squares must be of only two colours, blue or yellow. The positions of these colours were to be determined by the solution to the following puzzle.

Only two different digits are used in the solution, each representing a colour. One is 0 but 0 is never the first digit of a number. All the letters stand for prime numbers; different letters represent different numbers.

0 squares are to be coloured yellow and the other squares are to be coloured blue.

Can you provide the background for the concentric circles?

1	2	3	4	5
6				
7				
8				
9				
10				

Across

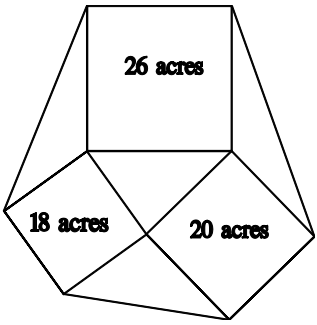
1. abcd
6. a^2b^2ef
7. ab^2gh
8. $abij^2k$
9. a^2bejl
10. ab^2ikm

Down

1. ab^2ijkm
2. a^2beij^2k
3. ab^2mnp
4. a^2bcde
5. abijkl

4. The Harvesters

Pieter Bruegel the Elder (1565)



Pieter's estate is made up of three square fields as shown, containing 18, 20 and 26 acres. He bought the four intervening triangular fields to make one large field in which he planted wheat. His harvest was successful with a yield per acre of 3 tons and Pieter was able to sell it for £160 per ton. How much did he receive?