MATHEMATICAL EDUCATION
ON MERSEYSIDE

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Challenge '26

Year 8 or below

Illustrations by Jules Farrelly and Anouk Riverol

Rules

1) Challenge '26 should be attempted at home during February half term.
2) Your entry must be your own work, though of course you may ask for help on how to get started or for the meanings of unfamiliar words.
3) Entries without any working out at all or written on this sheet **will not be marked**.
4) It is possible to win a prize or certificate even if you have not completed all of the questions, so hand in your entry even if it is not quite finished.
5) Please make sure that you staple your pages together and you must write **your name and school neatly on every page.**

Either you or your maths teacher needs to return your entry by 6th March to this address:

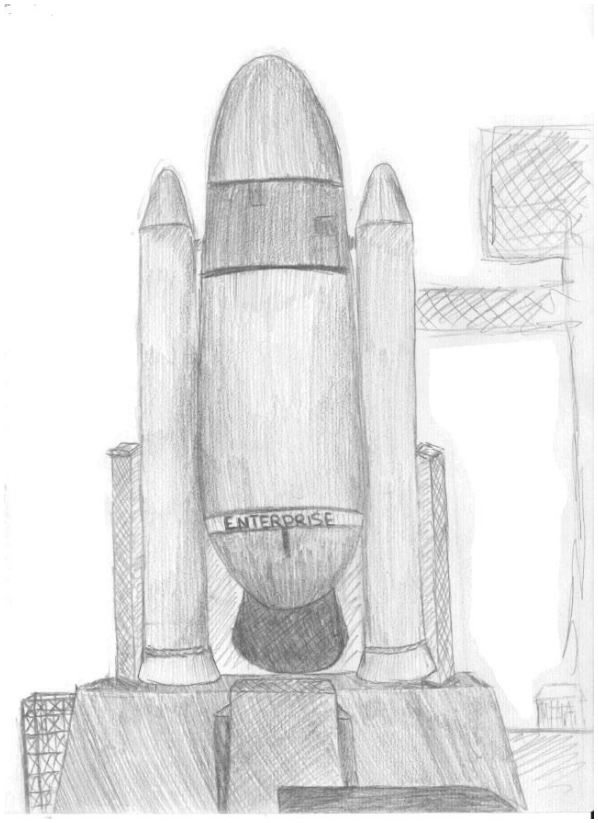
Challenge '26 Entries,
Chris Marchant,
Department of Mathematical Sciences,
University of Liverpool,
Peach Street,
Liverpool,
L69 7ZL

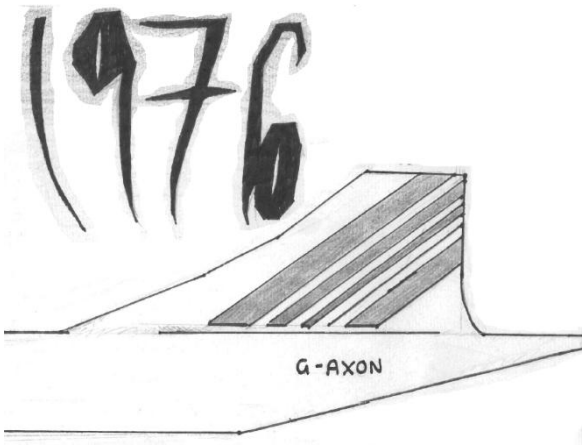
A Prize-Giving Evening will be held at the University of Liverpool on Tuesday 12th May.
We hope that you enjoy the questions.

1. Space Shuttles Soar!

In 1976, NASA unveiled its 1st space shuttle, named Enterprise. It subsequently launched 5 more shuttles: Challenger, Endeavour, Atlantis, Columbia and Discovery. Use the clues below to work out how many times each shuttle launched.

- Enterprise never went into orbit but was used for 5 take-off and landing tests.
- Challenger had twice as many launches as Enterprise, including the final flight when it sadly blew up after take-off.
- Columbia was lost during re-entry on its final mission. It had 3 more launches than Endeavour, which had 5 times the number of launches that Enterprise had.
- Discovery had the most launches, beating Atlantis by 6. Atlantis in turn beat Columbia by 5. You must show your working to gain the marks.





2. Concorde Conundrum

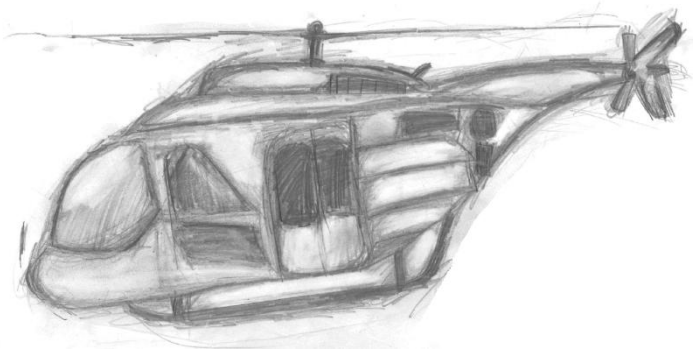
Also in 1976, Concorde took its maiden flight. Concorde holds the records for the fastest flight around the world, both for flying West to East and for flying East to West. The West to East record is 31:27:49, the East to West record is 32:49:03.
What is the difference between the two records in seconds?

3. Stars in the Sky

Sally the sky writer has been hired to draw a regular pentagram in the sky. She starts flying due North. What is the list of bearings she will need to fly on in order to complete the image, assuming she always turns to starboard at each corner of the pentagram?
What happens if she turns to port each time instead?

4. **Racing to the Rescue**

A helicopter flies 24km to rescue some stranded climbers and then 16km to take them to the nearest hospital. Its speed is twice as fast before picking up the climbers as after, due to the pilot taking great care not to cause further injuries. The total time in the air (i.e., not including the rescue time) is 14 minutes. How long did it take to reach the climbers?

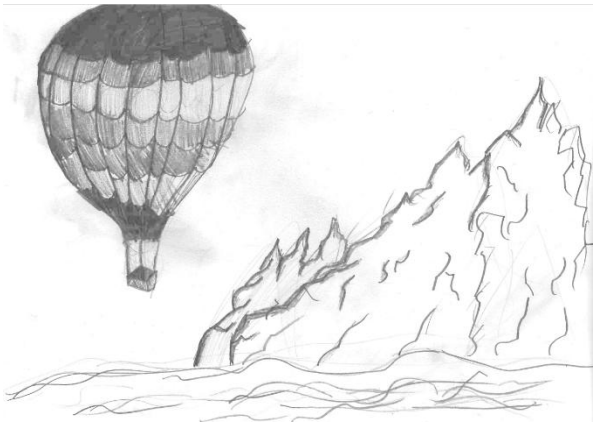


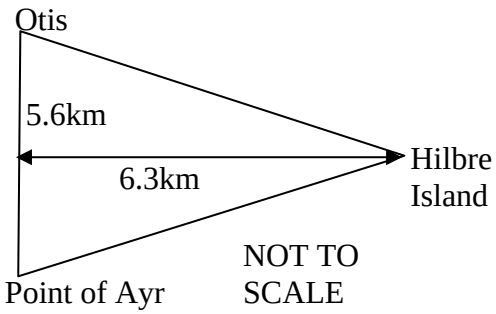
5. **Five go to the Museum**

Five friends are going to the Museum of Flight: Harry, Will, Claire, Anna and Oscar.
In some order, they live in Well Road, Holly Street, Clover Park, Abbey Avenue and Olive Gardens.
They take their pictures next to statues of famous aviators: Amelia Earhart, Wilbur Wright, Orville Wright, Charles Lindbergh and Howard Hughes.
A friend is always missing from the picture as they are holding the camera (no selfies here!).
No initial letters of name, street name or aviator (either forename or surname) match.
The girls took the pictures of Amelia Earhart and Howard Hughes.
Oscar lives in Clover Park.
The person who lives in Abbey Avenue took the picture of one of the Wright brothers and Oscar took the picture of the other one.
Anna picked up Claire from her house on Holly Street on the way to the museum.
Match each friend with the aviator whose photo they took and in which road they live.

6. Drone Dilemma

Nozama delivery service wants to avoid paying the Mersey Tunnel charges by using drones to fly packages between its storage depots in Chester and Liverpool.
The route varies slightly in each direction so that the journey to Chester takes 35 minutes, but it's 45 minutes back to Liverpool.
Drones leave from Chester at 09.00, 09.20, 09,40, etc and from Liverpool at 09.10, 09.30, 09,50, etc.
What is the fewest number of drones required to maintain the service (assuming no delays occur)? How long do the staff at each depot have to load the drones?





7. Dee Disaster

Charlie's hot-air balloon has crash landed on a sandbank in the estuary of the river Dee and sends out an SOS signal. It is picked up by the lighthouses on Hilbre Island and at Point of Ayr and by his support vessel, the Otis. Each can only locate the signal's bearing to within 5°.
The Otis is anchored 5.6km due North of Point of Ayr Lighthouse. Hilbre Island Lighthouse is 6.3km due East of the midpoint of the line joining the Otis and Point of Ayr Lighthouse.
The bearing from Point of Ayr is between 058° and 063°; from the Otis, between 120° and 125°; and from Hilbre Island, between 263° and 268°.
Using a scale of 1:50 000, carefully draw a scale diagram and shade the area which needs to be searched to find Charlie.

The competition is promoted by

Mathematical Education on Merseyside (MEM)
Registered Charity No 517028,
Department of Mathematical Sciences,
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