5. ISLAND HOPPING

There is one ferry port on each island in the archipelago of Geometrika. No two of the ports in the archipelago are the same distance apart. Daily from each port a ferry leaves for the nearest neighbouring port. Prove that in any one day no port has to cope with the arrival of more than five ferries.

6. THE FLYING SCOUSER

An express train of length 100 metres accelerates through Long Reach station, which has a platform of length 90metres. When the front of the train reaches the starting edge of the platform it is travelling at 22ms^{-1}. When it reaches the final edge of the platform its speed is 27ms^{-1}. How long does the entire train take to pass through the station?

FORTHCOMING EVENTS			
10 February	Dr Emily Howard	Orbits: Mathematics meets music	For further details please see the website
02 March	Prof Chris Budd OBE	TBA	
12 March	Pop Maths Quiz	Sixth Form Quiz	

Open Challenge '16
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) Individual entries only. You should attempt all six 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 write **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 '16 Entries,
Mrs A. Carter,
Danes Court,
Mudhouse Lane,
Burton,
Neston.
CH64 5TS.

All of the prizes and certificates will be awarded at an evening of mathematical recreation at the University of Liverpool on 4 May. Solutions will be posted on www.maths.liv.ac.uk/lms.html shortly afterwards. We hope that you enjoy the questions.

1. THE LAST BANG

At noon on 1 March 2150, Captain Kirk gathered information on 3 fragments of the former spaceship USS Centreprize. At that instant, with his own ship at the centre of a suitable galactic coordinate system, he found that all three fragments were moving directly away from him. He constructed the following table:

Fragment	Mass	Distance	Speed	Direction
1	100kg	4.000×10^9km	1.000kms^{-1}	North East
2	50kg	1.000×10^{10}km	2.500kms^{-1}	South East
3	200kg	5.530×10^8km	138.0ms^{-1}	West

Deduce that there was more than one explosion and find the date of what was probably the last one.

[Technical data: USS Centreprize: mass 4000tonnes, maximum dimension 200m, crew of 10. 1 day = 24 hours and leap years were abolished in 2097.]

2. ADAM'S ANTICS

Adam Ant makes a straight tunnel through a hemispherical anthill, of radius 1 metre, starting due East of centre at a height of 60 cm and emerging due West of centre at a height of 80 cm. He then returns to his starting point over the outside of the anthill. What is the shortest distance for his round trip? Adam is very tired when he emerges. By what route would you advise him to return over the surface so that he need not travel uphill?

3. SHARP RETURN

The Red Arrows have arranged to give three flying displays, each lasting twenty-five minutes, in the same afternoon. One is in Western Wales, 160km to the South-West of their base, another is in Eastern England, 300km to the East of the Welsh display, while the third is in Southern Scotland, directly to the North of the Welsh display and to the North-West of the English display and fifteen minutes' flying time from their base.

They are briefed to leave the base at 1400 hours and fly each leg at the same average speed. The squadron leader is due to play squash with his commanding officer at 1639 hours. Investigate whether or not he can arrange the order of displays so as to return to base in time for his match.

4. BACKWARDS............

A team of time travellers, the Tetracons, decide to travel backwards in time to visit palindromic years. Their time machine is programmed for 4 digit years which are a multiple of 11 but not a multiple of 13. Which years can they visit and why?
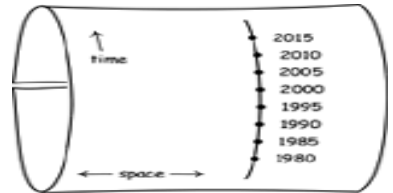
.........AND FORWARDS

Having gone as far back as possible, they then decide to travel forwards in time, visiting 4 digit palindromic years which are a multiple of 3. Compare the number of visits they make with those of the Treyvids, who decide to investigate 3 digit palindromic years which are a multiple of 3.