



Poster Competition

In addition to four rounds similar to those at the regional finals (Group Circus, Cross Number, Head to Head and Relay), there will be a Poster Competition at the National Final. All teams are required to submit a poster. This will be judged separately and will not affect the Team Maths Challenge score, but forms an integral part of the National Final.

After the competition some posters may be retained by the UKMT in order to be reproduced for promotional purposes; all the original posters will eventually be returned to schools.

On the day, teams will have 50 minutes to create a poster on a sheet of A1 paper (landscape), which will be provided. Sheets of A4 paper will also be available.

The subject of the poster will be *Quadrilaterals* (see overleaf). Teams must carry out research into this topic in the weeks leading up to the final.

Teams may create materials beforehand, but such prepared work must be on sheets no larger than A4 and must be assembled to create the poster on the day.

A team which arrives with a poster already assembled will be disqualified.

The materials of the poster must not extend beyond the edge of the A1 paper.

The judges will not touch the poster, so all information must be clearly visible.

Your team number (assigned to you on arrival) must be clearly visible in the bottom right-hand corner of the poster. There must be nothing else on the poster to identify the team.

Reference books may not be used at the competition, and large extracts copied directly from books or the internet will not receive much credit.

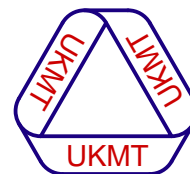
Teams must bring with them any drawing equipment they think they will need.

Glue sticks and scissors will be provided.

The content of each poster is limited only by the imagination of the team members. *However, on the day each team will be presented with three questions on the subject—the answers to these questions must be incorporated into the structure of the poster.* Teams may be asked to provide geometric or algebraic proofs, and some ingenuity may be involved.

Posters will be judged on the following criteria:

General mathematical content	(12 marks)
Imagination and presentation	(12 marks)
Answers to the three questions	(24 marks)



Quadrilaterals

A *quadrilateral* is a four-sided figure. In a *convex* quadrilateral each interior angle is less than 180° , otherwise it is *concave*. A quadrilateral is *planar* if all four edges lie in the same plane, otherwise it is *skew*. Unless otherwise specified, all quadrilaterals referred to are planar.

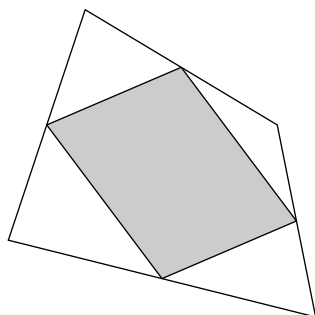
There are several special types of quadrilateral, such as squares or parallelograms.

What different types of quadrilateral are there?

A shape is said to *tile the plane* if equal-sized copies of the shape will fill the whole plane without gaps or overlaps. A rectangle, for example, clearly tiles the plane: think of a brick wall.

Which types of quadrilateral tile the plane?

Take any quadrilateral and join the midpoints of the sides to form another quadrilateral, shown shaded below.



Varignon's theorem states that the resulting figure is always a parallelogram. The theorem follows from the *midpoint theorem*.

How is Varignon's theorem proved?
 When is the resulting figure a rectangle, a rhombus, or a square?
 Does the result hold when the original quadrilateral is skew?
 What is Wittenbauer's parallelogram?

For a right-angled triangle there is a well-known relationship connecting the squares of the side lengths, namely, Pythagoras' theorem. There are similar results for quadrilaterals involving the squares of the lengths of the diagonals as well as the squares of the side lengths.

For a parallelogram, what is the relationship between the lengths of the sides and the diagonals?
 What is Euler's theorem for a quadrilateral?