Instructions

In addition to four rounds similar to those at the regional finals (Group Circus, Crossnumber, Shuttle and Relay), at the National Final there will be a Poster Competition, with a chance to win the Jacqui Lewis Trophy.

All teams are required to submit a poster. The poster competition 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.

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 *Polyominoes* (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 proofs, and some ingenuity may be involved.

Posters will be judged on the following criteria:

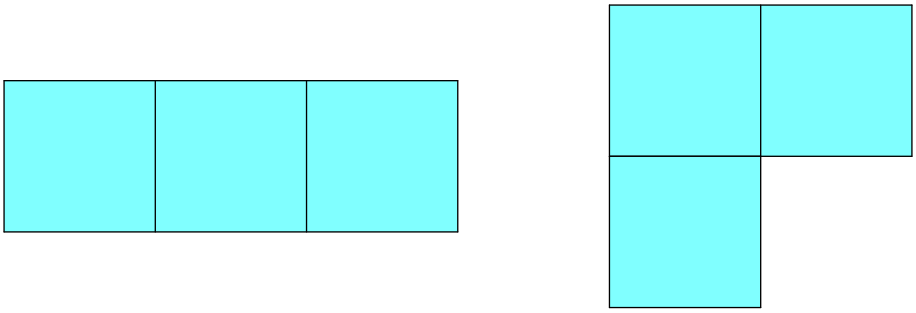
General mathematical content	12 marks
Imagination and presentation	12 marks
Answers to the questions	24 marks

Polyominoes

A *polyomino* is a plane shape made by connecting a number of equal squares; each square is joined to at least one other along an edge. Two polyominoes are considered to be the same when one may be obtained by rotating or reflecting the other.

A *triomino* is a polyomino made from three equal squares.

There are exactly two different triominoes, shown in the following diagram.



A *tetromino* is a polyomino made from four equal squares.

A *pentomino* is a polyomino made from five equal squares.

What are the twelve different pentominoes?

A *hexomino* is a polyomino made from six equal squares.

What are the thirty-five different hexominoes?

A set of polyominoes is said to *tile* a shape when the shape may be covered using all the polyominoes in the set without gaps or overlaps. Each polyomino may be turned around or turned over.

Show how to tile a 3×20 rectangle using the twelve pentominoes.
How many ways are there to do this?

Show how to tile an 8×8 square using the twelve pentominoes and a 2×2 square.
Are there any restrictions on where the square can be placed?

Polyominoes

Question 1

Which rectangles can be tiled by the complete set of twelve pentominoes? Explain why your answer is correct.

(Remember: each pentomino may be turned around or turned over.)

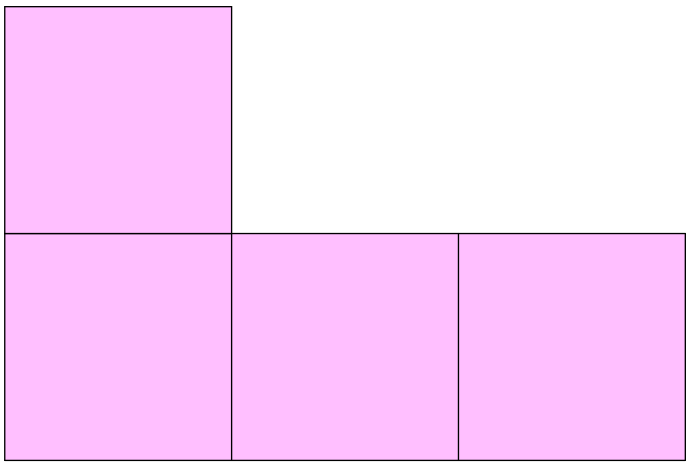
Question 2

A hexomino is a polyomino made from six squares. There are 35 different hexominoes.

How many of the hexominoes have exactly one line of symmetry? Explain why your answer is correct.

Question 3

Prove that it is *not* possible to tile an 8×8 square with 15 copies of the L-tetromino shown and one copy of a 2×2 square tetromino.



L tetromino

(Remember: each L-tetromino may be turned around or turned over.)