An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

Resource Booklet

Evaluating the Cognitive Demand of Mathematical Tasks

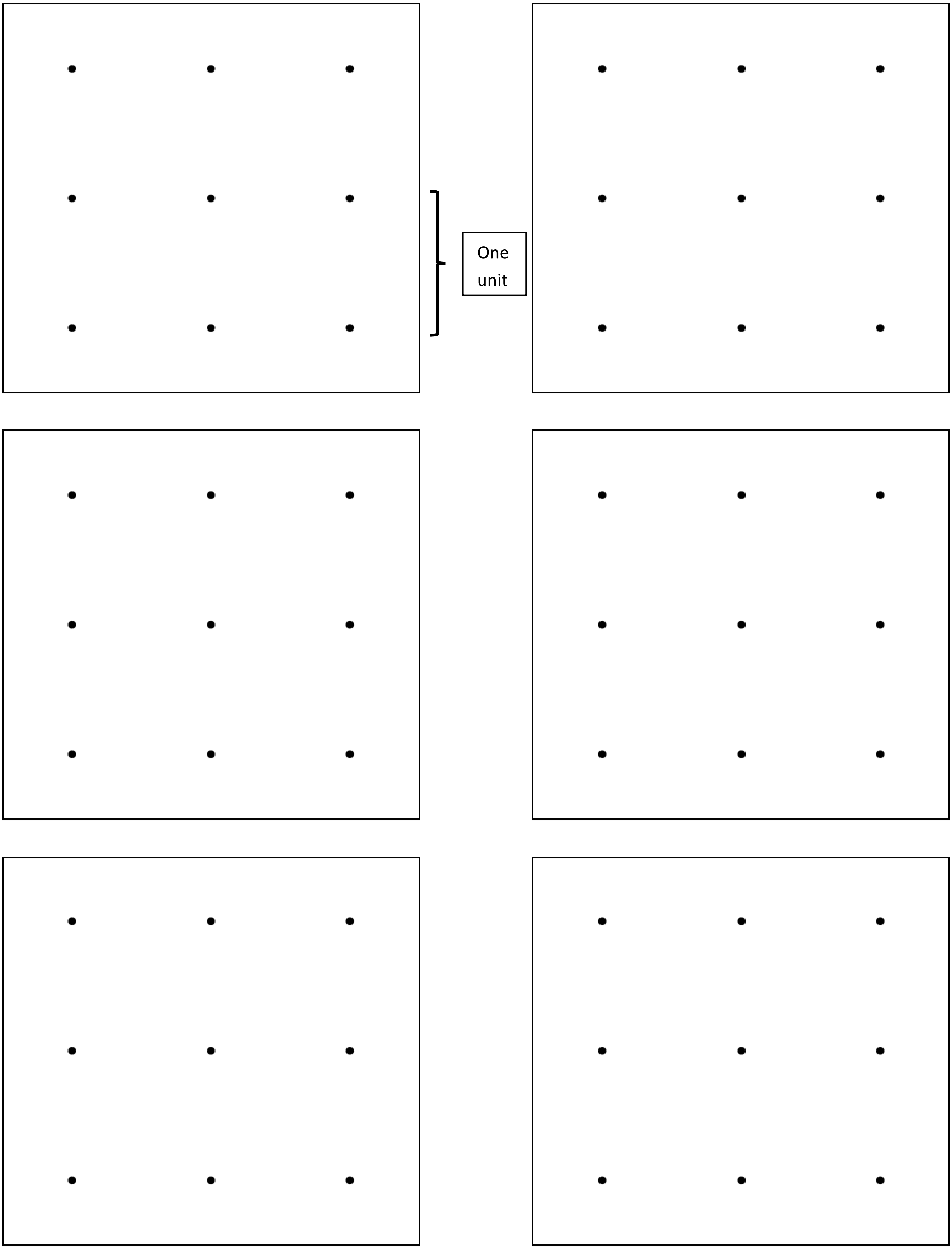
JCT Mathematics Symposium 2019

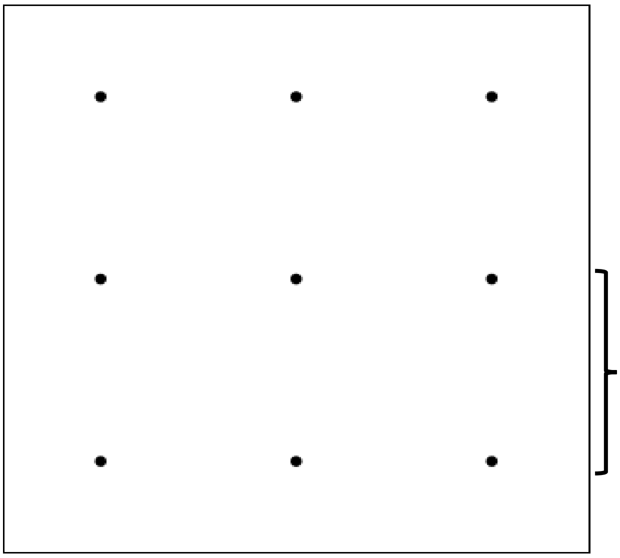
Ionad Oideachais Mhuineachain

AN ROINN OIDEACHAIS AGUS SCILEANNA | DEPARTMENT OF EDUCATION AND SKILLS

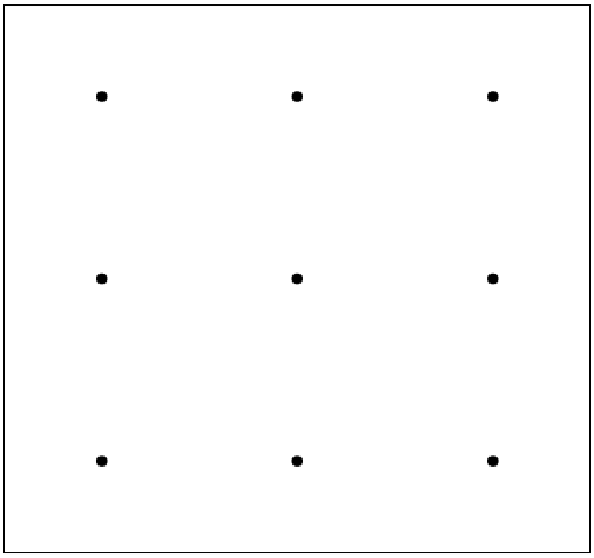
Cognitive Objective	Links to Thinking
KNOWLEDGE  *Remembering*	Students are more likely to retain information if it is needed for a specific task and linked to other relevant information. Questions and tasks in this area allow students to link aspects of knowledge.
COMPREHENSION  *Understanding*	Comprehension questions and tasks require students to process knowledge they already have. They demand a higher level of thinking and information processing than do knowledge questions and tasks.
APPLICATION  *Applying*	Questions and tasks in this area require students to use their existing knowledge and understanding to solve a new problem or to make sense of new learning. Students are more likely to be able to apply knowledge to a new context if it is linked to prior learning experiences.
ANALYSIS  *Analysing*	Analysis questions and tasks require students to break down what they have already learned and reassemble it to help them solve a problem. Students engage in more abstract, conceptual thought, which is central to the process of creativity.
SYNTHESIS  *Creating*	Synthesis questions and tasks demand that students combine and select from all their learning to respond to a new context. There is likely to be a great diversity of responses.
EVALUATION  *Reasoning*	Evaluation questions and tasks expect students to use their knowledge to form judgements and be able to defend the positions they take. Evaluation questions demand complex thinking and reasoning.

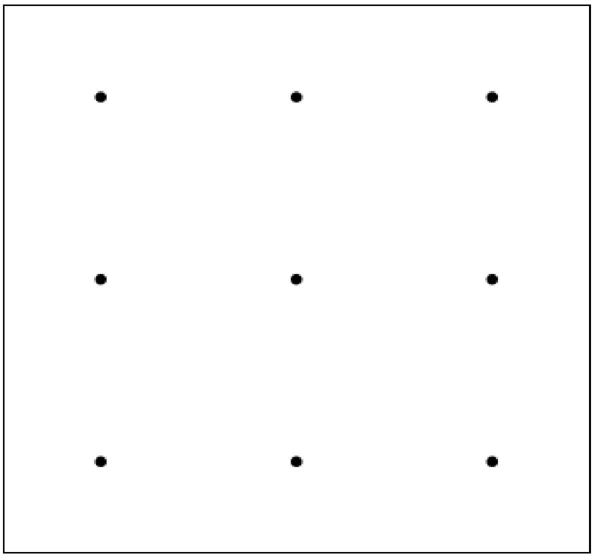
Working with Geoboards

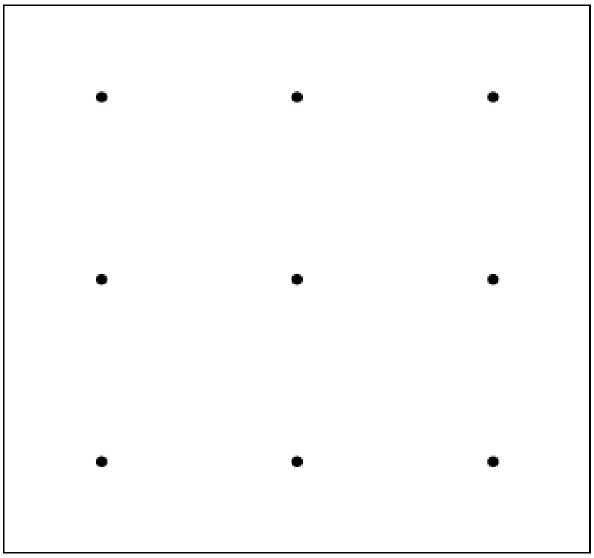


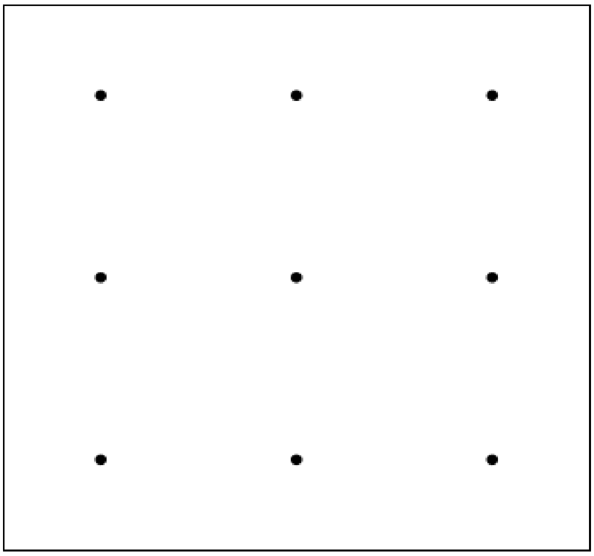


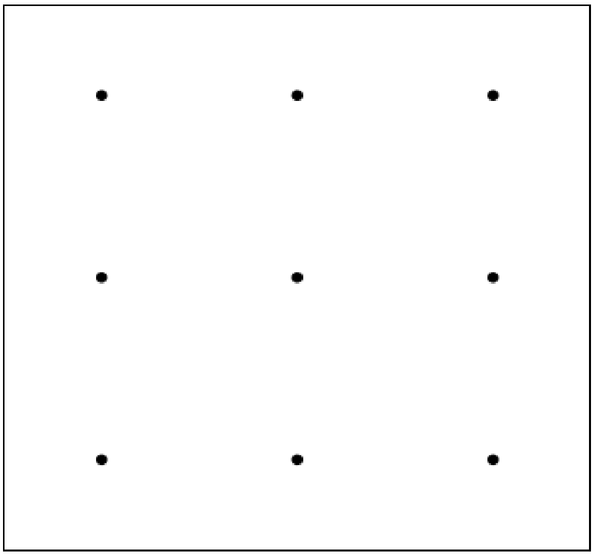
One unit











Classifying Quadrilaterals

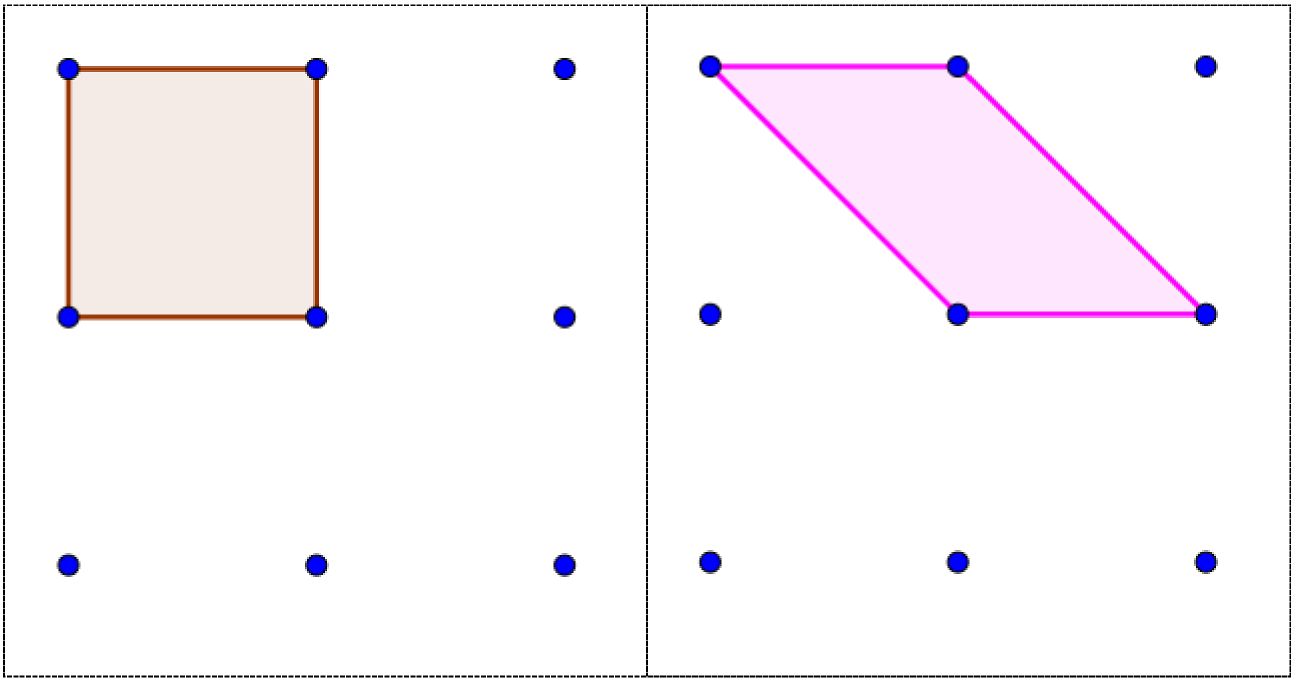
To promote students' mathematical thinking and discussion, and to generate rich classroom dialogue, it is recommended that the task be undertaken in groups of between 2 and 4 students.

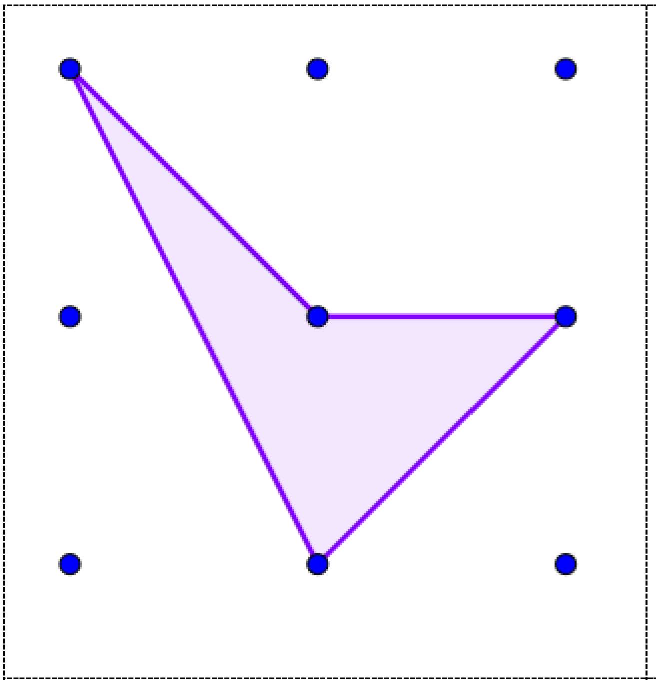
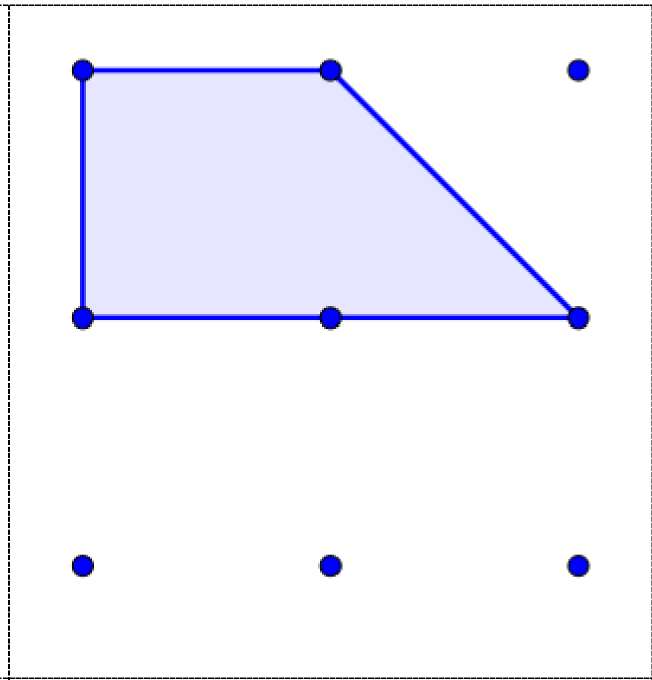
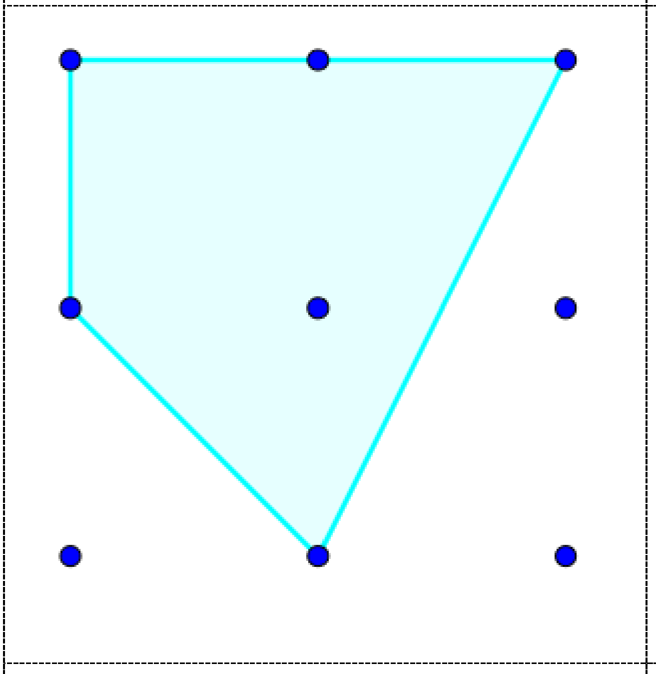
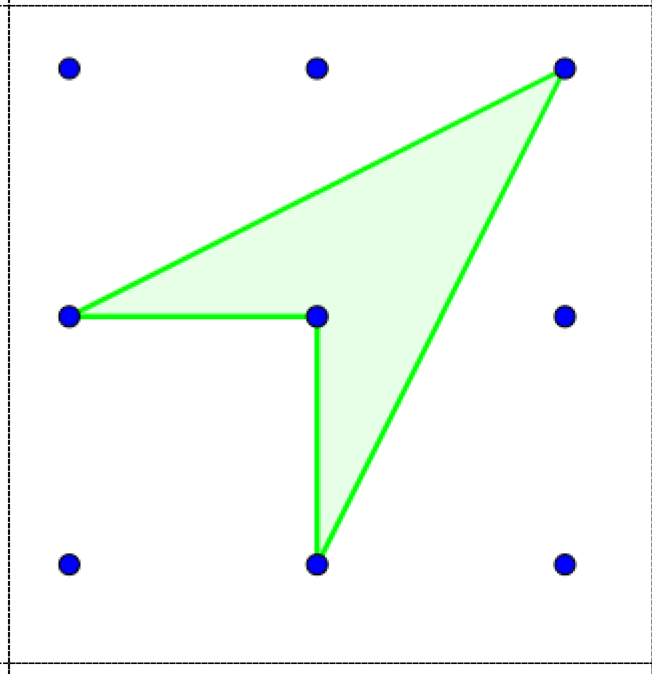
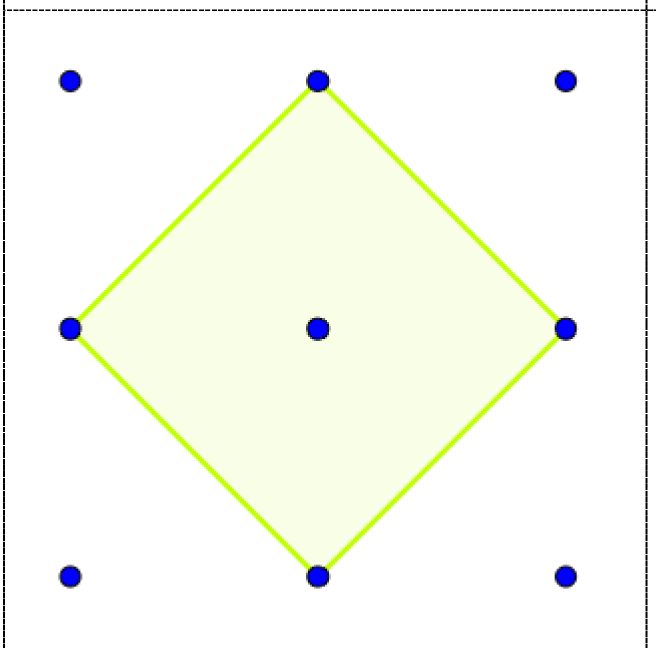
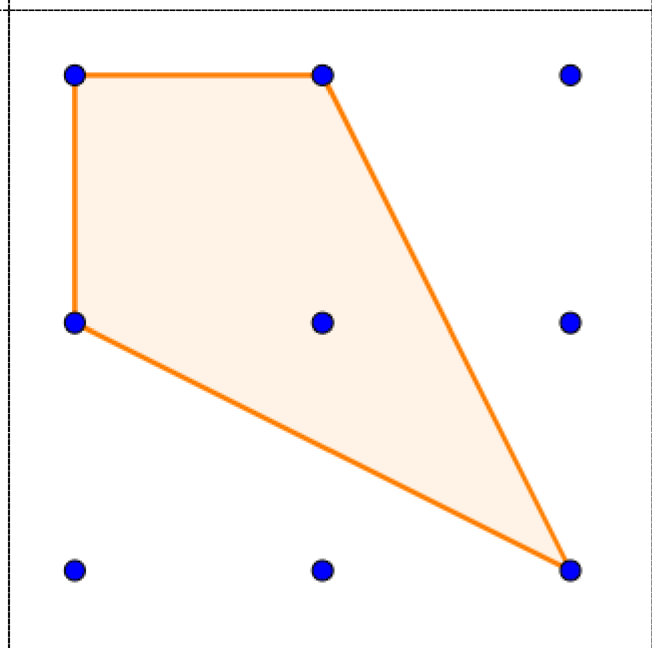
Suggested instructions for this task:

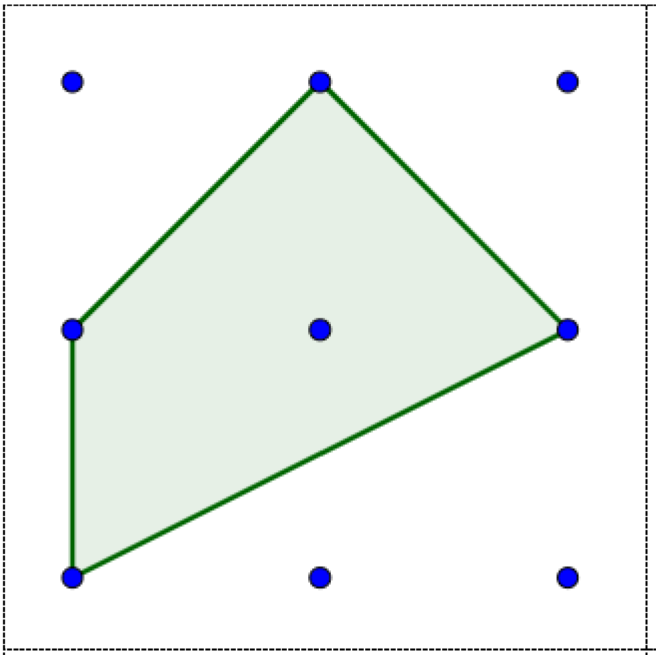
- Each group should be given a set of 9-pin geoboard quadrilateral cards (16 in total) along with text cards (2 cards with suggested text and 2 blank cards provided).
- The group should arrange the cards based on the criteria for classification outlined on the text cards.
- In turn, students in the group should select a card. The student identifies where they believe the card should be placed based on their understanding of the criteria for classification.
- The card can only be placed once the group has reached a consensus.
- The group can postpone the placement of a card only twice during the task and only after a discussion has has taken place about its placement. [This task condition is to ensure students engage with some of the more challenging cards. The class teacher is best placed to decide whether this task condition is appropriate]
- The teacher should move around the room gathering evidence about student's knowledge, understanding and learning. Appropriate questioning often provides greater insight.
- Once the task has been completed, a plenary discussion is recommended. This should be guided by the evidence gathered by the teacher during the task. Effective questioning has the potential to enrich the class discussion and student learning.

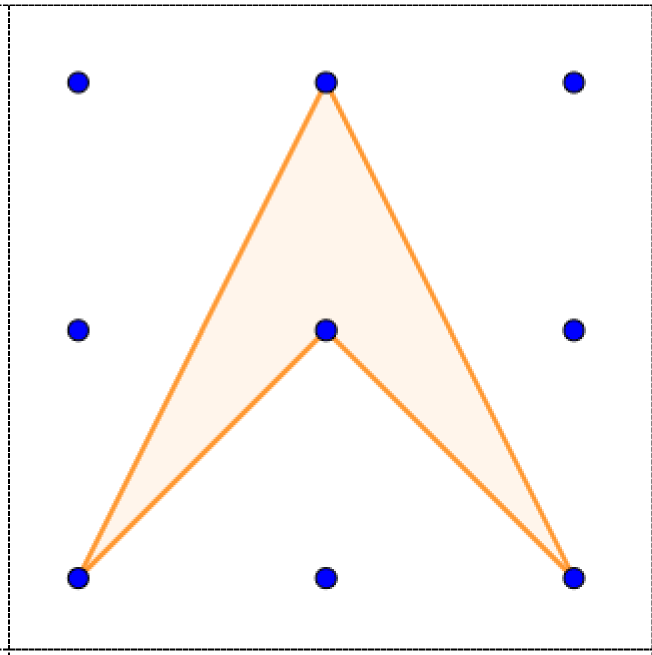
The task is linked to the following learning outcomes from the Junior Cycle Mathematics specification:

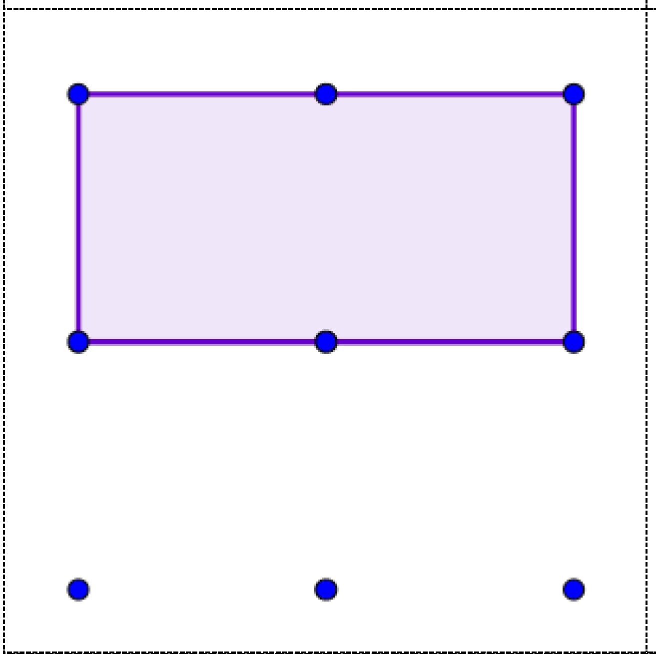
- GT2 investigate 2-D shapes
- GT3 (b) recall and use the concepts, axioms, theorems, corollaries and converses
- GT5 investigate properties of points, lines and line segments in the co-ordinate plane
- GT6 investigate transformations of simple objects
- N5 explore the concept of a set
- U4 represent a mathematical representation in a variety of different ways, including numerically, algebraically, graphically, physically, in words; and to interpret, analyse, and compare such representations
- U5 make connections within and between strands
- U13 communicate mathematics effectively: justify their reasoning, interpret their results, explain their conclusions, and use the language and notation of mathematics to express mathematical ideas precisely

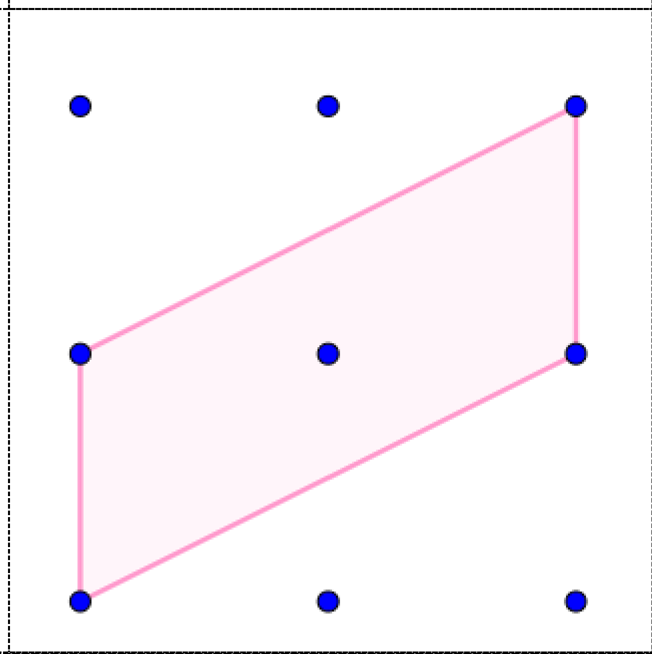


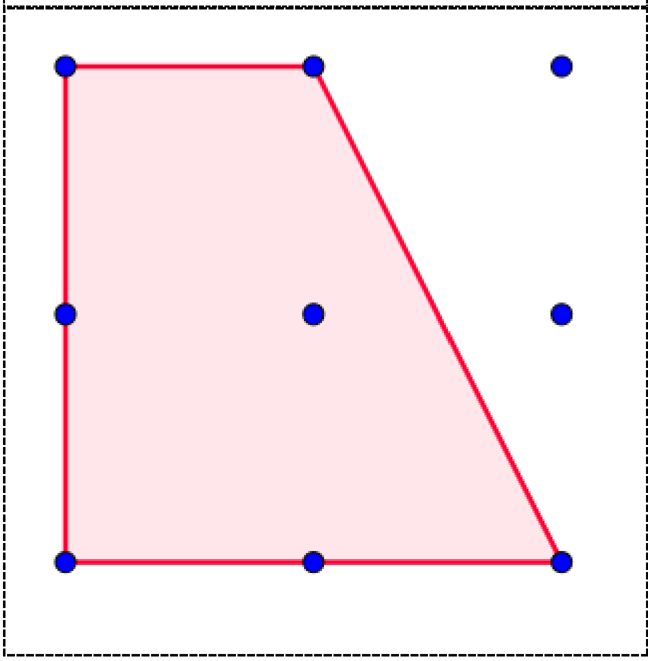







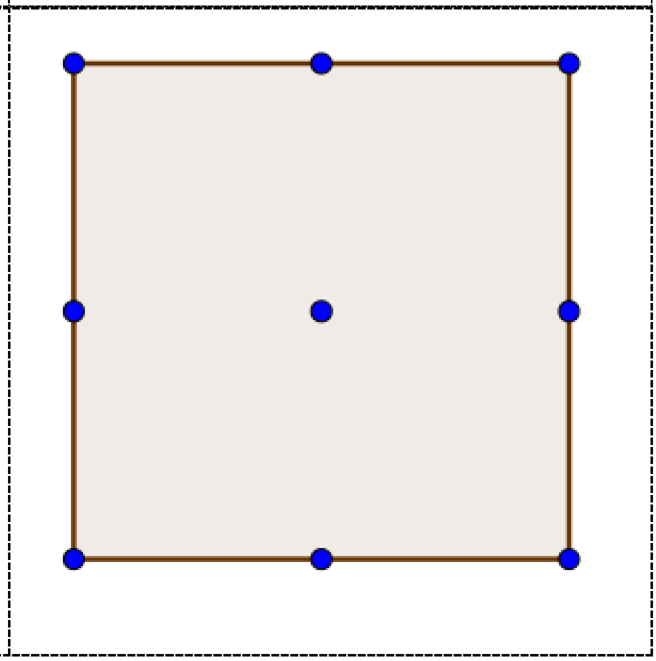


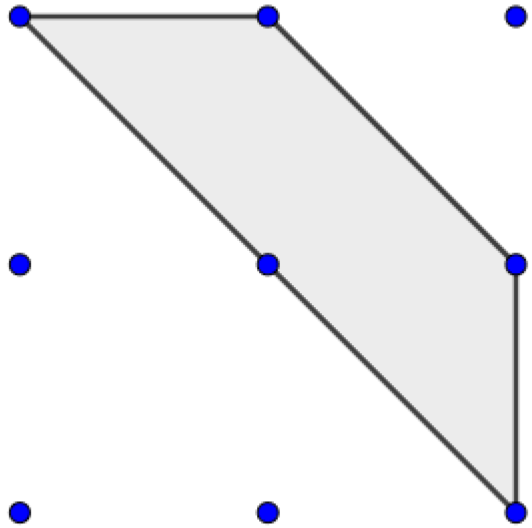


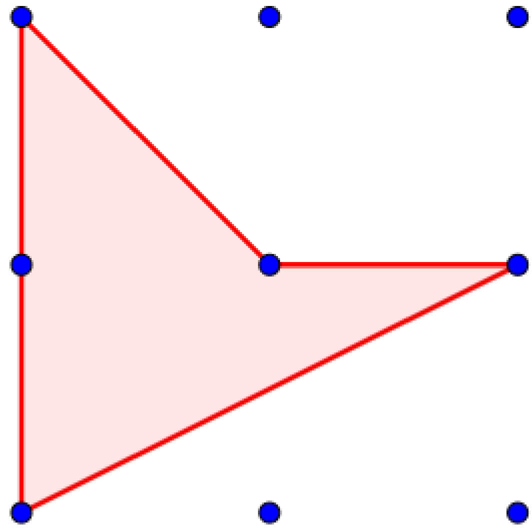












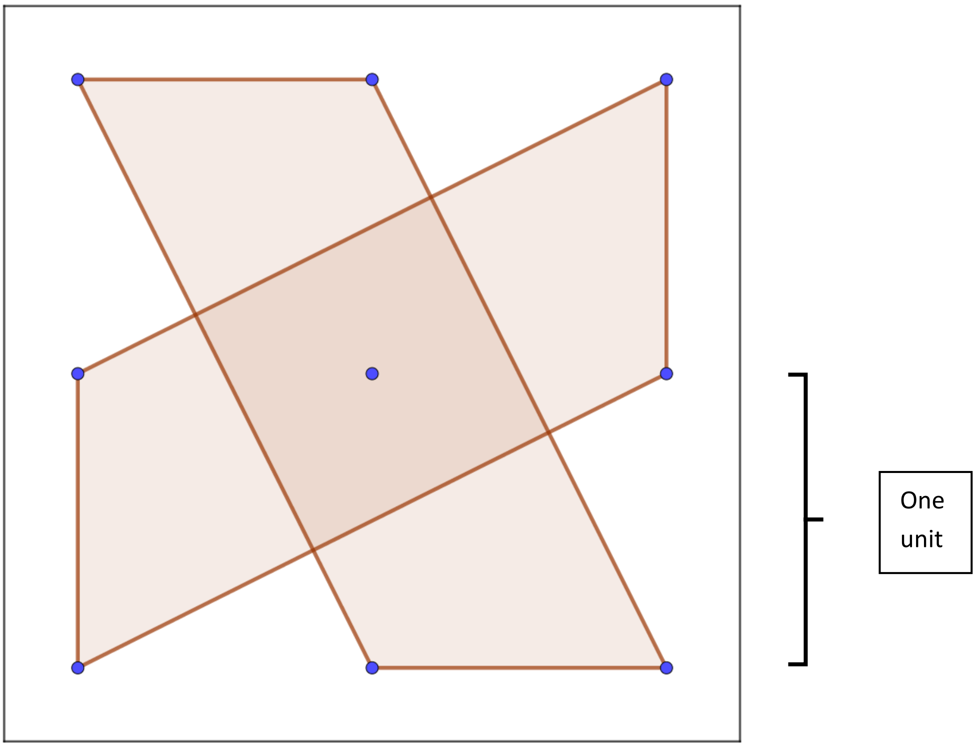
Quadrilaterals that can be sketched on a 9-pin geoboard with at least one pair of parallel lines

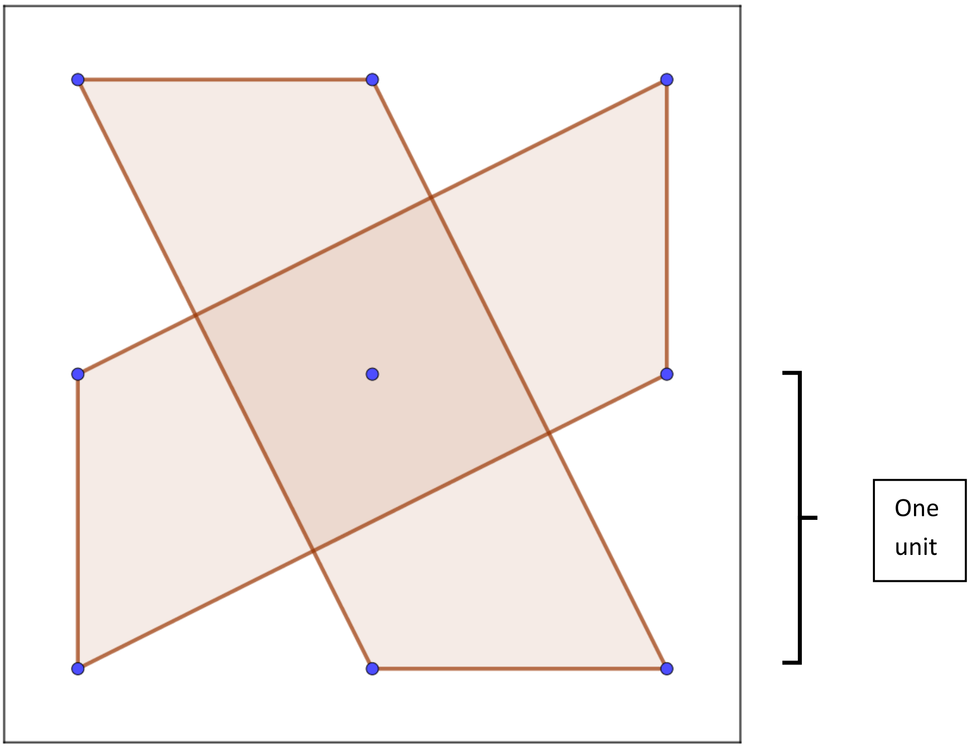
Quadrilaterals that can be sketched on a 9-pin geoboard with at least one axis of symmetry

Overlap Task

The shape below has been made by overlapping two parallelograms on a 9-pin geoboard.

Consider, with justification, if the shape created by the overlap is a square?



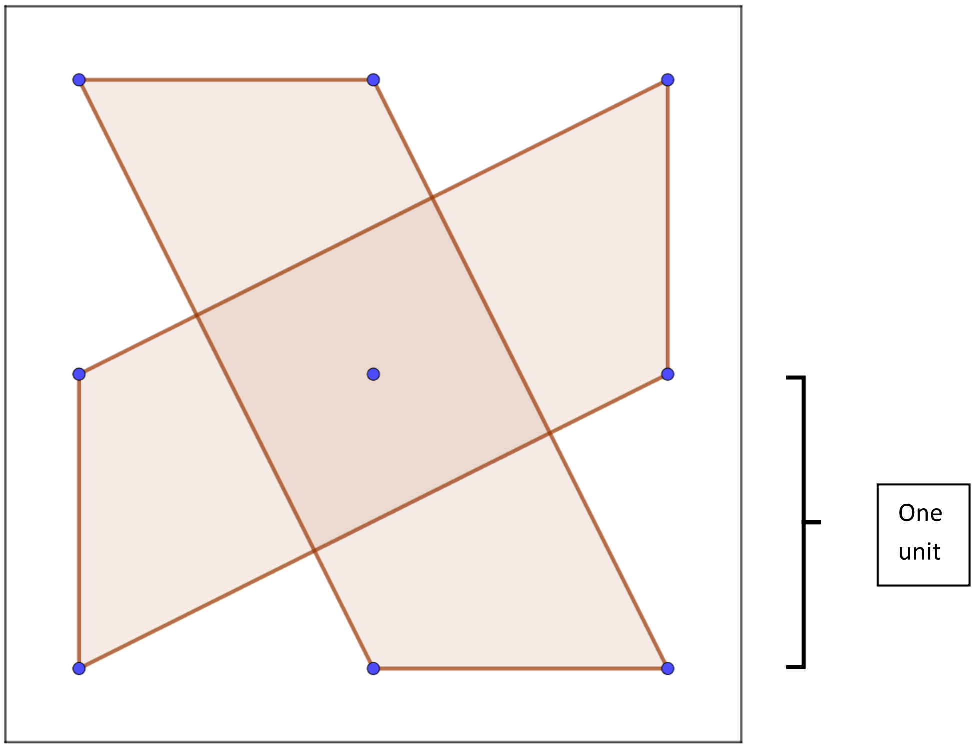

One
unit

Overlap Task - Variation

The shape below has been made by overlapping two parallelograms on a

9-pin geoboard.

Find the area of the overlap.



Unifying Strand

Element: Building blocks

Students should be able to:

U.1 recall and demonstrate understanding of the fundamental concepts and procedures that underpin each strand

U.2 apply the procedures associated with each strand accurately, effectively, and appropriately

U.3 recognise that equality is a relationship in which two mathematical expressions have the same value

Element: Representation

Students should be able to:

U.4 represent a mathematical situation in a variety of different ways, including: numerically, algebraically, graphically, physically, in words; and to interpret, analyse, and compare such representations

Element: Connections

Students should be able to:

U.5 make connections within and between strands

U.6 make connections between mathematics and the real world

Element: Problem solving

Students should be able to:

U.7 make sense of a given problem, and if necessary mathematise a situation

U.8 apply their knowledge and skills to solve a problem, including decomposing it into manageable parts and/or simplifying it using appropriate assumptions

U.9 interpret their solution to a problem in terms of the original question

U.10 evaluate different possible solutions to a problem, including evaluating the reasonableness of the solutions, and exploring possible improvements and/or limitations of the solutions (if any)

Element: Generalisation and proof

Students should be able to:

U.11 generate general mathematical statements or conjectures based on specific instances

U.12 generate and evaluate mathematical arguments and proofs

Element: Communication

Students should be able to:

U.13 communicate mathematics effectively: justify their reasoning, interpret their results, explain their conclusions, and use the language and notation of mathematics to express mathematical ideas precisely