Notes for 16-pin congruence

Teaching notes	Teaching points
This activity is described in the Year 7, 8 and 9 examples of the Key Stage 3 Framework for teaching mathematics.	
It involves using a virtual geoboard to model how pupils could investigate dividing a four by four geoboard into two congruent shapes.	
Start by opening the geoboard from the resources page or by going to: www.nrich.mathematics.org/public/viewer.php?obj_id=2883	
By using the icons at the bottom of the screen, show how to create a four by four square.	
Demonstrate how the applet works.	
Give pupils a mini-whiteboard or pre-printed sheet to record their work in pairs.	• Pupils working in pairs will be more likely to discuss their results.
Set the task as follows: on a four by four geoboard, divide the area of the geoboard in half so that each half is congruent with the other. Use two 'elastic bands' to demonstrate the two shapes.	
Pupils could work with real geoboards, on a computer or on paper, but will need plenty of opportunities to use trial and error.	
There will need to be a discussion about the definition of congruence as being exactly the same shape and size.	
When pairs have found all they can, invite them to suggest how they know they have them all.	• Pupils do not need to be told how many possibilities there are – better to discover them.
Invite pairs to share their reasoning with the class, encouraging good use of vocabulary and clear reasoning.	
Ask pupils to look for anything which is common to all the successful solutions. 'Could this be applied as a test for whether the pairs are congruent or not?'	• An opportunity to generalise.

© Crown copyright 2009

Notes for symmetry activities

Teaching notes	Teaching points
This activity is described in the Year 7, 8 and 9 examples of the Key Stage 3 Framework for teaching mathematics. It involves using a virtual geoboard to model how pupils could investigate symmetries of various shapes made on a three by three geoboard, and rotational symmetry of congruent shapes on a five by five geoboard. Start by opening the geoboard at: http://nrich.maths.org/public/viewer.php?obj_id=2883 By using the icons at the bottom of the screen, show how to create a three by three or five by five square. Demonstrate how the applet works. Give pupils a mini-whiteboard or pre-printed sheet to record their work in pairs. Set the tasks as follows: • On a three by three geoboard create as many different polygons as you can. Explore the maximum number of sides your shape can have, whether any are special 'regular' shapes and any symmetry properties of the shapes. • On a five by five geoboard, divide the board into as many congruent halves as you can. Explore the rotational symmetry properties of the resultant shapes. Pupils could work with real geoboards, on a computer or on paper. Ask pupils to keep a note of their findings for reporting back to the class, which could involve demonstrating to the class from the board.	• This is a fairly open exercise; with one of the outcomes a reasoned explanation of what has been discovered. • Pupils working in pairs will be more likely to discuss their results.

© Crown copyright 2009

Notes for translation investigation

Teaching notes	Teaching points
This activity is described in the Year 7, 8 and 9 examples of the Key Stage 3 Framework for teaching mathematics. It involves using a virtual geoboard to model how pupils could investigate the translations possible with a one by two right-angled triangle on a three by three geoboard. Start by opening the web page: www.nrich.mathematics.org/public/viewer.php?obj_id=2883 By using the icons at the bottom of the screen, show how to create a three by three square. Demonstrate how the applet works. Give pupils a mini-whiteboard or pre-printed sheet to record their work in pairs. Set the task as above. Pupils could work with real geoboards, on a computer or on paper. Give an example of how the same translation could come about from different methods – i.e. moving two across and one up appears the same as moving one up and two across – to draw out the convention of horizontal then vertical. When pairs have found all they can, invite them to suggest how they know they have them all. Invite pairs to share their reasoning with the class, encouraging good use of vocabulary and clear reasoning. Extension activities could include: • What about a four by four geoboard? Or a five by five? • How many translations do you think are possible? • Is there a pattern? • Could you predict and test what happens on a six by six geoboard?	• Pupils do not need to be told how many possibilities there are – better to discover them. • Pupils working in pairs will be more likely to discuss their results. • It is an important part of this objective to explore the pupils' geometrical reasoning.

© Crown copyright 2009

Notes for triangle investigations

Teaching notes	Teaching points
This activity is described in the Year 7, 8 and 9 examples of the Key Stage 3 Framework for teaching mathematics. It involves using a virtual geoboard to model how pupils could investigate the eight distinct triangles that can be constructed (eliminating reflections, rotations or translations) on a three by three square. Start by opening the web page: www.nrich.mathematics.org/public/viewer.php?obj_id=2883 By using the icons at the bottom of the screen, show how to create a three by three square. Demonstrate how the applet works.	• Pupils do not need to be told there are eight possibilities – better for them to investigate how many there are. • Take an opportunity to demonstrate how these transformations are not allowed.
Give pupils a mini-whiteboard or pre-printed sheet to record their work in pairs. Set the task as above. Pupils could work with real geoboards, on a computer or on paper. Allow class discussion about which are rotations, etc. and how many triangles there are.	• Pupils working in pairs will be more likely to discuss their results.
When pairs have a complete set of eight, encourage them to sort and classify their triangles, with reasons. Invite pairs to share their criteria with the class, trying to collect as many different criteria as you can. As an extension activity the same exercise could take place with a four by four geoboard. How many triangles do you think are possible?	• It is an important part of this objective to classify the triangles, exploring the pupils' geometrical reasoning.

© Crown copyright 2009

Notes for combining transformations

Teaching notes	Teaching points
This activity is described in the Year 7, 8 and 9 examples of the Key Stage 3 Framework for teaching mathematics. It involves using a virtual geoboard to model how pupils could investigate transforming a simple one by two right-angled triangle on a five by five geoboard represented by different coloured 'elastic bands'. Start by opening the geoboard at: http://nrich.maths.org/public/viewer.php?obj_id=2883 By using the icons at the bottom of the screen, show how to create a five by five square. Demonstrate how the applet works.	• Pupils will need to have an understanding of transformations to undertake this exercise.
Give pupils a mini-whiteboard or pre-printed sheet to record their work in pairs. Set the task as follows: on a five by five geoboard, create a series of small one by two right-angled triangles, which can have different orientations. Decide upon one triangle as the original one. Describe to each other how to create each of the other triangles by transformations or combinations of transformations. Pupils could work with real geoboards, on a computer or on paper.	• Pupils working in pairs will be more likely to discuss their results.
Pairs should be encouraged to look for different combinations to give the same result, and encouraged to generalise where possible. For example: is there a minimum or maximum number of translations required to move a given triangle to another?	• An opportunity to generalise.

© Crown copyright 2009