

Enlargements

The activities are for a plenary lesson starter using a SMART Board™ interactive whiteboard, related to the work in Ma3 Shape, Space and Measures.

Understand and use the language and notation associated with enlargement. Enlarge 2-D shapes, given a centre of enlargement and a positive whole-number scale factor. Explore enlargement using ICT.



Organisation of the materials

The SMART Notebook™ file is saved as “Enlargement.notebook”. It consists of nine pages, of which the first is the title page. There are five pages to support the activity and its extension.

Page 7 has links to dynamic geometry files.

Page 8 is a blank page.

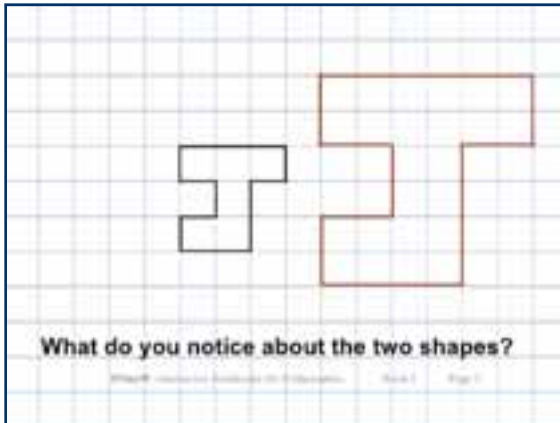
Page 9 contains teacher notes which are amplified here.

The Year 8 columns on pages 213, 215 (Y789 examples) of the Framework suggest some practical activities.

Notes

The first activity

Display page 2 and ask the class what they notice about the two shapes. Record their responses. For example, the two shapes are similar – the brown one has sides which are twice as long as the black one.

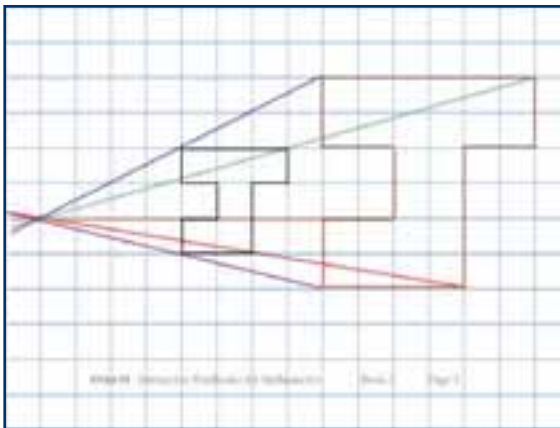


Page 2

Ask pupils to imagine a line passing through the top left-hand corner of both shapes. Now a line through the bottom left-hand corner. Where do they think they would meet?

Ask a volunteer either to draw a couple of freehand lines or to use the 'Straight Line' tool. Mark the intersection with a point and label it 'O'.

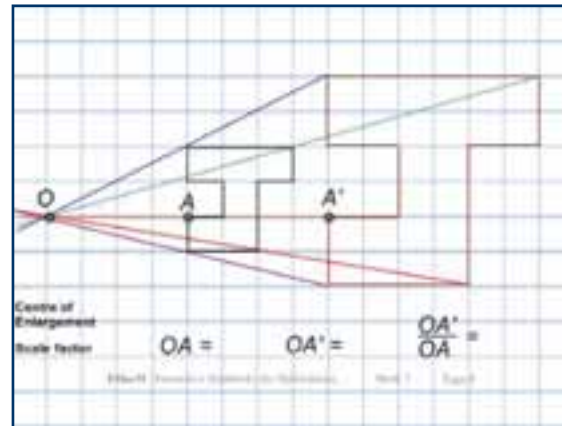
Ask pupils where they think lines joining other corresponding corners ('vertices') will go. Again, check that lines drawn on the board all pass through the same point. Page 3 has a clean diagram if you prefer to move on to it.



Page 3

You might like to introduce the word 'similar' at this stage. The two shapes are similar if every line joining corresponding points of the shapes passes through a common point. The large (brown) shape is an enlargement of the small (black) shape - with that common point as the centre of enlargement.

Now move to page 4 and drag the text 'Centre of Enlargement' to the point O. Ask the class to find the distances (in units) of A from O and of A' from O to work out the ratio of these distances. Record the results on the board. Label the top left-hand corners of the shapes with B and B'. Ask them to justify why OB and BB' must be the same length. (OB is the hypotenuse of a right-angled triangle with base 4 units and height 2 units and so is BB'). Hence find the ratio OB'/OB.

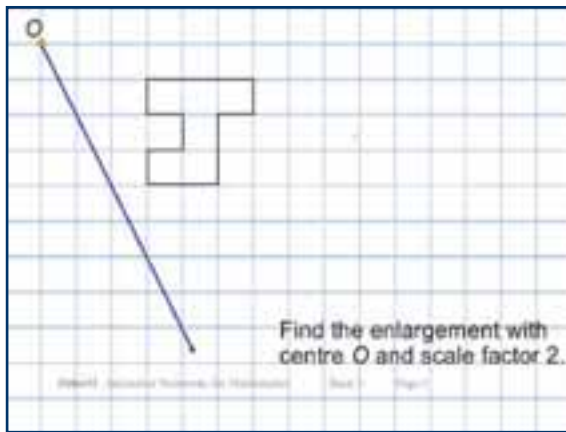


Page 4

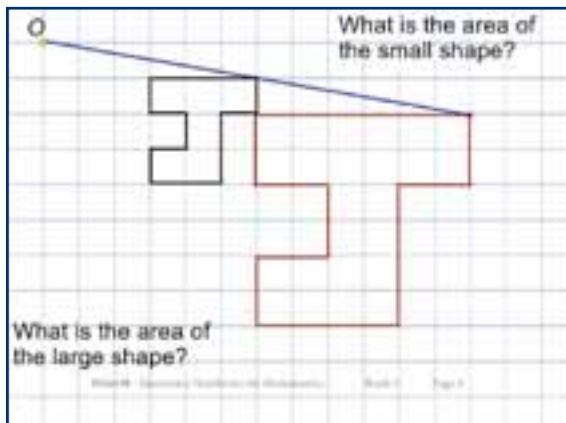
Now introduce the term 'scale factor' of an enlargement. For a scale factor of 2, each point P' on the larger shape lies on the line OP (where O is the centre of the enlargement) so that $OP' = 2 OP$. Ask the pupils to suggest how lengths of sides P'Q' on the larger shape are related to corresponding sides PQ on the smaller one.

Notes

The first activity (continued)



Page 5



Page 6

Show page 5 and ask pupils to imagine where the large brown shape should be if it is the enlargement of the black shape – with centre O and scale factor 2. Get one or more volunteers to put points showing their guesses of the images of some of the vertices of the black shape onto the grid. They can use the blue line to help them. Click on the line to show the endpoints and drag the 'free' end so that the line is anchored at O and passes through the required black vertex. Sketch it in the resulting image.

The actual result is there but hidden! Move to the pale pink dot a few squares to the right of the black shape – the cursor will change to a cross. Right-click, select 'Properties' and change the line colour from white to brown. The hidden shape should now be revealed.

SMART specific

How to use the 'Straight Line' tool to create outline shapes in SMART Notebook

Open a blank page in the Notebook. Select the Mathematics section of the Education folder in the Gallery and load the images for 'Paper backgrounds and tools'. Drag the 'Grid – large' thumbnail onto the page to give yourself a squared background to work on.

Straight Line Tool



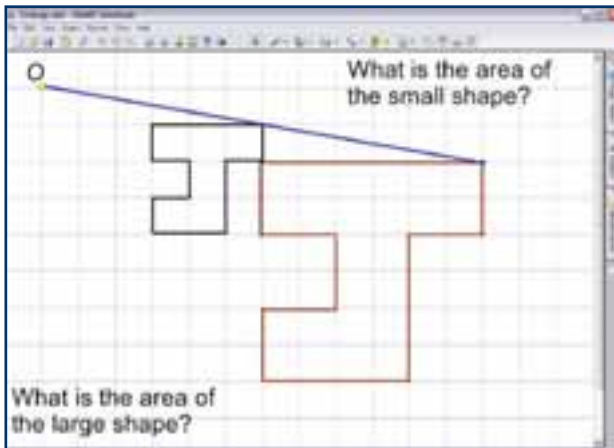
Use the 'Straight Line' tool to create the three sides of a 3,4,5 right-angled triangle as shown. Click on each in turn, use 'Properties' to change the colours and also drag the endpoints so that they align as closely as possible. With the 'Select' tool, drag open a rectangle (known as a 'marquee'), which surrounds your desired shape. Right-click on one of the drop-down menu boxes and select 'Grouping'. The option 'Group' will turn the three separate line segments into a single object. You can now drag this group object to a different position. Clicking on it, you can rotate it with the green circle, and resize it with the white one. Remember to use Shift if you want to maintain the same shape without distortion. Since the object was not created from the 'Shape' menu, you cannot fill it with colour within the Notebook – but of course you can always use the pens to colour it in!



Notes

Extension Task

Page 6 shows both shapes. We know that the sides of the larger brown shape are double the lengths of the corresponding sides in the smaller black shape. But what can we say about the areas of the two shapes?



Page 6

Ask the class if they can come up with a reason why the ratio of areas of similar figures should be the square of the scale factor of the enlargement.

Ideally, this activity should involve the use of some dynamic geometry software, such as "Cabri Geometry II Plus" or the "Geometer's Sketchpad" – either on the whiteboard or with pupils having hands-on access to computers. Page 7 refers to the 'Attachments' Tab at the right hand side of the page. This provides links to an interactive web page called "Enlarge.htm" which was created as a 'Java applet' using the 'Geogebra' software. You should be able to click on this to open it with Microsoft® Windows Explorer and to be able to drag objects around. The "Geogebra" software is freeware and there is a link to Markus Hohenwarter's website from which you can download and install it. The file "enlarge_worksheet.ggb" is the original used to create the web page. The "Cabri II Plus" file is "Enlarge.fig" and the "Sketchpad" file is "Enlarge.gsp".

There is a file attached for you to use to explore the effect of changing the centre of enlargement, the scale factor and the original shape.

Click on the Attachments Tab and then on the Enlarge.htm item.

You will then be able to drag A to move the centre, or to drag 'a' to change the factor, or to drag any vertex of the blue polygon to change the shape.

The file was created in the free GeoGebra software produced by Markus Hohenwarter from Salzburg, Austria. There is a link to his website from where you can download the software. In the Attachments Tab you will also find files written in GeoGebra, the Geometer's Sketchpad and Cabri II Plus which you can use if you have the appropriate software loaded.

HM0118 - Interactive Notebooks for Mathematics Book 3 Page 7

Page 7

Page 9 has the usual collection of hints and tips about the activity and this SMART Notebook file.

Teacher notes:

- The Straight Line tool is very useful here to join points. Click on the line to show its end points, and drag either to where you require them.
- The 'squared paper' from the Gallery makes a very useful background, both to help with accurate drawings and to estimate areas.
- Of course you can write and draw over the shapes and text - and also save your annotated work.
- In this Notebook the shapes used were just created with the Straight Line tool, and then grouped together to make a single object. The enlargement was done by copying and then resizing, using the Shift key.
- You can 'hide' a shape by using 'Preferences' to colour its outline in white! Make the shape transparent so that it does not blank out what is underneath it.
- You can 'reveal' a shape by using 'Preferences' to change its outline colour from white to black, brown etc. You have to guess where it is!

HM0118 - Interactive Notebooks for Mathematics Book 3 Page 9

Page 9

Resources

DfES (2004) 'Embedding ICT@Secondary: Use of interactive whiteboards in mathematics'. DfES, London 2005.

The book (ref: DfES/0812/2004) is one of the DfES series on whiteboards and was distributed as part of the DfES 'Key Stage 3 Embedding ICT@Secondary Mathematics pack' (ref: DfES/0806/2004). These can be ordered from DfES publications (0845 60 222 60 or dfes@prolog-uk.com). The book can also be downloaded as a file from: publications.teachernet.gov.uk/eOrderingDownload/DfES-0812-2004_Mathematics.pdf

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