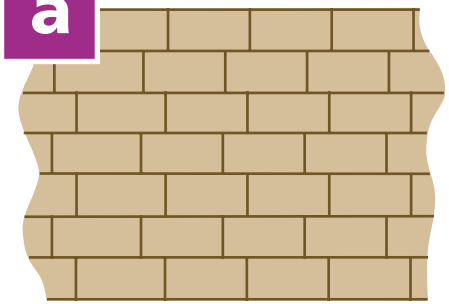
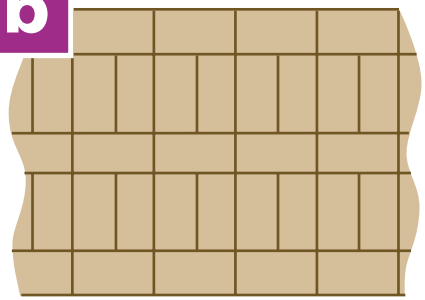
All of these walls have lines of weakness

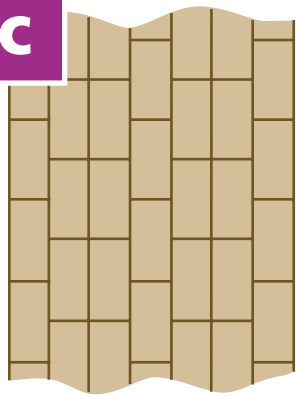
a



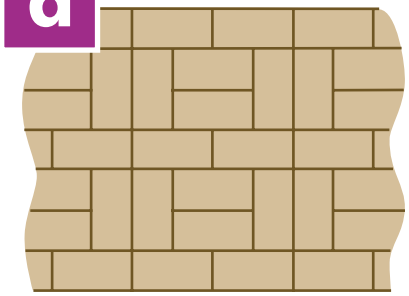
b



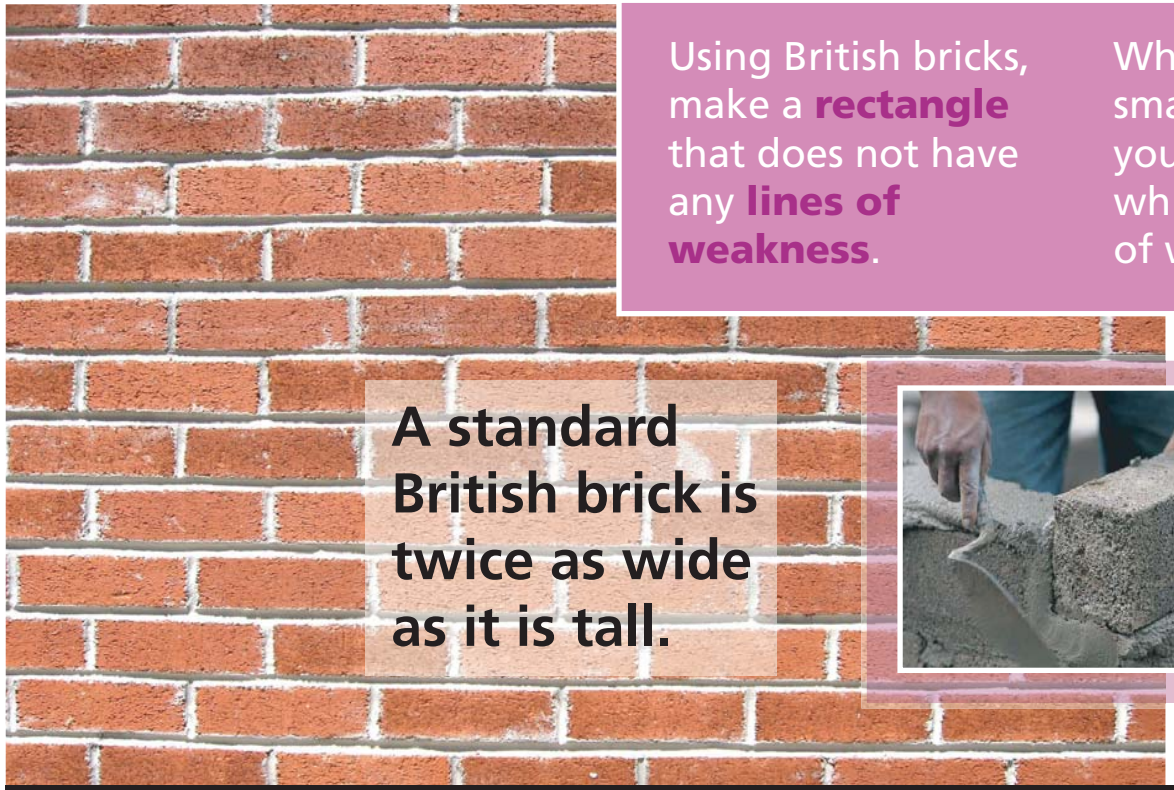
c



d



Where are these lines?



Using British bricks, make a **rectangle** that does not have any **lines of weakness**.

What is the smallest rectangle you can make which has no lines of weakness?

What is the smallest **square** you can make which has no lines of weakness?

A standard British brick is twice as wide as it is tall.

Why is it impossible to make a 5 by 7 rectangle with bricks like these?

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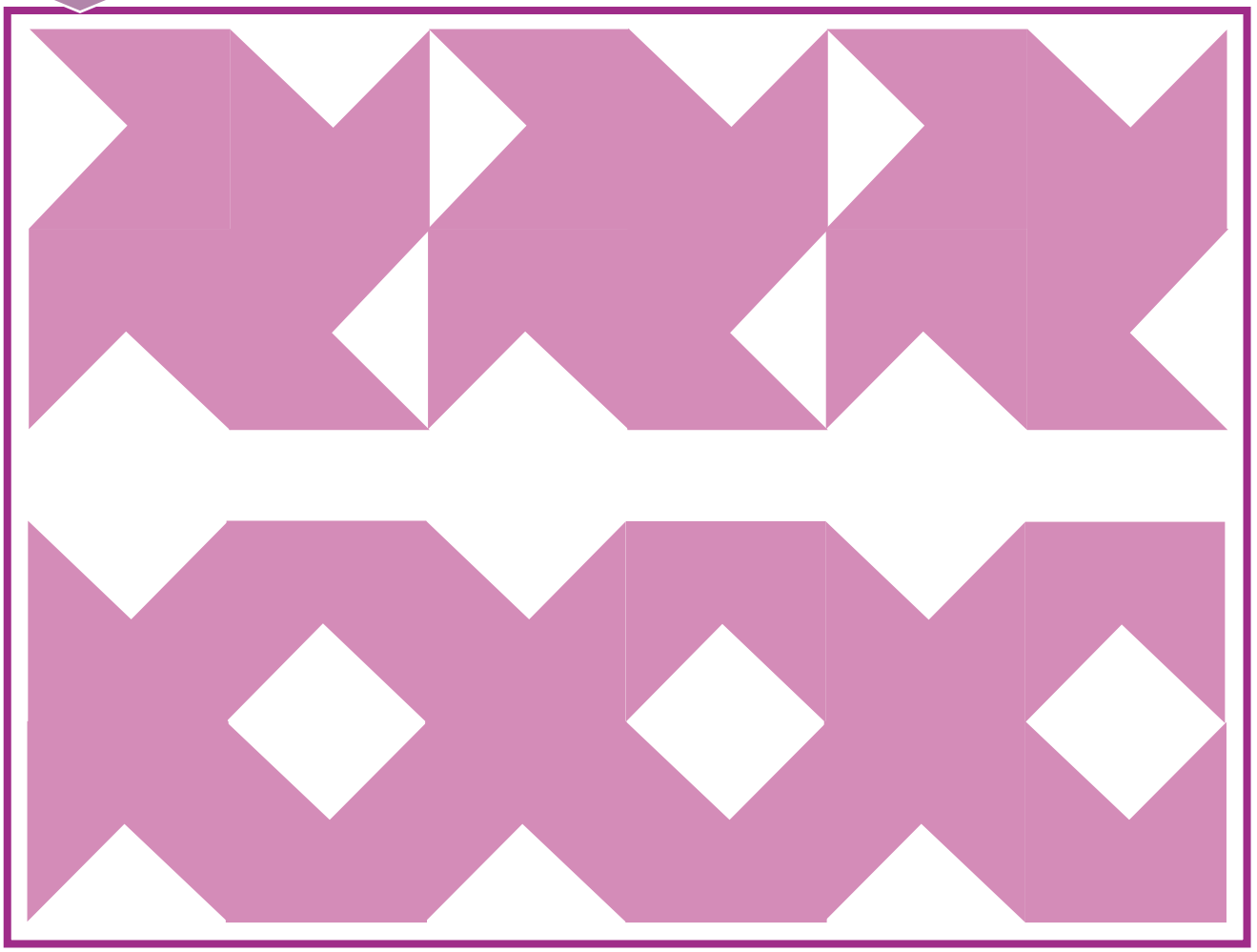
One tile **two patterns**

These two patterns were both made with the same tile based on a square.



Make a tile of your own design using the Draw toolbar in Word. It is a good idea to start with a tile based on a square. **Why?**

Once you have made your tile, you can very easily make copies of it.

Flip or rotate the copies of your tile to make a number of intriguing tiling patterns.

Can you detect the tile?

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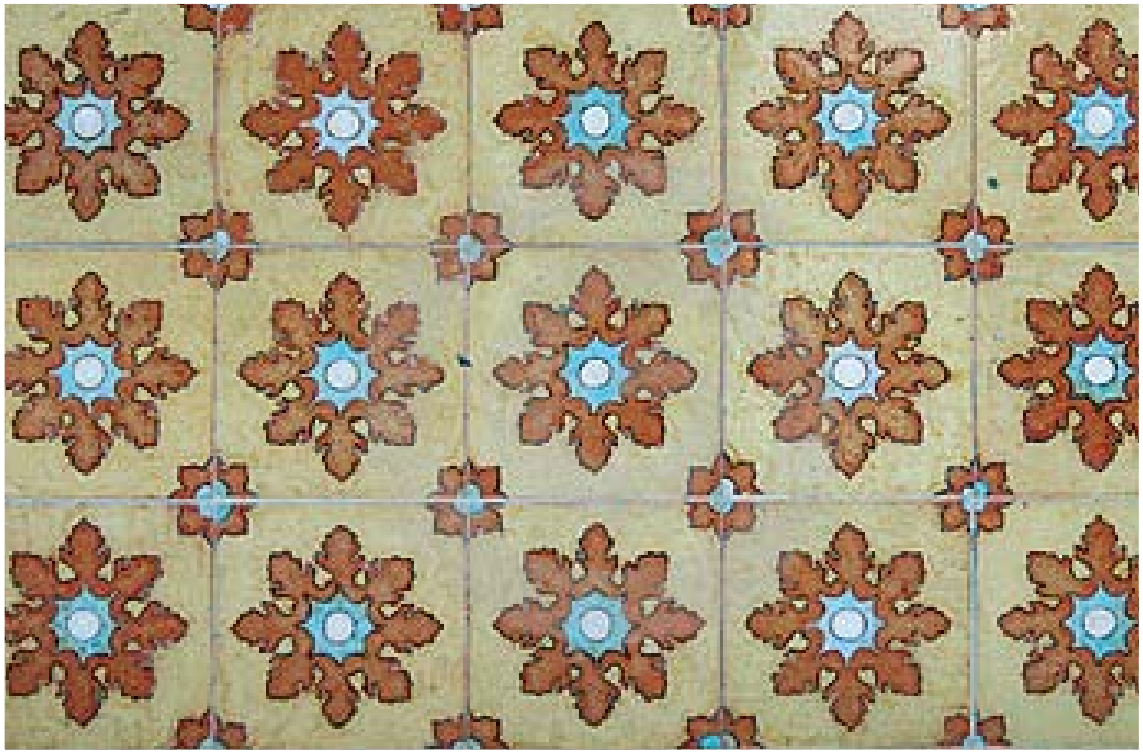
Square tiles

This tiling pattern is made from decorated square tiles.
The pattern on each tile is symmetrical.



Notice how the design of the tile creates new patterns where the corners of four tiles meet.

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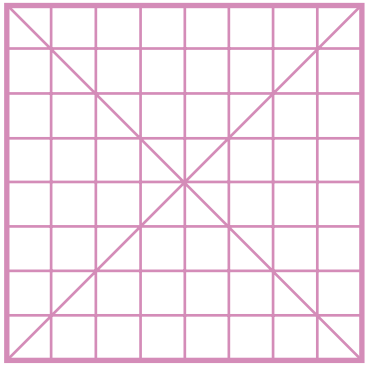
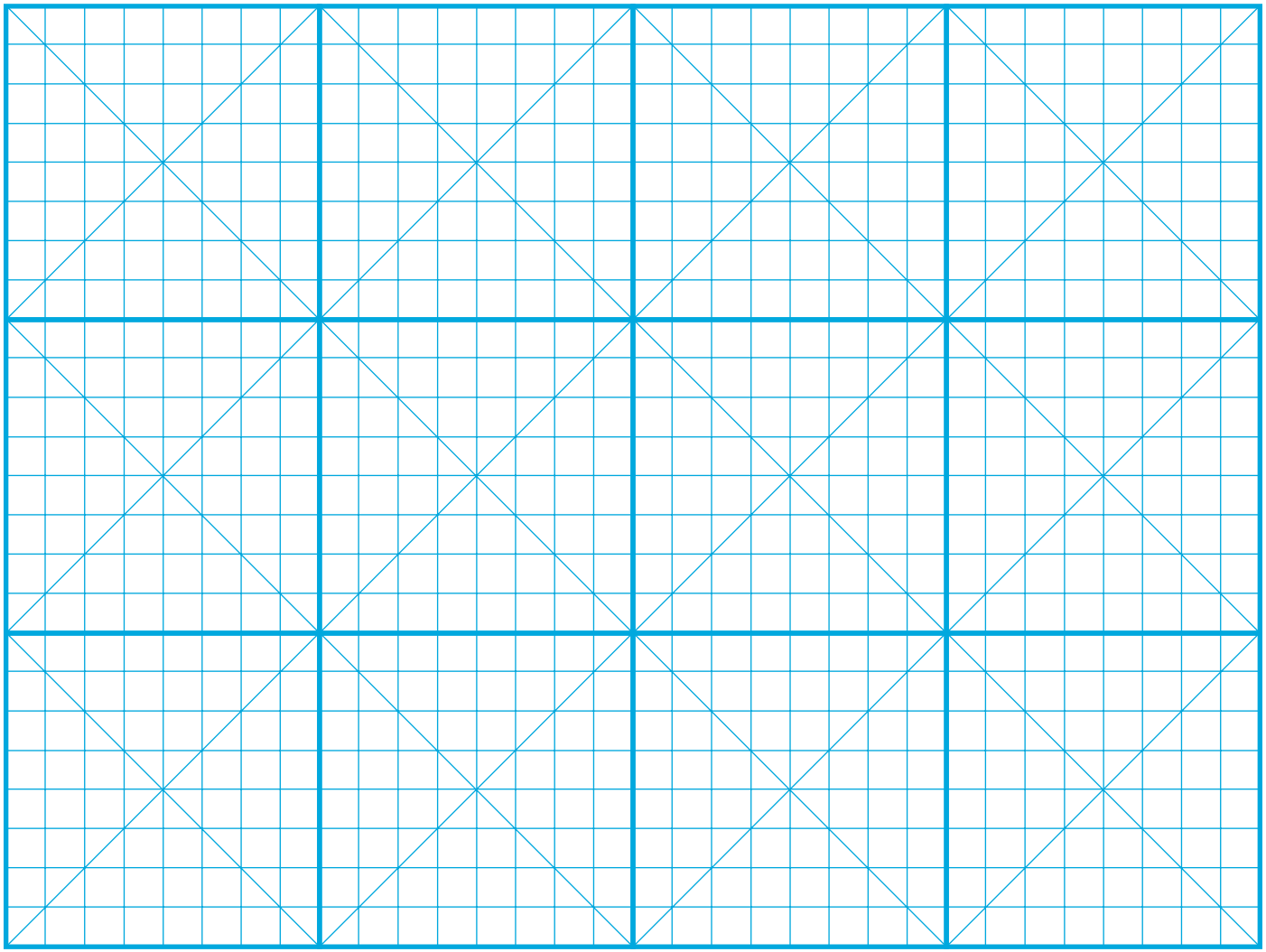
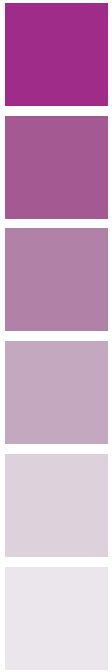
Square tiles



Design your own **patterned tile**.
Use the guide-lines to help you make your tile symmetrical.



Now repeat your single tile using the grid to the left to show what it looks like when several are placed into a tiling pattern.



building for the future

Teacher notes

Building for the future : Bricks and Tiles

Description

This topic begins with the humble brick, staple building material for walls, homes and factories in the region's industrial centres.

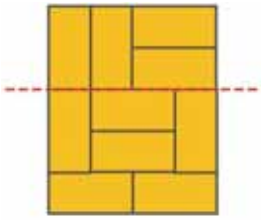
Activity 1: What makes a wall strong?
Activity 2: Square tiles
Activity 3: Drawing tiles

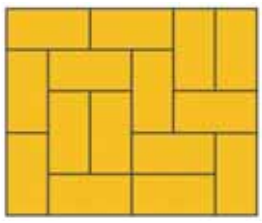
Resources

Dominoes are available from Arnold. http://www.nesarnold.co.uk/

What makes a wall strong? explores lines of weakness in structures. Boxes of dominoes are useful for this activity, as the standard dimensions of the long side face of a brick are in the ratio 2:1. Strictly, this is an approximation, since mortar is used to cement the bricks together; the dimensions are such that the ratio is 2:1 after the thickness of the mortar is taken into account. You can cut card shapes or just work on squared paper if no dominos are available.

The task is to avoid lines of weakness in either direction, vertically or horizontally. This arrangement of bricks has one horizontal line of weakness. Pupils will probably be surprised at how difficult it is to avoid such lines. It is a good idea to encourage them to check with a partner – someone else can often spot a line of weakness that you have missed yourself.





The smallest rectangular solution is a 6 by 5 rectangle. It can be shown using proof by exhaustion that this is the smallest rectangle: this is a challenging task to complete. Thinking about odd by odd rectangles will help eliminate some possibilities. One way to prove that no odd by odd rectangle can be made is to note that the product of any two odd numbers is another odd number. Since each brick covers 2 squares, the number of squares covered by any set of 2 by 1 bricks will always be an even number.

Square tiles gives rich opportunities to consider reflective and rotational symmetry and you could bring in art from different cultures. Drawing tiles extends this activity to examine what happens if you begin with an irregular tile, and then create a tessellation by placing the irregular tile using different rotations, for example:

...and here is an example where reflections have been used to place the same irregular tile.

It is easy to create a tile using the Draw toolbar within Microsoft Word for this activity, and this allows children to experiment with rotation and reflection possibilities very easily. There is a helpful internet resource which explains how to do this at: http://www.fsmq.org/data//files/ispsamakeysi-9259.doc

The mathematics

What makes a wall strong? will develop the process skills involved in solving problems: recording, systematic experimentation, justifying and proving. It gives opportunities for proof by systematic exhaustion.

Square tiles and Drawing tiles require thinking about and manipulating transformations – translation, reflection and rotation.