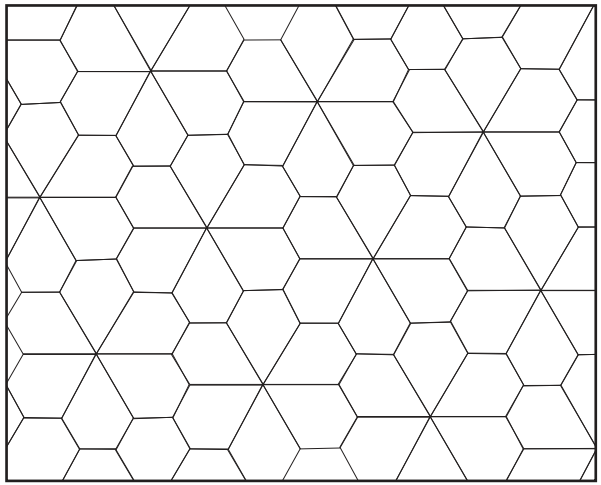
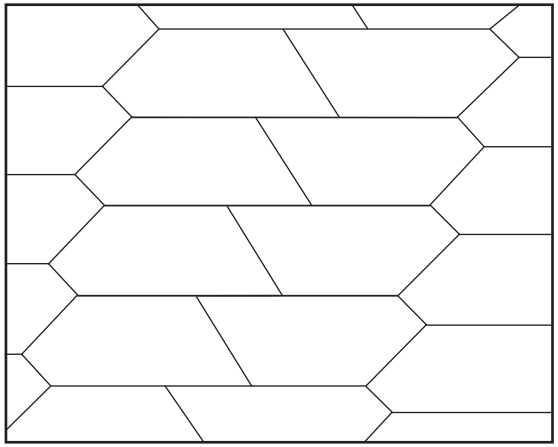
Pentagon patterns Finding tiles

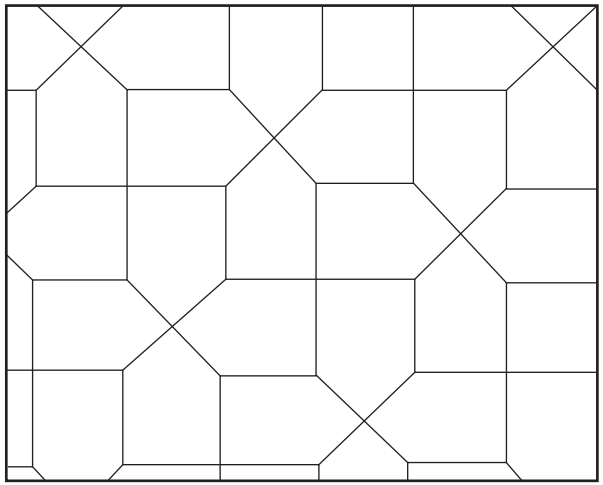
Repeating patterns are often used by designers – in wallpaper, in fabric, in wrapping paper. These are called **tilings**.

Some **regular polygons** fit together to make a tiling. Which ones?

A regular pentagon does not tile. **Why not?**







Look at the vertices of these tilings. Use them to find out as much as you can about the **angles** of the pentagons.

These are all **periodic** tilings. Find another **pentagon** that makes a **periodic** tiling.

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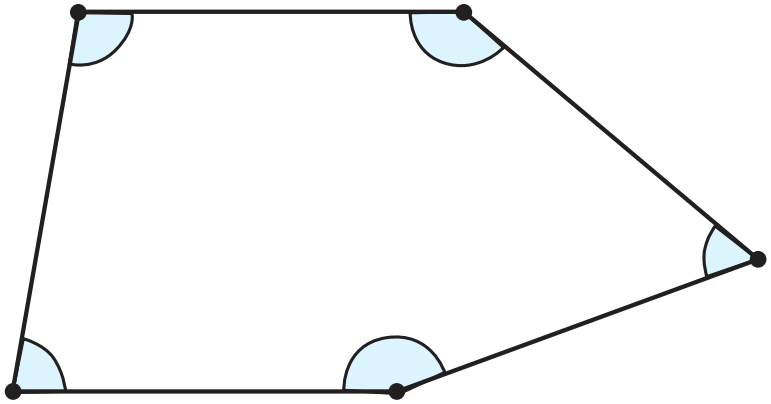
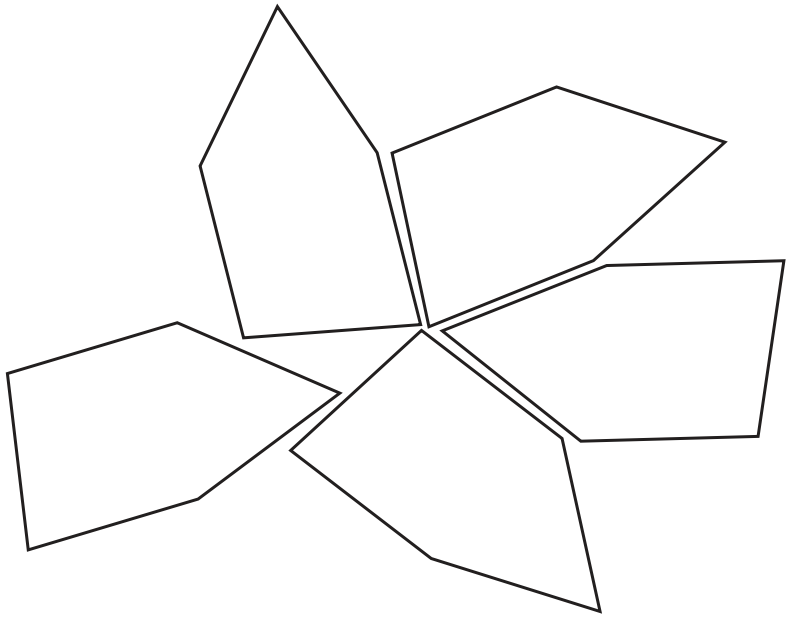
Pentagon patterns Equilateral pentagon



This is an **equilateral pentagon** – all the sides are the same length.

Architects are interested in how **irregular shapes fit neatly together**.

Shapes that tile **fit together round a point**. These pentagons fit together in lots of different ways. **For example:**



Find all the **different ways** that the tiles fit together **round a point**.

Based on an idea from Smile Mathematics.

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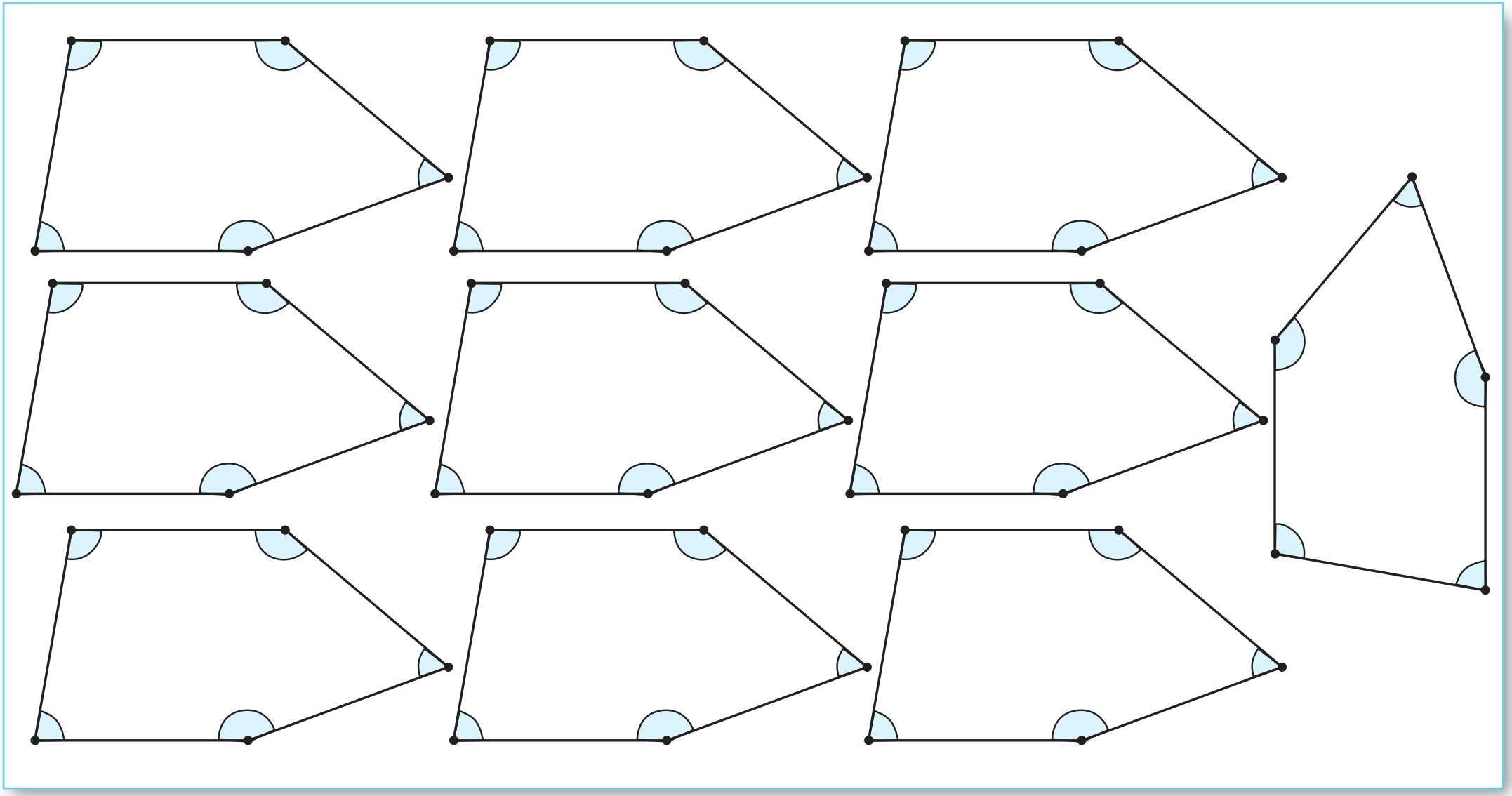
Pentagon patterns Equilateral pentagon worksheet



Based on an idea from Smile Mathematics.

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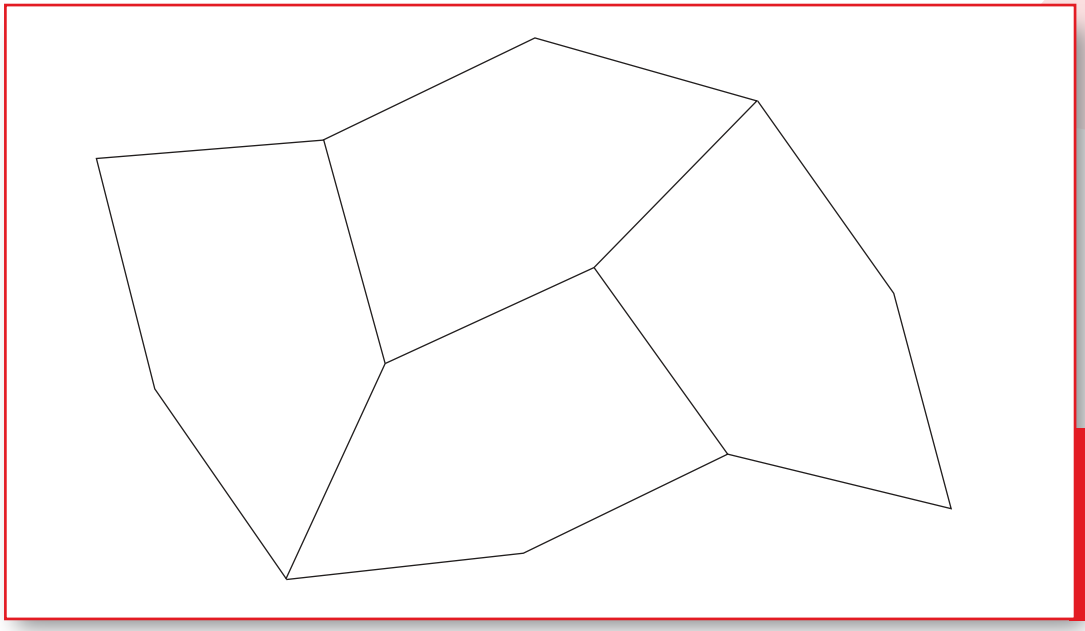
Pentagon patterns From point to pattern

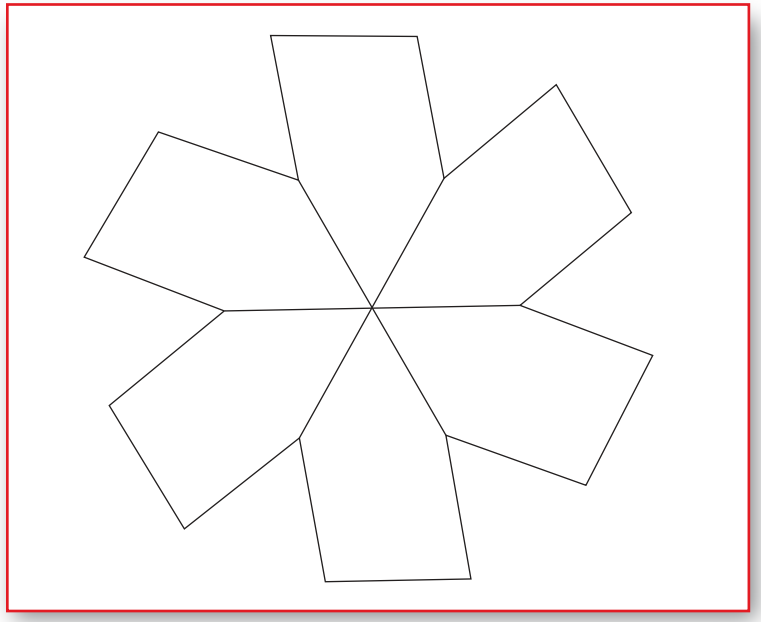


This shows the beginning of a tiling pattern. It shows **two different vertices** of the tiling. What are they?

Make a **periodic tiling** by extending this pattern.

What other vertices are needed?

What other **periodic** tilings can you find?



Here 6 x 60° have been fitted together.

The shape has **rotational symmetry**.

Try to extend this to make a **non-periodic tiling**.

Based on an idea from Smile Mathematics.

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Pentagon patterns

Topic

An understanding of how shapes fit together is important in a wide range of design contexts. This topic works with this idea focusing initially on angle properties and angle sums and then broadening out to periodic and non-periodic tilings.

Mathematical activities

Finding tiles

Equilateral pentagon

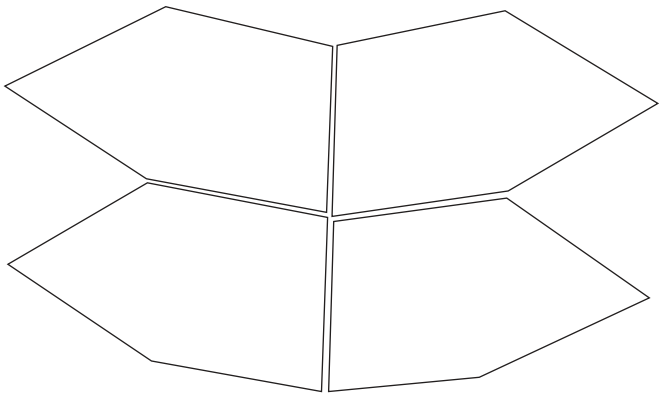
From point to pattern

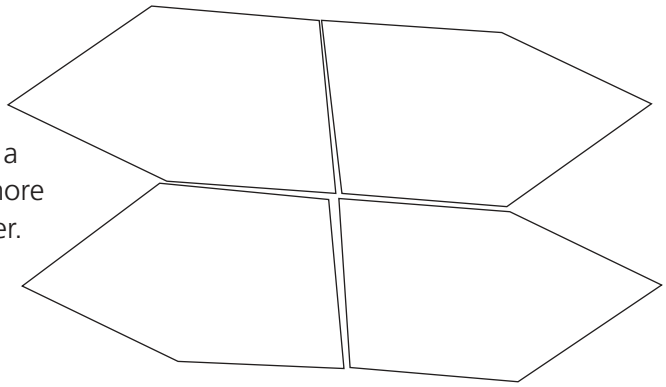
Planning for teaching

In **Finding tiles** pupils use angle properties at a point and on a straight line to define a given set of pentagons. Two of the patterns are wholly defined but in one case only certain relationships between the angles are fixed. Vocabulary that is likely to be new to the pupils is introduced – vertices of a tiling pattern and periodic patterns. Pupils are asked to find another pentagon that tiles – this might be by building on the pattern that is not fully fixed or other more creative responses. These can be shared with the rest of the class and pupils encouraged to justify their claims about them.

Equilateral pentagon introduces a curious pentagon that fits together in a surprising variety of ways. There are eleven different angle sums and each of these can create different vertices. For example, 80 + 80 + 60 + 80 + 60 degrees gives a different vertex from 80 + 80 + 80 + 60 + 60 degrees – and there are also different possibilities depending on whether or not the tiles are turned over. Photocopy the **Equilateral pentagon worksheet** onto several different brightly coloured sheets and give a number to each group to support their exploration. They may want to record their solutions by sticking down sets of tiles which create a vertex.

These results form the starting point for **From point to pattern**. There are a number of different possible tilings. For example, two of the fits for two 80 degrees plus two 100 degrees produce these distinct patterns.





Pupils will enjoy creating a poster showing one or more of the tilings they discover.

Mathematical activities

Careers link-up

A group of architects in the late eighties developed an architectural style they called 'deconstructivism' that challenges and distorts the orderly shapes we expect to see in buildings and highlights angles in order to create an appearance that looks chaotic but controlled. Students can explore the work of some of these architects or groups (Zaha Hadid, Gunther Behnisch, Hans Scharoun, Coop Himmelblau and Daniel Libeskind – the Imperial War Museum North in Manchester by Libeskind is a great example *http://en.wikipedia.org/wiki/Imperial_War_Museum_North*).

Follow this up by asking your local STEM broker for an Ambassador who is an architect (*www.stemnet.org.uk*) to come into school and find out more about becoming an architect.

Useful sites:

http://www.engagingplaces.org.uk/home
a site created to support links between building design and education.

http://www.architecture.com/EducationAndCareers/BecomingAnArchitect/BecomingAnArchitect.aspx
the RIBA careers site.

www.futuremorph.org
Careers from Science.

www.mathscareers.org.uk
Maths Careers and more.

Want to know more?

Contact STEM Subject Choice and Careers

info@careersinstem.co.uk

The Centre for Science Education
Sheffield Hallam University
City Campus, Howard Street
Sheffield S1 1WB

Tel: 0114 225 4870

A Department for Education initiative to promote subject choice and careers in Science, Technology, Engineering and Maths (STEM) delivered by the Centre for Science Education at Sheffield Hallam University and Babcock.

or for more information on careers go to Maths careers at www.mathscareers.org.uk/
or Future Morph at www.futuremorph.org/<http://www.futuremorph.org/

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