

What would it have been like to live in WWII? Geometry teaching pack



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GEOMETRY ACTIVITIES

ENQUIRY OF LEARNING What would it have been like to live in WWII?

The six activities in this pack have been developed to explore with students geometry associated with World War II. They support the Year 6 learning enquiry *What would it have been like to live in WWII?* which explores the reasons for the start of the war, the persecution of Jewish people and the consequences of the war, as well as the realities of daily life on the home front.

These activities provide opportunities to study the geometry of the ruined Gothic architecture of Coventry cathedral, the patterns of human fingerprints (which were used in ID cards) and the geometry of vegetables linked to the 'Dig for Victory' campaign.

They could be used as a stimulus for learning in art or history, or to teach geometry as a standalone activity.

For each activity, step-by-step instructions are provided as a guide for teachers, with accompanying diagrams and lists of the resources students will need to complete each activity. There are also photocopiable templates – where these are used, each student will need a copy to complete each activity.

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WHY GEOMETRY? Learning the geometry of Nature provides students with a new way of looking at the world. The observational skills and careful drawings that are required to recreate this geometry can have a powerful impact on students' understanding of Nature and their place in it. If we are to create a sustainable future, we need to see the world through a different lens, to understand that the patterns of life that exist around us also exist in us. This way of seeing the world means we view everything from a place of connection, rather than separation. This sense of connection is an essential part of learning to live sustainably. After all, the

word 'Harmony' means joined or connected.

COMPASSES

The activities in this pack can be adapted so that there is no need to use a compass to complete them by using the templates provided at the end of each activity. However, if you would like your students to engage in more of the geometric construction, Jakar compasses will help ensure accuracy and are easy to use. They can be purchased at a discount through The Harmony Project website.

GEOMETRY ACTIVITY 1

ENQUIRY OF LEARNING What would it have been like to live in WWII?

LEARNING QUESTION How can I draw the Jewish Star of David?

The Star of David has ancient roots, although it wasn't always a symbol of Judaism. It appears in early Jewish artwork and texts but also in other cultures. Its association with Judaism became more significant in the 17th century, when Jewish communities began using it prominently on synagogues and gravestones. During the Holocaust, the Star of David took on a tragic significance: Nazis forced Jews to wear a yellow star for identification, turning a symbol of pride into one of persecution.

After World War II, the star became a powerful emblem of Jewish resilience and remembrance, symbolising both the suffering and the perseverance of the Jewish people. Today, the Star of David is a widely recognised emblem of Jewish identity and heritage. On the Israeli flag, it symbolises Jewish unity and heritage.

YOU WILL NEED

Ruler HB pencil Compass Good-quality eraser Coloured pencils Copies of Resource 1A (Optional)

To adapt the activity for students requiring additional support, use the template on Resource 1A and begin from Step 6.





Top: Stone carving of the Star of David Above: A Hebrew manuscript painting



DID YOU KNOW?

The Star of David is a hexagram made up of two overlapping triangles. Some interpret it as a symbol of the connection between God and humanity, with one triangle pointing upwards to the divine, and the other downwards to the earthly realm. Others see it representing the duality of existence, such as good and evil, or the balance of opposites.



Above: Jewish children in Antwerp, Belgium, in 1943 wearing the compulsory yellow Star of David badge (Yad Vashem Photo Archives)

ACTIVITY 1

STEP 1 Draw a vertical line

Use a ruler to draw a 15cm-long vertical line down the centre of the page and mark the midpoint (7.5cm from either end) with a dot.



STEP 3 Draw the first semi-circle

Place the compass needle on the point where the bottom end of the vertical line meets the circumference of the circle. Draw a semi-circle. You will notice that this passes through the centre point of the circle you drew in Step 2.

STEP 2 Draw a circle

Place the compass needle on the midpoint of the line and extend the arms of the compass so that the pencil point rests on one end of the line. With the compass needle still on the midpoint, draw a circle (it will have a radius of 7.5cm).



STEP 4 Draw the second semi-circle

Repeat Step 3 with the compass needle on the point where the top end of the vertical line meets the circumference of the circle.





STEP 5 Divide the circle

Use dots to mark the four points where the two semi-circles intersect the circumference of the circle. Use a ruler to draw two lines connecting these dots, as shown below. Each line should pass through the centre of the circle. The circle is now divided into six equal segments.



STEP 7 Draw the second triangle

Locate the point where the bottom of the vertical line meets the circumference of the circle. Now locate the two points where the top of the diagonal lines you drew in Step 5 meet the circumference of the circle. Use a ruler to join all three points to draw a triangle, as shown below.

STEP 6 Draw the first triangle

Locate the point where the top of the vertical line meets the circumference of the circle. Now locate the two points where the bottom of the diagonal lines you drew in Step 5 meet the circumference of the circle. Use a ruler to join all three points to draw a triangle, as shown below.



STEP 8 Draw two more triangles

Use a ruler to draw two more triangles: one smaller, 0.5cm in from the edges of the first triangle you drew in Step 6, and one larger, 0.5cm outside it, as shown below. You should now have a 1cm-thick triangle outline.





STEP 9 Repeat on the second triangle Repeat Step 8 with the second triangle you drew in Step 7.

STEP 10 Add colour

Choose a sandy yellow pencil to colour your Star of David.





PHOTOCOPIABLE RESOURCE 1A



GEOMETRY ACTIVITY 2

ENQUIRY OF LEARNING What would it have been like to live in WWII?

LEARNING QUESTION How can I recreate the geometry of the Union Jack?

The Union Jack is the flag that represents the unity of the nations of the United Kingdom. The Union Jack we know today was officially adopted in 1801, following the union of Great Britain and Ireland. Before that, it only combined the flags of England and Scotland.

The name 'Union Jack' originally referred to the flag when it was flown on the jack staff of a ship, but now it's commonly used to refer to the flag in all contexts. It is used on government buildings, military uniforms and during national celebrations and events.

The Union Jack doesn't have reflective symmetry because of the way the red (St Patrick) and white (St Andrew) diagonal stripes – called saltires– are arranged. On the side closer to the flagpole (or the left-hand side on paper), the white stripes above the diagonals are wider. On the side farther from the flagpole (or the right-hand side on paper), the white lines below are wider. It does, however, have rotational symmetry: if you rotate the flag 180 degrees, it looks the same.

YOU WILL NEED

Copies of Resource 2A Ruler HB pencil Compass Good-quality eraser Coloured pencils





Above: The pattern of the Union Jack (top) incorporates the crosses of St Andrew (above left) and St George (above right)

Right: British WWII soldiers holding the Union Jack



DID YOU KNOW?

Flying the flag upside down is seen as disrespectful, but was used as a signal for help in emergencies during the Boer War and in some battles in India in the late 1700s.

The Union Jack

Flag of Great Britain

The earlier flag of Great Britain was established in 1606 by a proclamation of King James VI of Scotland as he was crowned James I of England. It combined the cross of St George and the cross of St Andrew.

The Union Jack flag

The present-day flag dates from 1801 and the union of Ireland with England and Scotland. To represent this, the Irish red saltire of St Patrick was added to the previous flag.







Land flag proportions

The flag to be flown on land has a proportion of 3:5. That means it is three squares tall and five squares wide.

Sea flag proportions

The flag to be flown on ships has a proportion of 1:2. That means it is one square tall and two squares wide.





ACTIVITY 2

STEP 1 Familiarise yourself with the template

Start with a printout of Resource 2A, which is a template of a 1:2 Union Jack.

STEP 2 Colour the cross of St George

Use a red pencil to colour the vertical and horizontal lines that represent the cross of St George of England.





STEP 3 Colour the cross of St Andrew

Use a dark blue pencil to colour the right-angled triangles in the design. These represent the cross of St Andrew. How many of them are there?

STEP 4 Colour the cross of St Patrick

This part of the flag is asymmetrical to show that the white parts of the cross of St Andrew are a cross, rather than a border for the red diagonal cross of St Patrick. Use a red pencil to colour the four diagonal lines, as shown below.





PHOTOCOPIABLE RESOURCE 2A



GEOMETRY ACTIVITY 3

ENQUIRY OF LEARNING What would it have been like to live in WWII?

LEARNING QUESTION What patterns can I find in my fingerprint?

There are three main types of fingerprint patterns: loops, whorls and arches. Most people have loops; significantly fewer have whorls or arches. Fingerprints are unique, even those of identical twins. This makes them perfect for identifying people.

Fingerprints have been used for identification for more than 100 years. It all started in the 1880s, when Sir William James Herschel in India noticed that fingerprints could be used to tell people apart. Then, in 1892, a British scientist named Sir Francis Galton wrote a book called *Finger Prints*, in which he showed that everyone's fingerprints are unique and don't change over time. This idea meant fingerprints started to be used to help solve crimes.

In 1897, another British police official, Sir Edward Henry, created a system to organise fingerprint records. This made it easier for the police to use fingerprints to catch criminals. By 1901, Scotland Yard, the main police headquarters in London, started using fingerprints to identify criminals. Since then, fingerprints have become a common way to identify people all around the world.

In Activities 3A and 3B, students explore the diverse fingerprint patterns of students (and adults!) in their class.



Copies of Resource 3A HB pencil Good-quality eraser Ink pad Paper Magnifying glasses



DID YOU KNOW?

Starting in April 1941, everyone in the Netherlands aged 15 and over had to have an ID card. This card included a photo, a fingerprint and a unique number. Later, big capital 'J's were stamped on the ID cards of Jewish people to identify them quickly. From 1 January 1942, everyone had to carry their ID card at all times. The Nazis and Dutch police used these cards to find Jews, resistance fighters and people avoiding compulsory work.



Above: An ID card for a Jewish citizen in the Netherlands

Left: An enlarged fingerprint and the front page of Francis Galton's 1892 book on fingerprint analysis

Exploring fingerprints

Before staring these activities, use an ink pad to collect the fingerprints of the whole class. Collect some adult fingerprints, too, but keep these separate from the class set (some children's fingerprints can be small or less developed than adult fingerprints, which makes them harder to examine). Enlarge some of the clearest fingerprints you have collected using a photocopier at 400%.





To familiarise students with the patterns found in fingerprints, and to encourage close observation, allow them time to practise drawing the three patterns – whorls, loops and arches – in their sketchbooks or on paper.

Loop pattern





Whorl pattern





Arch pattern





ACTIVITY 3A

Using the class set of fingerprints, observe them with a magnifying glass. See if you can categorise them using the three types of pattern (loop, whorl and arch) that the students previously explored. Make a simple tally chart of the results, showing how many examples of each fingerprint pattern you found.



Whorl	
Loop	
Arch	



TEACHER TIP

When it comes to patterns, 65% of people are said to have a loop pattern in their fingerprints. Meanwhile, 30% have whorls and only around 5% have the arch pattern. How did the results of your class survey compare with this?

ACTIVITY 3B

In this activity, students recreate the most common pattern found in fingerprints: the loop. Encourage them to use examples of fingerprints from the class set to support their drawing.

STEP 1 Draw the loop

Start with a printout of Resource 3A. Draw the lower section of a fingerprint with the distinctive loop pattern, as shown below.

STEP 2 Draw the arch

Above the main loop section of the fingerprint, an arch shape starts to form. Add these lines, as shown below.





STEP 3 Draw the flat top At the top of the fingerpint, there is a section with much flatter lines. Draw these next to complete the fingerprint.





PHOTOCOPIABLE RESOURCE 3A



GEOMETRY ACTIVITY 4

ENQUIRY OF LEARNING What would it have been like to live in WWII?

LEARNING QUESTION How can I create the shape of an eye?

In this activity, students draw a war portrait with a particular focus on how the shape of our eyes changes when we're scared or anxious.

When we're scared, our eyes open wide. This happens because our brain wants to take in as much information as possible to help us understand what's happening and find a way to stay safe. The black part in the middle of our eyes (the pupil) gets bigger (dilates) in the dark to help us see better; when we are scared, the same thing happens. This helps us to see more details around us.

Eyebrows also express our emotions. When we are scared, our eyebrows often lift up and arch. Sometimes, worry and anxiety cause the inner parts of the eyebrows to draw together and create wrinkles or furrows between them.

YOU WILL NEED

Copies of Resource 4A Ruler HB pencil Compass Good-quality eraser Coloured pencils





Top: Portrait of American tanker John Parks during the Battle of the Bulge, December 1944 Above: Marines in Iraq 2004 (Anja Niedringhaus)

DID YOU KNOW?

People who have experienced war often continue to feel the psychological effects of it after the conflict has ended. This is called post-traumatic stress disorder, or PTSD. It can cause bad dreams and make people feel very anxious and remember distressing events. The effects of PTSD can be felt for a long time and can make it hard for someone to feel well again.



Above: A Jewish boy being detained at the Warsaw Ghetto in Poland

ACTIVITY 4

STEP 1 Draw a vesica piscis

The eye is shaped a bit like an almond or vesica piscis (the shape that is created when two circles overlap). Experiment with a compass or work freehand to draw two overlapping circles to create this shape.

STEP 2 Practise drawing an eye

Start with a printout of Resource 4A. The spacing between the lines on the grid helps give a sense of the size to draw your eyes on this template. Each eye should be the same width as the distance between the two vertical dashed lines. Draw a vesica piscis shape very lightly between the two vertical lines to practise, then rub it out before proceeding with Step 3.





STEP 3 Draw the outline of the eyes

Draw two vesica piscis shapes the same size as the one you drew to practise in Step 2, but this time on either side of the vertical dashed lines on the template. Try to make them as symmetrical as possible.

STEP 4 Draw the pupils and irises

Draw the pupil and iris for each eye. Pupils – the black part of the eye – become wider when we are in the dark to let in more light, or when we are feeling fear and worry and need to get more information about our surroundings.



STEP 5 Draw the brows

Add the eyelids and the brows. To make the eyes more expressive, think about the effect that is created when the eyebrows are raised at the centre.

STEP 6 Draw the furrows

When someone's eyebrows are raised, you will also notice lines or furrows showing expression between the brows and on the forehead. Add these to your drawing.



STEP 7 Add detail

Exposing the white eyeball above the iris adds an expression of fear or shock to the eye. Consider these details when fine-tuning your drawing.

STEP 8 Add colour

Colour in your eye portrait. Remember to colour the iris of the eye and use shading for the lines in between the brows and on the forehead.







TEACHER TIP

Encourage students to experiment in a new sketch with what they can change about eyes and eyebrows to represent a different person or convey a different expression.





PHOTOCOPIABLE RESOURCE 4A

GEOMETRY ACTIVITY 5

ENQUIRY OF LEARNING What would it have been like to live in WWII?

LEARNING QUESTION How can I draw the windows of Coventry Cathedral?

During World War II, Coventry Cathedral in England was bombed on 14 November 1940 in what's known as the Coventry Blitz. The bombing was part of an air raid by German planes to disrupt industry in Coventry. The original cathedral, St Michael's, was a 14th-century Gothic church and the only English cathedral to be destroyed during the war. It was badly damaged (its roof caved in) but the walls and spire survived. Instead of rebuilding the old cathedral, a new one was built next to the ruins. It was designed by architect Sir Basil Spence and was finished in 1962. Today, the old ruins stand as a memorial to the destruction of the war, while the new cathedral symbolises peace and hope for the future.

YOU WILL NEED

Copies of Resource 5A Ruler HB pencil Compass Good-quality eraser Coloured pencils Optional copies of Resource 5B

Before it was bombed, the old Coventry Cathedral had big, colourful stained glass windows showing stories from the Bible and other religious tales.





) DID YOU KNOW?

The air raid on Coventry was the most concentrated attack on a British city in World War II. The raid involved around 500 Luftwaffe bombers and lasted for 11 hours. After the attack, the Germans coined a new word, 'coventrieren', to describe razing a city to the ground.



Above: Coventry Cathedral after the bombing and filled with rubble Left: The ruins of the cathedral today are a place of remembrance

ACTIVITY 5



TEACHER TIP

If possible, take students to visit a church with stained glass windows before starting this activity. Draw their attention to the images they can see. Are there abstract colours and grids? Floral decorations? Images of people?



STEP 2 Draw four circles

Use a compass to draw four circles. Place the compass needle on the far left dot and extend the arms so the pencil point rests on the horizontal line below. Draw the first circle, then repeat with the other three dots to complete four circles. Press only lightly; the circles do not need to be too pronounced.



STEP 1 Familiarise yourself with the template

Start with a printout of Resource 5A. This template will guide your construction of the arch and stained glass window. Pay attention to the points marked across the top line, shown below in green.



STEP 3 Draw the first arc

Place the compass needle on the dot in the centre of the third circle and extend the arms so the pencil rests on the dot in the centre of the first circle. Draw an arc to the top of the page, as shown below in green.



STEP 4 Draw the second arc

Repeat Step 3 on the other side of the drawing. Placing the compass needle on the dot in the centre of the second circle, extend the arms of the compass so the pencil point rests on the dot in the centre of the fourth circle. Draw a second arc, as shown below in green.



STEP 6 Draw two inner arcs

With the compass radius still set to the same length as in Steps 3 and 4, place the compass needle on each end of the line you extended in Step 5 in turn to draw two inner arcs, as shown below in green.



STEP 5 Extend the line

Using a ruler, line up the dots at the centre of the four circles you drew in Step 2 (it will also line up with the horizontal line at the top of the template). Extend the line so that it touches the left-hand side of the circumference of the first circle and the right-hand side of the circumference of the fourth circle, as shown below in green.



STEP 7 Draw the window frame

Inside the arch are carved stone frames for the windows in the style of Gothic architecture. Draw a simplified outline, as shown below. Use Resource 5B as a guide if you need to.



STEP 8 Colour the window frame

Use a grey stone-coloured pencil to fill in the gaps between the arch and the Gothic window frames.



STEP 9 Draw grid lines

Work with a ruler or by hand to divide your frame into a simple grid. This will be used to make a stained glass design.



STEP 10 Add colour

Choose different coloured pencils to shade the stained glass window panels. Take inspiration from the church you visited or look at photos of stained glass windows to guide you.





PHOTOCOPIABLE RESOURCE 5A



PHOTOCOPIABLE RESOURCE 5B



GEOMETRY ACTIVITY 6

ENQUIRY OF LEARNING What would it have been like to live in WWII?

LEARNING QUESTION What patterns can I find in different vegetables?

Homegrown food was important during World War II because disrupted supply chains led to food shortages and rationing. People were encouraged to grow their own food in 'victory gardens' in backyards and public spaces to supplement rations and make sure everyone had enough to eat. This helped with community spirit as everyone felt they were contributing to the war effort, even at home. Having fresh, healthy food helped people cope with the stress and strain of living through wartime.

Onions and carrots were popular 'Dig for Victory' crops in World War II because they're easy to grow and don't need much care. Both vegetables can be stored for a long time without spoiling and you can grow a lot of them in a small space, making them perfect victory garden crops. They're also nutritious, providing lots of essential vitamins, and are extremely versatile in cooking.

YOU WILL NEED

Copies of Resource 6A Ruler HB pencil Compass Good-quality eraser Coloured pencils Red onions (cut in half across their 'equator')





Above: WWII soldiers prepare onions while wearing gas masks to prevent their eyes from watering Right: A poster from the 'Dig for Victory' campain



Onions have rings when you cut them across their 'equator' because of their layered structure. Each layer, or scale, is essentially a modified leaf that wraps around the central shoot. These layers are formed as the onion grows underground, with new layers developing from the inside out.



ACTIVITY 6

STEP 1 Examine a sliced red onion

Encourage students to examine the inside of the onion that is exposed when the bulb is cut in half across its 'equator'. Draw their attention to the concentric rings.



STEP 2 Compare to rings in Nature

The pictures below show ring patterns inside a tree trunk and on water. Discuss other places in the natural world where you can find rings and encourage students to think about how they are formed.



STEP 3 Familiarise yourself with the template

Start with a printout of Resource 6A. It features a vertical line with markings on it and a central point from which you will draw circles with varying radii.

STEP 4 Draw the first circle

Place the compass needle on the midpoint of the vertical line. Extend the arms of the compass so that the pencil point rests on the top marking (the compass should now have a radius of 8cm). Draw the first circle to represent the outermost layer of the onion.



STEP 5 Draw the second circle

Repeat Step 4 to draw a second circle with a radius of 7cm.



STEP 7 Draw the fourth circle

Repeat Step 4 to draw the next circle, which has a radius of 4.9cm.

STEP 6 Draw the third circle

Repeat Step 4 to draw the next circle, which has a radius of 5.8cm. This small difference in width introduces the variation we find in Nature.



STEP 8 Draw the fifth circle

Repeat Step 4 to draw the next circle, which has a radius of 3.3cm. Pay particular attention to your compass grip as you start to draw smaller circles; the smaller the circle, the harder the compass will be to contol.





TEACHER TIP Going over the circumference of each circle by hand adds variation to the thickness of the rings so that they look more realistic.



STEP 9 Draw the final circle

Repeat Step 4 to draw the last circle, which has a radius of 2.2cm. This will be fiddly, so take your time to make the circle as accurate as you can and then go over the line by hand.



STEP 10 Add colour

Look closely at the sliced red onion and think about how to recreate its colours. There is a dark red-purple line outlining each ring and the colour bleeds out a little along the edges. The centre of the onion often has a green tinge where it is still growing.





TEACHER TIP

What other vegetables can you think of that have different shapes and patterns inside them?





PHOTOCOPIABLE RESOURCE 6A



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SUSTAINABLE PRINTING

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