Summer Scheme of Learning

Year 5/6

#MathsEveryoneCan

2019-20
In this document, you will find suggestions of how you may structure a progression in learning for a mixed-age class.

Firstly, we have created a yearly overview.

For each block of learning, we have grouped the small steps into themes that have similar content. Within these themes, we list the corresponding small steps from one or both year groups. Teachers can then use the single-age schemes to access the guidance on each small step listed within each theme.

The themes are organised into common content (above the line) and year specific content (below the line). Moving from left to right, the arrows on the line suggest the order to teach the themes.
How to use the mixed-age SOL

Here is an example of one of the themes from the Year 1/2 mixed-age guidance.

### Subtraction

**Year 1 (Aut B2, Spr B1)**
- How many left? (1)
- How many left? (2)
- Counting back
- Subtraction - not crossing 10
- Subtraction - crossing 10 (1)
- Subtraction - crossing 10 (2)

**Year 2 (Aut B2, B3)**
- Subtract 1-digit from 2-digits
- Subtract with 2-digits (1)
- Subtract with 2-digits (2)
- Find change - money

In order to create a more coherent journey for mixed-age classes, we have re-ordered some of the single-age steps and combined some blocks of learning e.g. Money is covered within Addition and Subtraction.

The bullet points are the names of the small steps from the single-age SOL. We have referenced where the steps are from at the top of each theme e.g. Aut B2 means Autumn term, Block 2. Teachers will need to access both of the single-age SOLs from our website together with this mixed-age guidance in order to plan their learning.

### Points to consider

- Use the mixed-age schemes to see where similar skills from both year groups can be taught together. Learning can then be differentiated through the questions on the single-age small steps so both year groups are focusing on their year group content.
- When there is year group specific content, consider teaching in split inputs to classes. This will depend on support in class and may need to be done through focus groups.
- On each of the block overview pages, we have described the key learning in each block and have given suggestions as to how the themes could be approached for each year group.
- We are fully aware that every class is different and the logistics of mixed-age classes can be tricky. We hope that our mixed-age SOL can help teachers to start to draw learning together.
<table>
<thead>
<tr>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
<th>Week 6</th>
<th>Week 7</th>
<th>Week 8</th>
<th>Week 9</th>
<th>Week 10</th>
<th>Week 11</th>
<th>Week 12</th>
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<td>Number: Place Value</td>
<td>Number: Four Operations</td>
<td>Number: Fractions</td>
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<tr>
<td>Y5: Number: Fractions</td>
<td>Number: Decimals and Percentages</td>
<td>Y5: Number: Decimals</td>
<td>Measurement: Converting Units</td>
<td>Measurement: Perimeter, Area and Volume</td>
<td>Statistics</td>
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<td>Y6: Number: Ratio</td>
<td>Y6: Number: Algebra</td>
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</tbody>
</table>
In this section, content from single-age blocks are matched together to show teachers where there are clear links across the year groups. Teachers may decide to teach the lower year’s content to the whole class before moving the higher year on to their age-related expectations. The lower year group is not expected to cover the higher year group’s content as they should focus on their own age-related expectations.

In this section, content that is discrete to one year group is outlined. Teachers may need to consider a split input with lessons or working with children in focus groups to ensure they have full coverage of their year’s curriculum. Guidance is given on each page to support the planning of each block.

The themes should be taught in order from left to right.

Year Specific

Guidance

Common Content

Year 5 content

Year 6 content

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Properties of Shape

Common Content

**Measure angles**
Year 5 (Sum B2)
- Measuring angles in degrees
- Measuring with a protractor (1)
- Measuring with a protractor (2)
Year 6 (Sum B1)
- Measure with a protractor

**Angles**
Year 5 (Sum B2)
- Angles on a straight line
- Angles around a point
Year 6 (Sum B1)
- Introduce angles
- Calculate angles
- Vertically opposite angles

**Angles in shapes**
Year 5 (Sum B2)
- Lengths and angles in shapes
Year 6 (Sum B1)
- Angles in a triangle (1)
- Angles in a triangle (2)
- Angles in a triangle (3)
- Angles in quadrilaterals

**Polygons**
Year 5 (Sum B2)
- Regular and irregular polygons
Year 6 (Sum B1)
- Angles in polygons

**Draw shapes**
Year 5 (Sum B2)
- Draw lines and angles accurately
Year 6 (Sum B1)
- Drawing shapes accurately

**3-D shapes**
Year 5 (Sum B2)
- Reasoning about 3-D shapes
Year 6 (Sum B1)
- Nets of 3-D shapes

There are a lot of opportunities in this block to bring the class together to consolidate shape knowledge before moving Year 6 on to ideas that are linked to their prior learning.

Both year groups measure and draw angles using a protractor before moving on to draw shapes accurately. Year 5 focus on angles on a straight line and round a point whilst Year 6 apply this understanding to vertically opposite angles and angles in triangles and quadrilaterals.
Block 4 - Shape

Theme 1 - Measure angles
Measuring Angles in Degrees

Notes and Guidance

Children recap acute and obtuse angles. They recognise a full turn as 360 degrees, a half-turn as 180 degrees and a quarter-turn (or right angle) as 90 degrees. They consider these in the context of compass directions. Children also deduce angles such as 45 degrees, 135 degrees and 270 degrees. Reflex angles are introduced explicitly for the first time. Children define angles in terms of degrees and as fractions of a full turn.

Mathematical Talk

What is an angle?
Can you identify an acute angle on the clock?
Can you identify an obtuse angle?
What do we call angles larger than 180° but smaller than 360°?
What angles can you identify using compass directions?
What is the size of the angle?
What fraction of a full turn is the angle?

Varied Fluency

Use the sentence stems to describe the turns made by the minute hand. Compare the turns to a right angle.

The turn from ___ to ___ is ______ than a right angle. It is an ______ angle.

Use the compass to complete the table.

<table>
<thead>
<tr>
<th>Turn</th>
<th>Degrees</th>
<th>Type of angle</th>
<th>Fraction of a turn</th>
</tr>
</thead>
<tbody>
<tr>
<td>North-East to South-East Clockwise</td>
<td>90°</td>
<td>Right angle</td>
<td>\frac{1}{4} of a turn</td>
</tr>
<tr>
<td>North-West to North-West Clockwise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South-West to South-East Anti-clockwise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South-West to South-East Clockwise</td>
<td>180°</td>
<td>Reflex angle</td>
<td>\frac{1}{2} of a turn</td>
</tr>
<tr>
<td>North-East to East Clockwise</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Measuring Angles in Degrees

Reasoning and Problem Solving

Which angle is the odd one out?

180°  45°  79°  270°

Could another angle be the odd one out for a different reason?

Multiple responses e.g. 79° is the odd one out because the others are multiples of 45 degrees; 270 degrees is the only reflex angle etc.

Always, sometimes or never true?

- If I turn from North-East to North-West, I have turned 90°
- If I turn from East to North-West, I will have turned through an obtuse angle.
- If I turn from South-West to South, my turn will be larger than 350°

Pick a starting point on the compass and describe a turn to your partner. Use the mathematical words to describe your turns:

- Clockwise
- Anti-clockwise
- Degrees
- Acute
- Obtuse
- Reflex
- Right angle

Can your partner identify where you will finish?

Lots of possibilities. Children can be challenged further e.g. I turn three right angles. I start at North-West and turn clockwise, where do I finish?
Measuring with a Protractor (1)

Notes and Guidance

Children are taught to use a protractor for the first time. They begin with measuring angles less than 90°, acute angles. They use their knowledge of right angles to help estimate the size of acute angles e.g. “It’s close to a right angle, so about 80°.”

Children need to develop their understanding of using both the inside and outside scales of the protractor, and need to be taught how to decide which to use.

Mathematical Talk

What unit do we use to measure angles?

How can we tell whether an angle is acute?

How do we know which scale to use on a protractor?

Where will you place your protractor when measuring an angle?

Does moving the paper help you to measure an angle?
Measuring with a Protractor (1)

Reasoning and Problem Solving

I have measured the angle correctly because my protractor is the right way round.

Whitney

I have measured the angle correctly because my protractor is on the line accurately.

Teddy

They are both correct. It doesn’t matter which way the protractor is as long as it is placed on the angle correctly.

Who do you agree with? Explain why.

Three children are measuring angles. Can you spot and explain their mistake?

Mo hasn’t recognised his angle is acute, so his measurement is wrong.

Alex has not placed one of her lines on 0. Her angle measures 25˚.

Dora has misread the scale. Her angle measures 25˚.
Measuring with a Protractor (2)

Notes and Guidance

Children continue to learn how to use a protractor and focus on measuring obtuse angles. They use their knowledge of right angles to help estimate the size of obtuse angles e.g. “It’s just over a right angle, so about 100°.”

Children need to develop their understanding of using both the inside and outside scales of the protractor, and need to be taught how to decide which to use.

Mathematical Talk

How do you know an angle is obtuse?
Can you see where obtuse angles would be measured on the protractor?
Can you estimate the size of this angle?
What is the size of the angle? What mistake might someone make?
Where will you place your protractor first?

Varied Fluency

- Measure the angles shown on the protractors.
- Estimate the size of the angles and then use a protractor to measure them to the nearest degree.
- Identify obtuse angles in the image. Estimate the size of the angles, and then measure them.
Measuring with a Protractor (2)

Reasoning and Problem Solving

Rosie is measuring an obtuse angle. What’s her mistake?

Rosie has not placed the 0 line of the protractor on one of the arms of the angle.

How many ways can you find the value of the angle?

Children may:
- subtract $150 - 13 = 137^\circ$
- add up on the protractor as a number line e.g. $+7 +100 +30 = 137^\circ$
- place the protractor correctly.

Use a cut out of a circle and place a spinner in the centre.

- Point the arrow in the starting position above.
- Move the spinner to try to make the angles shown on the cards below.
- Check how close you are with a protractor.

$40^\circ$ $72^\circ$ $154^\circ$
Measure with a Protractor

Notes and Guidance

This step revisits measuring angles using a protractor from Year 5.
Children recap how to line up the protractor accurately, and identify which side of the scale to read. They link this to their understanding of angle sizes.
Children read the measurement and practise measuring angles given in different orientations.
Angles are also related to compass points.

Varied Fluency

Identify the type of angle, and measure the angle using a protractor.

Estimate, then measure each of the angles at the vertices of the quadrilateral.

Work out the size of each angle.

Mathematical Talk

Can we name and describe the 4 different types of angles? (right angle, obtuse, acute, reflex)
What unit do we use to measure angles?
Does it matter which side of the protractor I use?
What mistakes could we make when measuring with a protractor?
How would I measure a reflex angle?
Look at a compass, what angles can we identify using the compass?
<table>
<thead>
<tr>
<th>Measure with a Protractor</th>
<th>Reasoning and Problem Solving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut out a circle and draw a line from the centre to the edge. Add a spinner in the centre.</td>
<td>Alex measures this angle:</td>
</tr>
<tr>
<td>Put the arrow in the starting position as shown above. Turn over a flash card with an angle on.</td>
<td>She says it is 130°</td>
</tr>
<tr>
<td>Estimate the given angle by moving the spinner.</td>
<td>Explain what she has done wrong.</td>
</tr>
<tr>
<td>Check how close you are using a protractor.</td>
<td>Alex is wrong because 130° is an obtuse angle and the angle indicated is acute. She has used the wrong scale on the protractor. She should have measured the angle to be 50°</td>
</tr>
<tr>
<td>Children could work in pairs and get a partner to check the accuracy of the angles made.</td>
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</tr>
</tbody>
</table>
Angles on a Straight Line

Notes and Guidance

Children build on their knowledge of a right angle and recognise two right angles are equivalent to a straight line, or a straight line is a half of a turn. Once children are aware that angles on a straight line add to 180 degrees, they use this to calculate missing angles on straight lines. Part-whole and bar models may be used to represent missing angles.

Mathematical Talk

How many degrees are there in a right angle?

How many will there be in two right angles?

If we place two right angles together, what do we notice?

How can we calculate the missing angles?

How can we subtract a number from 180 mentally?

Varied Fluency

There are _____ degrees in a right angle.

There are _____ right angles on a straight line.

There are _____ degrees on a straight line.

Calculate the missing angles.

Is there more than one way to calculate the missing angles?
Here are two angles.

\[ a, b \]

Angle \( b \) is a prime number between 40 and 50

Use the clue to calculate what the missing angles could be.

Jack is measuring two angles on a straight line.

His angles total more than 180°.

\[ b = 41°, a = 139° \]

\[ b = 43°, a = 137° \]

\[ b = 47°, a = 133° \]

• The total of angle \( f \) and \( g \) are the same as angle \( e \)
• Angle \( e \) is 9° more than the size of the given angle.
• Angle \( f \) is 11° more than angle \( g \)

Calculate the size of the angles.

Create your own straight line problem like this one for your partner.
Complete the sentences.

$\frac{1}{4}$ of a turn = 1 right angle = 90°

$\frac{1}{2}$ of a turn = ___ right angles = ____°

$\frac{3}{4}$ of a turn = 3 right angles = ____°

A full turn = ___ right angles = ____°

Calculate the missing angles.

Calculate the missing angles.
Angles around a Point

Reasoning and Problem Solving

Two sticks are on a table. Without measuring, find the three missing angles.

- a + b + c + d + e = 360°
- d + e = 180°

Write other sentences about this picture.

Various answers e.g.
- a + b + c = e + d
- 360° − e − d = 180°
- etc.

Eva says,

Rosie says,

Use Rosie’s method to draw angles of:
- 300°
- 200°
- 280°
Notes and Guidance

Children build on their understanding of degrees in a right angle and make the connection that there are two right angles on a straight line and four right angles around a point.

Children should make links to whole, quarter, half and three-quarter turns and apply this in different contexts such as time and on a compass.

Mathematical Talk

If there are 90 degrees in one right angle, how many are there in two? What about three?

How many degrees are there in a quarter/half turn?

Between which two compass points can you see a right angle/half turn/three quarter turn?

Varied Fluency

There are \( \square \) degrees in a right angle.

There are \( \square \) right angles on a straight line.

There are \( \square \) degrees on a straight line.

Complete the table.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Fraction of a full turn</th>
<th>Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right angle</td>
<td>( \frac{1}{4} )</td>
<td>90°</td>
</tr>
<tr>
<td>Straight line</td>
<td></td>
<td></td>
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<tr>
<td>Three right angles</td>
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<tr>
<td>Full turn</td>
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</tbody>
</table>

Use a compass to identify how many degrees there are between:
- North & South (turning clockwise)
- South & East (turning anti-clockwise)
- North-East and South-West (turning clockwise)
Dora and Eva are asked how many degrees there are between North-West and South-West.

Dora says,

There are 90 degrees between NW and SW.

Eva says,

There are 270° between NW and SW.

Who do you agree with? Explain why.

They are both correct. Dora measured anti-clockwise whereas Eva measured clockwise.

If it takes 60 minutes for the minute hand to travel all the way around the clock, how many degrees does the minute hand travel in:

- 7 minutes
- 12 minutes

How many minutes have passed if the minute hand has moved 162°?

- 360 ÷ 60 = 6 so the minute hand travels 6° per minute.
- 7 minutes : 42°
- 12 minutes : 72°
- 162° : 27 minutes

Always, sometimes, never.

- W to S = 90 degrees
- NE to SW = 180 degrees
- E to SE in a clockwise direction > 90°

Sometimes
Always
Never
Children apply their understanding of angles in a right angle, angles on a straight line and angles around a point to calculate missing angles.

They should also recognise right angle notation and identify these on a diagram. Children then use this information to help them calculate unknown angles.

What do we know about a and b? How do we know this?

Which angle fact might you need to use when answering this question?

Which angles are already given? How can we use this to calculate unknown angles?

How many number sentences can you write from the images?

Calculate the missing angles.
There are five equal angles around a point.

What is the size of each angle?

Explain how you know.

Four angles meet at the same point on a straight line.

One angle is 81°

The other three angles are equal.

What size are the other three angles?

Draw a diagram to prove your answer.

72° because

\[ 360 \div 5 = 72 \]

180° − 81° = 99°

99 ÷ 3 = 33°

Here is a pie chart showing the colour of cars sold by a car dealer.

The number of blue cars sold is equal to the total number of red and green cars sold.

The number of red cars sold is twice the number of green cars sold.

Work out the size of the angle for each section of the pie chart.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>180°</td>
</tr>
<tr>
<td>Red</td>
<td>120°</td>
</tr>
<tr>
<td>Green</td>
<td>60°</td>
</tr>
</tbody>
</table>
Vertically Opposite Angles

Notes and Guidance

Children recognise that vertically opposite angles share a vertex. They realise that they are equal and use practical examples to show this.

They continue to apply their understanding of angles on a straight line and around a point to calculate missing angles.

Mathematical Talk

What sentences can we write about vertically opposite angles in relation to other angles?

How can we find the missing angle?

Is there more than one way to find this angle?

Varied Fluency

- Take a piece of paper and draw a large ‘X’. Mark the angles on as shown. Measure the angles you have drawn. What do you notice about angles b and d? What do you notice about angles a and c? Is this always the case? Investigate with other examples.

- Use the letters from the diagram to fill in the boxes.

- Find the size of the missing angles.

  Is there more than one way to find them?
Vertically Opposite Angles

Reasoning and Problem Solving

The diagram below is drawn using three straight lines.

Whitney says that it’s not possible to calculate all of the missing angles.

Do you agree? Explain why.

I disagree because:

180 \(-\) 157 = 23
so a = 23°
because angles on a straight line add up to 180°

Angles a and c are equal because they are vertically opposite so c = 23°

Angles around a point add up to 360° so b = 67°

Amir says that angle g is equal to 30° because vertically opposite angles are equal.

Do you agree? Explain your answer.

Find the size of all missing angles.

Is there more than one way to find the size of each angle?

Amir is wrong because g is vertically opposite to e, not to 30° so g would actually be 60°

e = 60°
g = 60°
f = 120°

There are multiple ways to find the size of each angle.
Children look at squares and rectangles on a grid to identify right angles. Children use the square grids to reason about length and angles, for example to deduce that half a right angle is 45 degrees. Children should be confident in understanding parallel and perpendicular lines and right angles in relation to squares and rectangles.

Look at the rectangle and square, where can you see parallel lines? How many right angles do they have?

What can you say about the lengths of the sides in a rectangle or in a _____?

If I fold a square in half diagonally to make a triangle, what will the size of each of the angles in the triangle be?

Using what you know about squares and rectangles, how can you calculate the sizes of the angles?
Whitney is calculating the missing angles in the shape. She says,

The missing angles are 60 degrees because $180 \div 3 = 60$

Do you agree? Explain why.

Whitney is wrong. The angles are not equal. The angles will be worth 45°, 90° and 45° because the line shows a square being split in half diagonally. This means 90° has been divided by 2.

Alex has this triangle. She makes this composite shape using triangles identical to the one above.

- Calculate the perimeter of the shape.
- Calculate the missing angles. Use your own triangle, square or rectangle to make a similar problem?

Perimeter = $57 \times 9 = 513$ mm

\[ a = 60 \times 4 \]
\[ a = 240° \]

\[ b = 60 \times 2 \]
\[ b = 120° \]

\[ c = 60 \times 3 \]
\[ c = 180° \]
Use different coloured pieces of card to make an equilateral, isosceles, scalene and right-angled triangle. Use a protractor to measure each interior angle, then add them up. What do you notice?

Now take any of the triangles and tear the corners off. Arrange the corners to make a straight line. The interior angles of a triangle add up to 180 degrees. Calculate the missing angles and state the type of triangle that these corners have been torn from.

Children practically explore interior angles of a triangle and understand that the angles will add up to 180 degrees.

Children should apply their understanding that angles at a point on a straight line add up to 180 degrees.

What’s the same and what’s different about the four types of triangle?

What do the three interior angles add up to? Would this work for all triangles?

Does the type of triangle change anything?

Does the size of the triangle matter?
## Angles in a Triangle (1)

### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>Amir says,</th>
<th>Amir can’t be correct because these two angles would add up to 180 degrees, and the third angle can’t be 0 degrees.</th>
</tr>
</thead>
<tbody>
<tr>
<td>My triangle has two 90° angles.</td>
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<tr>
<td>Can Amir be correct? Can you demonstrate this?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Eva says,</th>
<th>The interior angles of Eva’s triangle are 56°, 93° and 31°.</th>
</tr>
</thead>
<tbody>
<tr>
<td>My triangle is a scalene triangle. One angle is obtuse. One of the angles measures 56°. The obtuse angle is three times the smallest angle.</td>
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<tr>
<td>Work out the size of each of the angles in the triangle.</td>
<td></td>
</tr>
</tbody>
</table>

### True or False?

- A triangle can never have 3 acute angles.
  - False
  - Children could use multiple examples to show this.
Children are introduced to hatch marks for equal lengths. They concentrate on angles in right-angled triangles and isosceles triangles.

Children use their understanding of the properties of triangles to reason about angles.

**Mathematical Talk**

How can we identify sides which are the same length on a triangle?

How can we use the hatch marks to identify the equal angles?

If you know one angle in an isosceles triangle, what else do you know?

Can you have an isosceles right-angled triangle?

**Varied Fluency**

Identify which angles will be identical in the isosceles triangles.

Calculate the missing angles in the isosceles triangles.

What type of triangle is this?
What will the size of each angle be?
How do you know?
Will this always be the same for this type of triangle?
Explain your answer.
I have an isosceles triangle. One angle measures 42 degrees. What could the other angles measure?

The angles could be:
42°, 42°, 96° or
42°, 69°, 69°

Alex
My angles are 70°, 70° and 40°

Mo
My angles are 45°, 45° and 90°

Eva
My angles are 60°, 60° and 60°

What type of triangle is each person describing? Explain how you know.

How many sentences can you write to express the relationships between the angles in the triangles? One has been done for you.

Possible responses:
40° + a + b = 180°
20° + c + d = 180°
b = 90°
c = 90°
a = d etc.

Children could also work out the value of each angle.
Children build on prior learning to make links and recognise key features of specific types of triangle. They think about using this information to solve missing angle problems.

They should also use their knowledge of angles on a straight line, angles around a point and vertically opposite angles.

Is it sensible to estimate the angles before calculating them?
Are the triangles drawn accurately?
Can you identify the type of triangle? How will this help you calculate the missing angle?
Which angle can you work out first? Why? What else can you work out?

Work out the value of x and y. Explain each step of your working.

Work out the value of f and g. Explain each step of your working.

Work out the value of x and y. Explain each step of your working.
Calculate the size of the reflex angle \( b \).

\[ 234° \]

Calculate the size of angles \( a \), \( b \) and \( c \).

- \( a \) is 58 degrees because vertically opposite angles are equal.
- \( c \) is 57 degrees because angles on a straight line add up to 180 degrees.
- \( b \) is 65 degrees because angles in a triangle add up to 180 degrees.

Give reasons for all of your answers.
Take two quadrilaterals.

For the first quadrilateral, measure the interior angles using a protractor.

For the second, tear the corners off and place the interior angles at a point as shown.

What’s the same? What’s different? Is this the case for other quadrilaterals?

Here are two trapeziums. What’s the same? What’s different?

Can you draw a different trapezium?

Measure the interior angles of each one and find the total.

Calculate the missing angles.
### Angles in Quadrilaterals

#### Reasoning and Problem Solving

<table>
<thead>
<tr>
<th>How many quadrilaterals can you make on the geoboard?</th>
<th>There are lots of different quadrilaterals children could make. They should notice that opposite angles in a parallelogram and rhombus are equal. They should also identify that a kite has a pair of equal angles, and some kites have a right angle. On a larger grid, they could draw a trapezium without a right angle.</th>
<th>Jack says, All quadrilaterals have at least one right angle. Draw two different shapes to prove Jack wrong. Measure and mark on the angles.</th>
<th>Examples: Trapezium (without a right angle) Rhombus Parallelogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify the names of the different quadrilaterals. What do you notice about the angles in certain quadrilaterals?</td>
<td>This quadrilateral is split into two triangles. Use your knowledge of angles in a triangle to find the sum of angles in a quadrilateral. Split other quadrilaterals into triangles too. What do you notice?</td>
<td>Children should find that angles in all quadrilaterals will always sum to 360 degrees.</td>
<td></td>
</tr>
<tr>
<td>If your geoboard was 4 × 4, would you be able to make any different quadrilaterals?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Examples:
- Trapezium (without a right angle)
- Rhombus
- Parallelogram

Children should find that angles in all quadrilaterals will always sum to 360 degrees.
Regular & Irregular Polygons

Notes and Guidance

Children distinguish between regular and irregular polygons. They need to be taught that “regular” means all the sides and angles in a shape are equal e.g. an equilateral triangle and a square are regular but a rectangle with unequal sides and an isosceles triangle are irregular polygons. Once they are confident with this definition they can work out the sizes of missing angles and sides.

Mathematical Talk

What is a polygon?
Can a polygon have a curved line?
Name a shape which isn’t a polygon.
What makes a polygon irregular or regular?
Is a square regular?
Are all hexagons regular?

Varied Fluency

- Sort the shapes into irregular and regular polygons.
- Draw a regular polygon and an irregular polygon on the grids.
- Look at the 2D shapes. Decide whether the shape is a regular or irregular polygon. Measure the angles to check.

What’s the same? What’s different?
Regular & Irregular Polygons

Reasoning and Problem Solving

Always, sometimes or never true?

- A regular polygon has equal sides but not equal angles.
- A triangle is a regular polygon.
- A rhombus is a regular polygon.
- The number of angles is the same as the number of sides in any polygon.

• Never true – equal sides and equal angles.
• Sometimes true – equilateral triangles are, scalene are not.
• Sometimes true – if the rhombus has right angles and is a square.
• Always true.

How many regular and irregular polygons can you find in this picture?

Cut out lots of different regular and irregular shapes. Ask children to work in pairs and sort them into groups. Once they have sorted them, can they find a different way to sort them again? Children could use Venn diagrams and Carroll diagrams to deepen their understanding, for example:

<table>
<thead>
<tr>
<th>Regular polygon</th>
<th>Irregular polygon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has at least one right angle</td>
<td></td>
</tr>
<tr>
<td>Has no right angles</td>
<td></td>
</tr>
</tbody>
</table>
Children use their knowledge of properties of shape to explore interior angles in polygons.

Children explore how they can partition shapes into triangles from a single vertex to work out the sum of the angles in polygons.

They use their knowledge of angles on a straight line summing to 180° to calculate exterior angles.

What is a regular polygon? What is an irregular polygon?

What is the sum of interior angles of a triangle?

How can we use this to work out the interior angles of polygons?

Can we spot a pattern in the table? What predictions can we make?
Use the clues to work out what shape each person has.

Dora:
- My polygon is made up of 5 triangles.
- The sum of my angles is more than 540° but less than 900°

Tommy:
- Hexagon – 720°

Alex:
- Pentagon – 540°

What is the sum of the interior angles of each shape?

Dora: 
- Heptagon – 900°

Here are two regular hexagons.

The interior angles of a hexagon sum to 720°.
Use this fact to work out angle a in the diagram.

60°
Block 4 - Shape
Theme 5 - Draw shapes
Children need to draw lines correct to the nearest millimetre. They use a protractor to draw angles of a given size, and will need to be shown this new skill.

Children continue to develop their estimation skills whilst drawing and measuring lines and angles. They also continue to use precise language to describe the types of angles they are drawing.

How many millimetres are in a centimetre?

How do we draw a line that measures ___?

Explain how to draw an angle.

What's the same and what's different about drawing angles of 80° and 100°?

How can I make this angle measure ___ but one of the lines have a length of ___?

What's the same? What's different?

Draw:
- angles of 45° and 135°
- angles of 80° and 100°
- angles of 20° and 160°

What do you notice about your pairs of angles?

Draw:
- an acute angle that measures 60° with the arms of the angle 6 cm long
- an obtuse angle that measures 130° but less than 140° with the arms of the angle 6.5 cm long

Compare your angles with your partner’s.
Draw a range of angles for a friend. Estimate the sizes of the angles to order them from smallest to largest. Measure the angles to see how close you were.

<table>
<thead>
<tr>
<th>Always, sometimes or never true?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Two acute angles next to each other make an obtuse angle.</td>
</tr>
<tr>
<td>• Half an obtuse angle is an acute angle.</td>
</tr>
<tr>
<td>• 180° is an obtuse angle</td>
</tr>
</tbody>
</table>

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sometimes</td>
</tr>
<tr>
<td>• Always</td>
</tr>
<tr>
<td>• Never</td>
</tr>
</tbody>
</table>

Use Kandinsky’s artwork to practice measuring lines and angles.

For example, “My line is horizontal and has an obtuse angle of 110° on it.”
On a piece of squared paper, accurately draw the shapes.

- A square with perimeter 16 cm.
- A rectangle with an area of 20 cm².
- A right-angled triangle with a height of 8 cm and a base of 6 cm.
- A parallelogram with sides 3 cm and 5 cm.

Draw the triangle accurately on squared paper to work out the missing length. Measure the size of angles A and B.

Rosie has been asked to draw this triangle on plain paper using a protractor.

Create a step-by-step plan to show how she would do this.

What do you know about the shapes which will help you draw them?

How can we ensure our measurements are accurate?

How would you draw a triangle on a plain piece of paper using a protractor?
Mr Harrison is designing a slide for the playground.

Use a scale of 1 cm to represent 1 m. Draw a scale diagram. Use the diagram to find out how long Mr Harrison needs the ladder to be.

Children will have to use the scale to give their answer in m once they have measured it in cm.

The ladder should be approximately 4.5 m

What is the size of each interior angle of the regular shape below.

Accurately draw a regular pentagon with side length 5 cm.

Eva has drawn a scalene triangle. Angle A is the biggest angle. Angle B is 20° larger than angle C. Angle C is the smallest angle, and it is 70° smaller than angle A.

Use a bar model to help you calculate the size of each angle, then construct Eva’s triangle.

Is there more than one way to construct the triangle?

| Angle A: 100° |
| Angle B: 50° |
| Angle C: 30° |

These angles would work with different side lengths.
Reasoning about 3-D Shapes

Notes and Guidance

Children identify 3-D shapes, including cubes and cuboids, from their 2-D nets. They should have a secure understanding of language associated with the properties of 3-D shapes, for example, faces, curved surfaces, vertices, edges etc.

Children also look at properties of 3-D shapes from 2-D projections, including plans and elevations.

Mathematical Talk

What’s the difference between a face and a curved surface?

Name some 3-D solids which have curved surfaces and some which don’t.

What faces can we see in the net? What shape will this make?

Which face will be opposite this face? Why?

Can we spot a pattern between the number of faces and the number of vertices a prism or pyramid has?

Varied Fluency

Look at the different nets. Describe the 2-D shapes used to make them and identify the 3-D shape.

Use equipment, such as Polydron or 2-D shapes, to build the 3-D solids being described.

- My faces are made up of a square and four triangles.
- My faces are made up of rectangles and triangles.

Can the descriptions make more than one shape?

Draw another dot on the nets so the dots are on opposite faces when the 3D shape is constructed.
Amir says,

If two 3-D shapes have the same number of vertices, then they also have the same number of edges.

Do you agree? Explain why.

Create cubes and cuboids by using multilink cubes. Draw these on isometric paper. Would it be harder if you had to draw something other than squares or rectangles?

Multiple responses.

No e.g. a square-based pyramid and a triangular prism. Children could investigate this and look for a pattern.

Using different 3-D solids, how can you represent them from different views? Work out which representation goes with which solid.

For example,

Children may explore a certain view for a prism and discover that it could always look like a cuboid or cube due to the rectilinear faces.
Nets of 3-D Shapes

Notes and Guidance

Children use their knowledge of 2-D and 3-D shapes to identify three-dimensional shapes from their nets.

Children need to recognise that a net is a two-dimensional figure that can be folded to create a three-dimensional shape.

They use measuring tools and conventional markings to draw nets of shapes accurately.

Mathematical Talk

Looking at the faces of a three-dimensional shape, what two-dimensional shapes can you see?

What is a net? What shape will this net make? How do you know? What shape won’t it make?

If you make this net, what would happen if you were not accurate with your measuring?

Varied Fluency

What three-dimensional shape can be made from these nets?

Identify and describe the faces of each shape.

Accurately draw this net. Cut, fold and stick to create a cuboid.

Draw possible nets of these three-dimensional shapes.
Dora thinks that this net will fold to create a cube.

Dora is incorrect because a cube has 6 faces, this net would only have 5.

Use Polydron to investigate how many different nets can be made for a cube. Is there a rule you need to follow? Can you spot an arrangement that won’t work before you build it? How do you know why it will or won’t work? Can you record your investigation systematically?

There are 11 possible nets.

Here is an open box.

Which of the nets will fold together to make the box? The grey squares show the base.

B and C

A

B

C