SPRINGBOARD 6 LESSON 14
SHAPE AND SPACE

TOTAL TIME

30 MINUTES

Objective:

- Calculate angles in a triangle and around a point

Vocabulary:

- acute, obtuse, reflex, right angle
- square, rectangle, equilateral triangle

By the end of the lesson children should be able to:

- find the missing angles in a triangle and around a point.

Resources:

- whiteboards and pens
- OHT 14.1
- OHT 14.2
- Resource Sheet 14.1
- triangle made from thin card
- OHP protractor

ORAL AND MENTAL STARTER

5 MINUTES

Write 'Target number is 180' on the board. Call out '40' and ask:

Q: What do we add to 40 to make 180?

Children respond by showing their answers on whiteboards.
Repeat for other numbers between 0 and 180, include multiples of 10 and 5.

Collect and check the children's responses.
Repeat using a target number of 360. Ask a mixture of questions using the two target numbers 180 and 360.

MAIN TEACHING ACTIVITY

15 MINUTES

Q: How many degrees are there in one complete turn?

Show the children one full turn using an OHP protractor. Remind the children that there are 360° in a full turn. Demonstrate that a straight line represents half a complete turn.

Q: How many degrees are there in half a turn?

Establish that the answer is 180°. By putting 2 right angles together show that 2 right angles are equivalent to half a turn.

Q: How many degrees are there in 1 right angle?

Establish that the answer is 90° and that it is one quarter of a turn.

Place the triangle made from thin card on the overhead projector. Refer to the image and identify the 3 angles in the triangle.

Q: What do the 3 angles in a triangle add up to?

Tear off the angles from the triangle and on the OHP demonstrate that they sum to 180° by placing them around a point to form a straight line. Tell children that they should remember that the angle sum in a triangle is 180°.

Show OHT 14.1 and demonstrate how to measure an angle in triangle A using an OHP protractor. Emphasise the key points about positioning the protractor and using the correct scale.
Invite some children to measure the other two angles in triangle A.

Q: What should the 3 angles sum to?

Add the 3 measurements and discuss how the accuracy of each measurement can affect the answer.

Say that two of the angles have been measured in triangle B. They are 90° and 24°. Ask the children to identify these angles.

Q: How can we find the size of the third angle without measuring it?

Establish that we can work out the sum of the two angles and that adding the third angle must make the total 180°.
Compare and discuss 180° – 90° – 24° and 180° – (90° + 24°).

Check the answer by measuring the third angle.
Remind the children of the accuracy with which we are able to measure.

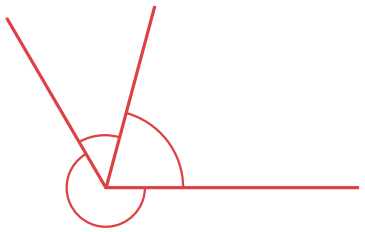
Repeat the above using triangles C and D.
Point out the obtuse angle, and demonstrate how to measure it.

Give out Resource Sheet 14.1. Children work in pairs to find the size of the missing angle in each of the triangles.

PLENARY

10 MINUTES

Draw the following diagram on the board.



Q: How many angles are marked?

Establish that there are 3 angles. Remind the children that two of the angles are acute and one is reflex. Say that you know that two of the angles are 220° and 60°. Invite the children to identify and label the two angles.

Q: How can we calculate the other angle?

Discuss the children's methods and correct misunderstandings.
Compare different methods, 360° – 220° – 60° and 360° – (220° + 60°) as before.

Show OHT 14.2, and discuss the diagram.

Explain that the triangle is equilateral and that this means that the 3 sides are the same length and that the 3 angles are equal.

Q: If all the angles are equal and the angles sum to 180°, what is the size of each angle in the triangle?

Q: What other angles do we know in the diagram?

Get the children to identify the right angles in the square and rectangle, and to annotate the diagram.

Q: How can we calculate the angle marked X on the diagram?

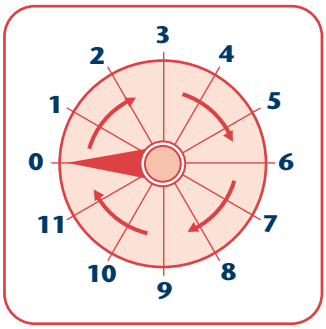
Use the angles around a point to establish that the angle marked **X** is 120°.

Remember:

- The angles in a triangle sum to 180°.
- The angles on a straight line sum to 180°.
- The angles around a point sum to 360°.
- The angles in a square and rectangle are each 90°.
- The angles in an equilateral triangle are each 60°.

LESSON 14 RELATED TEST QUESTION
1998 TEST A (NON-CALCULATOR PAPER)

12 Here is a dial.



The pointer on this dial turns in a **clockwise** direction.
The pointer is at **0**.

(a) Which **number** does it point to after a turn of **270°**?

1 mark

The pointer moves from **10** to **11**.

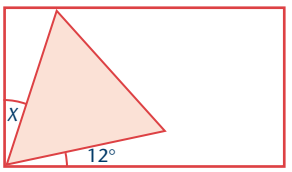
(b) How many **degrees** does it turn through?

°

1 mark

LESSON 14 RELATED TEST QUESTION
2001 TEST B (CALCULATOR PAPER)

26 Here is an **equilateral triangle** inside a **rectangle**.



Not to scale

Calculate the value of angle *x*.

Do **not** use a protractor (angle measurer).

Show your **method**. You may get a mark.

°

2 marks

GUIDANCE FROM MARK SCHEME

Question	Requirement	Additional Guidance
12a	9	
12b	30	

Question	Requirement	Additional Guidance
26	Award **TWO** marks for the correct answer of 18°. If the answer is incorrect, award **ONE** mark for evidence of an appropriate method, e.g. 90–60–12	*Calculation need not be performed for the award of the mark.*

ANALYSIS OF CHILDREN'S ANSWERS

- In Question 12, children were not always clear what 'clockwise' meant and the representation of the dial was unfamiliar to some. In part (b) some children tried to divide 360° by 11, and some tried to measure the angle. Few children annotated the diagram.
- Question 26 was answered poorly and many children working at levels 3 and 4 did not attempt the question. Those who attempted the question did not know the angles of an equilateral triangle were 60° and despite the instruction, some children measured the angle.

IMPLICATIONS FOR PLANNING

- In the oral and mental starter, include more recall involving properties of shapes with the shapes set in different contexts.
- Children should be taught how to find missing angles within combinations of shapes and how to cope with different constraints on angles. They should understand that 'calculate' does not mean 'measure'.
- Children should be shown how to annotate diagrams and be encouraged to do so. They should recognise that 'not to scale' means the shape is not drawn accurately and taking measurements is inappropriate.