S2.2 Properties of triangles and rectangles

objectives

- Identify parallel and perpendicular lines.
- Recognise properties of rectangles.
- Classify triangles (isosceles, equilateral, scalene).
- Solve problems and investigate in shape, space and measures.
- Explain and justify conclusions.

starter

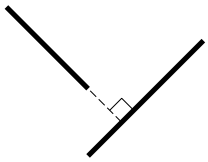
Vocabulary
parallel
perpendicular

Resources
OHT S2.2a

Draw a pair of sloping parallel lines on the board. Tell the class that these lines are called *parallel lines*. Write *parallel* on the board. Explain that the lines never cross or meet, even if they are extended.

Draw a pair of perpendicular lines on the board. Tell the class that these lines meet at a right angle, and that they are called *perpendicular lines*. Write *perpendicular*.

Explain that these lines are also perpendicular.



Q What parallel and perpendicular lines can you see in the classroom?
(e.g. the edges of a sheet of paper)

Show **OHT S2.2a** and work through the questions with the class.

main activity

Vocabulary
horizontal
vertical
equilateral
isosceles
scalene
adjacent

Resources
drinking straws
ruler and scissors for each pupil
mini-whiteboards

Draw a square and a rectangle on the board, each with its diagonals. Ask:

Q What statements can you make about the sides or angles that apply to both the square and the rectangle?

Draw out that in both the square and the rectangle:

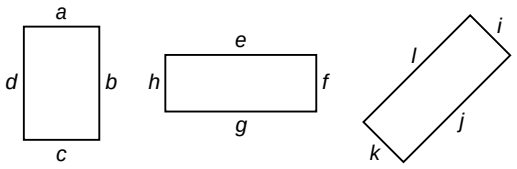
- there are four sides;
- opposite sides are equal and parallel;
- all four angles are equal;
- each angle is a right angle, or 90°, so that adjacent sides are perpendicular;
- the diagonals are equal and cut each other in half.

Say that a square is a special case of a rectangle, and that in the square only:

- all four sides are equal;
- the diagonals cut each other at right angles.

Tell the class that the line where the sea and the sky meet is called the *horizon*, and that lines which are parallel to the horizon are called *horizontal*. Draw some horizontal lines on the board and write *horizontal*. Explain that vertical lines are at right angles to horizontal lines. Draw some on the board and write *vertical*.

Draw three rectangles on the board and label the sides *a* to *l*.



Q **Which sides are horizontal?** (*a*, *c*, *e*, *g*) **Which are vertical?** (*b*, *d*, *f*, *h*)

Q **Which pairs of sides are parallel?** (*a*, *c*; *b*, *d*; *h*, *f*; *e*, *g*; *i*, *k*; *j*, *l*)

Q **Which sides are perpendicular to side *a*?** (*b, d* and *h, f*) **To side *d*?** (*a, c* and *e, g*) **To side *f*?** (*e, g* and *a, c*) **To side *k*?** (*j* and *l*)

Tell the class to close their eyes. Say:

Q **I want you to imagine a square. How many pairs of parallel lines can you see?**

Q **Imagine a rectangle. How many pairs of parallel lines can you see?**

Q **Imagine a regular hexagon. How many pairs of parallel lines can you see?** (3 pairs)

Say that you are now going to give the class instructions for making an imaginary 3-D shape with straws all the same length. Say:

> *Imagine a square made of four straws lying on a horizontal table top.*
> *Put a straw vertically at each corner of the square.*
> *Finish off with another square of straws on the top.*

Tell pupils to open their eyes and to answer questions using their whiteboards.

Q **How many horizontal squares are there in the shape you have made?** (2)
Q **How many horizontal straws are there?** (8)
Q **How many vertical straws are there?** (4)
Q **How many vertical squares are there?** (4)
Q **What is the name of the 3-D shape that you have made?** (a cube)

Give each pupil two drinking straws and a pair of scissors. Ask them to measure and cut off six shorter straws: three of length 4 cm and three of length 6 cm. They should keep safe the remaining pieces.

Now ask them to use any of their six straws to make a triangle. They should then sketch the triangle in their exercise books, labelling each side with its length.

Q **Now make some different triangles. How many different triangles can you make?**

Establish that four different triangles can be made altogether:
4 cm, 4 cm, 6 cm; 6 cm, 6 cm, 4 cm; 4 cm, 4 cm, 4 cm; and 6 cm, 6 cm, 6 cm.

Tell the class that there is a special name for triangles in which all three sides are equal. They are called *equilateral triangles*. There is also a special name for triangles in which two sides are equal and one is different. These are called *isosceles triangles*. Write *equilateral* and *isosceles* on the board.

Ask pupils to cut another two straws from their remaining pieces: one of length 2 cm and one of length 5 cm. Ask them to use any of their eight short straws to see if they can make triangles where three sides are different lengths. Establish that there are three possibilities:

2 cm, 4 cm, 5 cm; 2 cm, 5 cm, 6 cm; and 4 cm, 5 cm, 6 cm.

Tell the class that triangles in which all three sides are different lengths are called *scalene triangles*. Write *scalene* on the board.

other tasks

Springboard 7
Unit 8

Unit 8 section 1: Lines and rectangles

Unit 8 section 2: Triangles and coordinates

plenary

Resources
OHT S2.2b

Show the upper half of **OHT S2.2b**, a set of different triangles. Ask:

Q Which of the triangles are isosceles? Which are equilateral?

Ask pupils to explain why they think they are correct. Point to triangle C, and ask:

Q Why is this triangle not an isosceles triangle? (it does not have two equal sides) **What type of triangle is it?** (scalene)

Show the lower half of **OHT S2.2b**, a set of four-sided shapes in different orientations. Ask:

Q Which of the shapes are rectangles?

Again, ask pupils to explain why they think they are correct. Stress that all the shapes with four right angles are rectangles, including the squares.

Q Why is shape S not a rectangle? (its angles are not 90°)
Q Are any of the rectangles identical? (R and T)

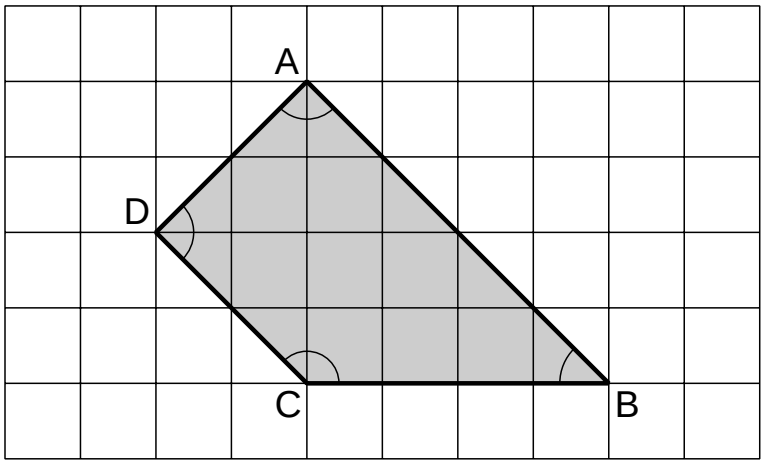
Discuss how a rectangle remains a rectangle when rotated.

Remember

- Parallel lines are straight lines that never meet. Perpendicular lines meet at a right angle.
- Horizontal lines are parallel to the horizon. Vertical lines are perpendicular to the horizon.
- An equilateral triangle has three equal sides. An isosceles triangle has two equal sides. A scalene triangle has three sides of different lengths.

OHT S2.2a

Here is a shape on a square grid.



For each sentence, put a tick (✓) if it is true.

Put a cross (✗) if it is not true.

Angle A is a right angle. ☐

Angle C is an obtuse angle. ☐

Angle D is an acute angle. ☐

Line AD is parallel to line BC. ☐

Line AB is perpendicular to line AD. ☐

OHT S2.2b