Area and perimeter

How to use these resources

In a departmental meeting:

- consider the pupil's responses to the questions set (resource C1) and discuss the misconceptions that are evident;

- compare your response with the findings from the researchers (resource C2);

- predict how the pupil might answer an associated test question (resource C3);

- explore approaches that target the misconceptions (resource C4) and do the card sort activity (resource C5);

- discuss likely outcomes from pupils' discussions when they use the card sort;

- consider how to use pupils' responses to create and resolve the cognitive conflict by encouraging them to discuss their imagery and reasoning.

In teaching:

- consolidate skills by setting questions that focus on the application of the newly acquired concept;

- adjust your schemes of work to incorporate the activities designed to counter misconceptions.
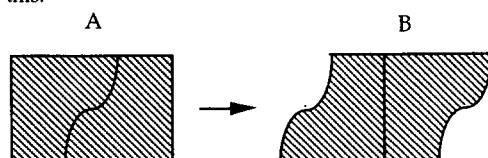
Samples of a pupil's work

---

3. Explain, in your own words, the meanings of the terms:

Perimeter... Is the outside of a shape

....

Area... The flat surface of a shape ....

Volume... The length + surface area eg ......
...the whole shape.

eg Inside of shape

---

4. You cut rectangle A, and arrange the pieces to make a new shape B, like this:

A   B

Ring two statements that are true:

The area of A is greater than the area of B

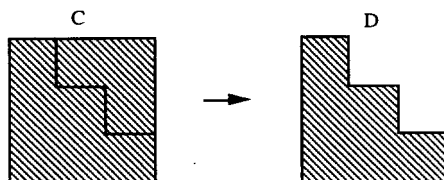The area of A is less than the area of B

(Both areas are the same)

The perimeter of A is greater than the perimeter of B

The perimeter of A is less than the perimeter of B

(Both perimeters are the same)

---

5. You cut a piece out of C and throw the piece away.
You are left with piece D:

C   D

Ring two statements that are true:

(The area of C is greater than the area of D)

The area of C is less than the area of D

Both areas are the same

(The perimeter of C is greater than the perimeter of D)

The perimeter of C is less than the perimeter of D

Both perimeters are the same

Commentary on the pupil's work

The pupil's answers to question 3 show that she is able to distinguish area from perimeter which, in her words, mean 'the flat surface of a shape' and 'the outside of a shape' respectively. She appears to have difficulty explaining the concept of volume, which she describes as the 'whole shape', including length, surface area and inside the shape. Her drawings indicate that she relates these concepts to the number of dimensions involved.

Her answers to question 4 indicate that she knows that area is conserved when a shape is cut up and reassembled, but she seems to think that perimeter also is conserved. Her response to question 5 suggests she believes that if the area of a shape is increased, then so the perimeter must also increase. She may thus believe that there is a relationship between the area and the perimeter of a shape.

Key Stage 3 test questions

1 Look at the hexagon and the triangle.
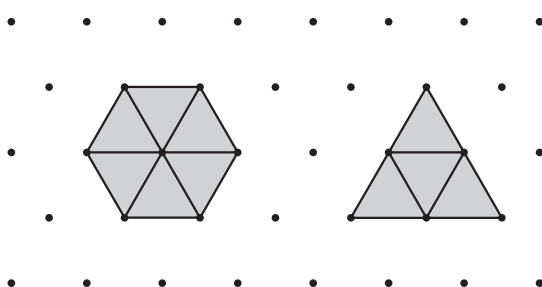
(a) Do the hexagon and the triangle have the same area?
Tick (✔) Yes or No.

Yes ☐ No ☐

Explain your answer.

_____

_____

(b) Do the hexagon and the triangle have the same perimeter?
Tick (✔) Yes or No.

Yes ☐ No ☐

Explain your answer.

_____

_____

2 The information in the box describes three different squares, A, B and C.

> The area of square A is 36 cm^2.
>
> The side length of square B is 36 cm.
>
> The perimeter of square C is 36 cm.

Put squares A, B and C in order of size, starting with the smallest.

You must show calculations to show how you worked out your answer.

_____   _____   _____

  smallest   largest

Always, sometimes or never true?

Do these three questions **on your own**, without talking to your neighbour.

1   Explain in your own words what is meant by **perimeter** and **area**.

2   Draw a shape with a big perimeter and a small area.

3   Draw a shape with a small perimeter and a big area.

4   You cut rectangle A and arrange the pieces to make a new shape B, like this.
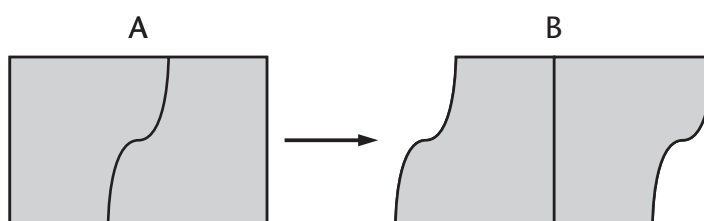
Tick (✔) two statements that are true:

☐   The area of A is greater than the area of B.

☐   The area of A is less than the area of B.

☐   Both areas are the same.

☐   The perimeter of A is greater than the perimeter of B.

☐   The perimeter of A is less than the perimeter of B.

☐   Both perimeters are the same.

Try the following activity in a small group.
You will need the cards for sorting from resource C5.

5   Divide a sheet of paper into three columns. Label them 'Always true', 'Sometimes true', 'Never true'.

Decide whether each of the statements on the cards is
- Always true   (it is true for all possible shapes)
- Sometimes true   (it is true for just some shapes)
- Never true   (no shapes make the statement true)

Take it in turns in your group to explain your thinking.

When you reach agreement, stick the statement into the correct column.

Explain using examples and drawings how you made your decision.
Write these reasons directly on the poster, next to the statement.

On your own, go back and revise your answers to questions 1 to 4.
Make notes on any mistakes you made and the reasons for them.
Make notes on new things you have learned about area and perimeter.

Statements for sorting

C1

Draw two rectangles.

The one with the greater area will also have the greater perimeter.

C2

If you cut a piece out of a rectangle, you make its area smaller.

C3

If you cut a piece out of a rectangle, you make its perimeter smaller.

C4

A square and a rectangle both have the same perimeter.

The square has the greater area.

C5

A square and a rectangle both have the same area.

The square has the greater perimeter.