Lesson 10 Coordinates and reflections

Oral and mental starter 15 minutes

Objectives

Find coordinates of points determined by geometric information (Y7)

Understand and use the language and notation associated with reflections (Y7)

Vocabulary

point, coordinate, reflection

Resources

OHT 10.1

Using the grid on **OHT 10.1**, invite pupils to plot the points (1,2) (6,2) and (6,7).

Indicate the points in turn and check the coordinates.

Q What are the coordinates of the fourth corner if the shape is a square?

Invite a pupil to plot the points (1,5), (3,1), (3,9).

Q What are the coordinates of the fourth point that makes this a square? Pupils should discuss and then compare their answers.

Reflect the squares in the vertical and horizontal lines on the diagram.

Discuss where the new squares will be and the coordinates of their vertices.

Main teaching 35 minutes

Objectives

Recognise transformation and symmetry of a 2-D shape: reflection in given mirror lines and line symmetry (Y7)

Vocabulary

lines of symmetry

reflection, mirror lines

Resources

OHTs 10.2 and 10.4 (Plenary)

Handouts 10.3a and b

tracing paper, mirrors

square tiles if available

Springboard 7 Unit 14

Using **OHT 10.2**, demonstrate how to use tracing paper to find the image of trapezium A after reflection in the line OT.

Ask pupils to trace shapes C and D and to find the mirror line so that shape C is a reflection of shape D.

Q Can you always find the reflection of a shape in a given mirror line?

Q If you have two identical shapes, can you always find a mirror line that will reflect one onto the other?

Ask pupils to draw examples to demonstrate their responses.

Using tracing paper and mirrors (and square tiles if available), allow pupils to investigate the problems on **Handouts 10.3a** and **b**.

Consolidate with Springboard 7 Unit 14 pages 452 and 453.

Plenary 10 minutes

By the end of the lesson

pupils should be able to:

- plot points and read coordinates in the first quadrant;
- reflect 2-D objects in mirror lines;
- complete the reflection of a shape in a given mirror line.

Framework supplement of examples pages 202–206

Level 4

Show **OHT 10.4**.

Q Which triangles are reflections of triangle A?

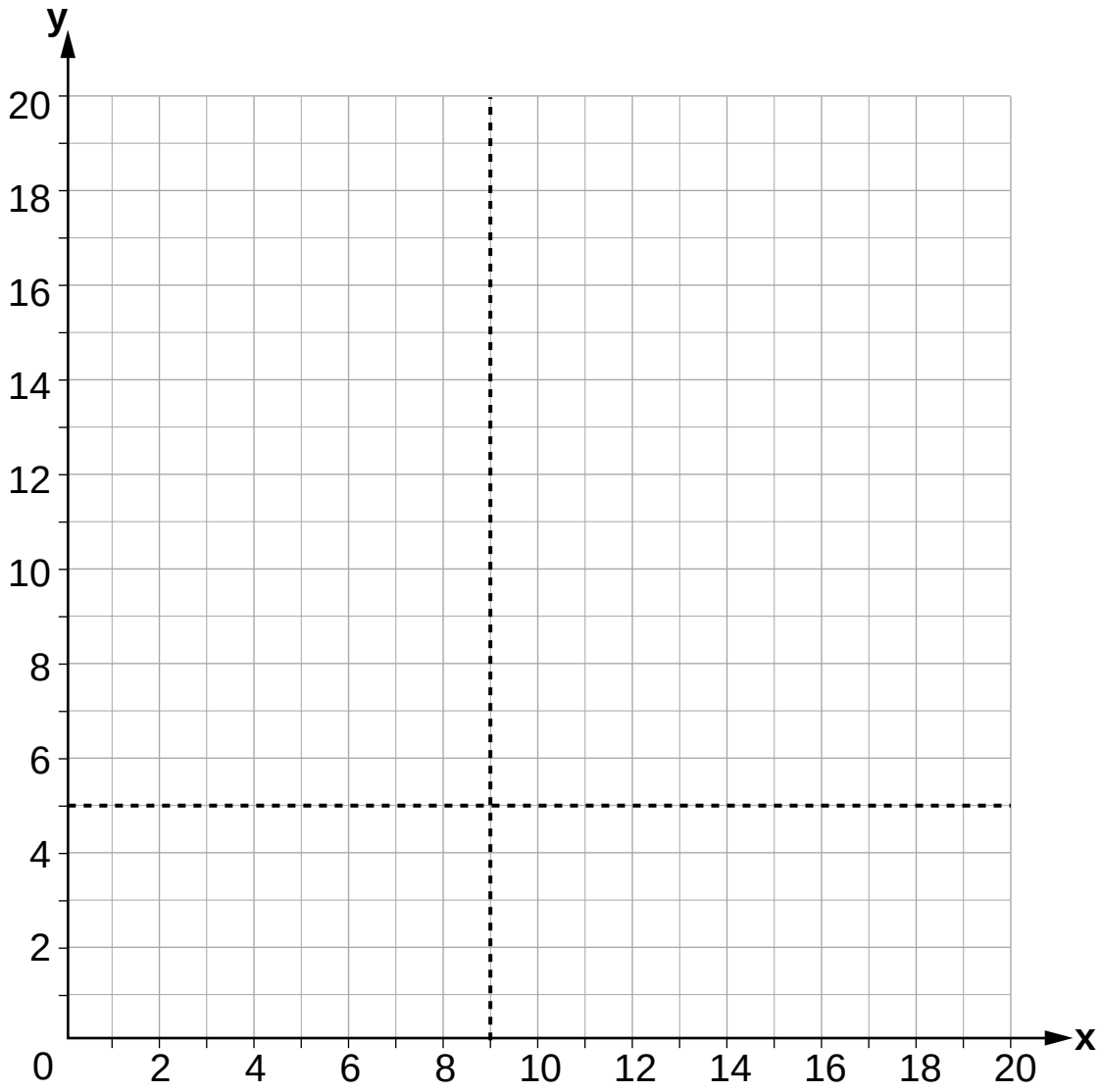
Q Find pairs of triangles that will reflect onto each other.

Q Are there any triangles that cannot be reflected onto any of the others?

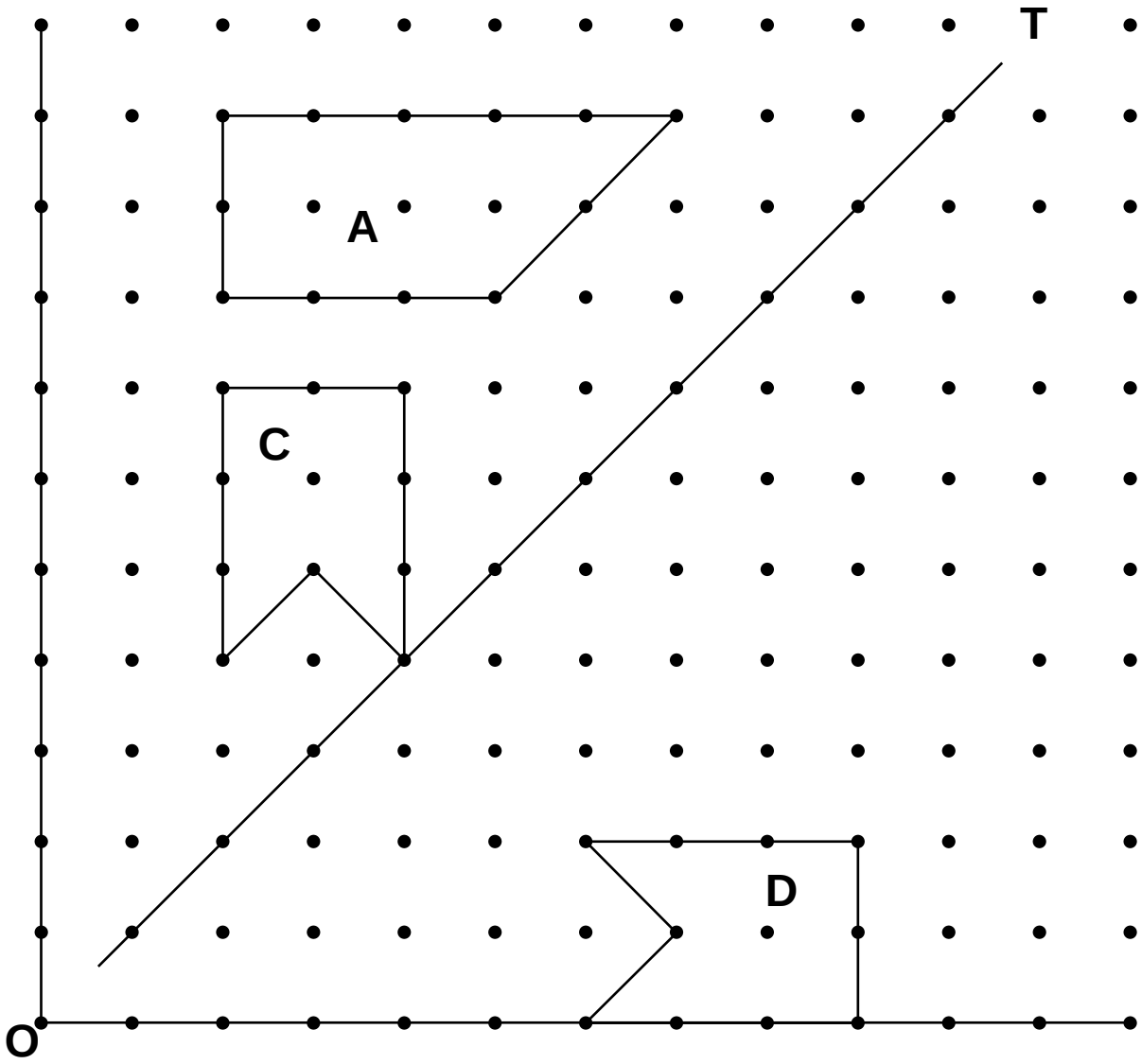
Q How can you tell if you cannot reflect a given triangle onto another one?

OHT 10.1

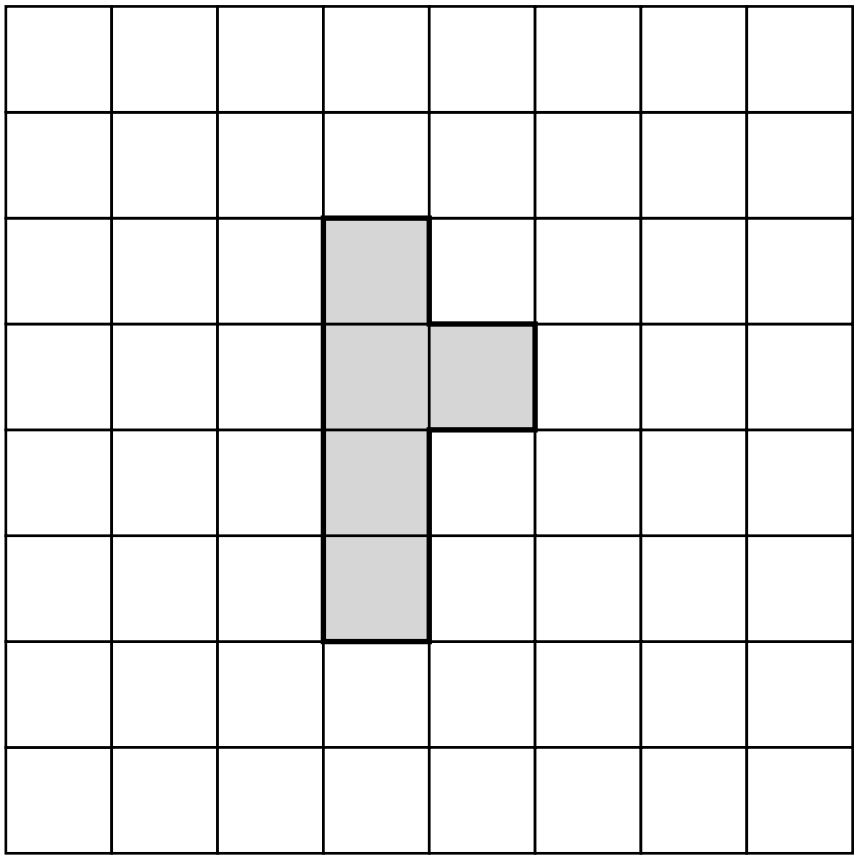
Coordinates



Reflections



Symmetry



1 For each question start with the shape above. Move one square only to make each of the shapes described.

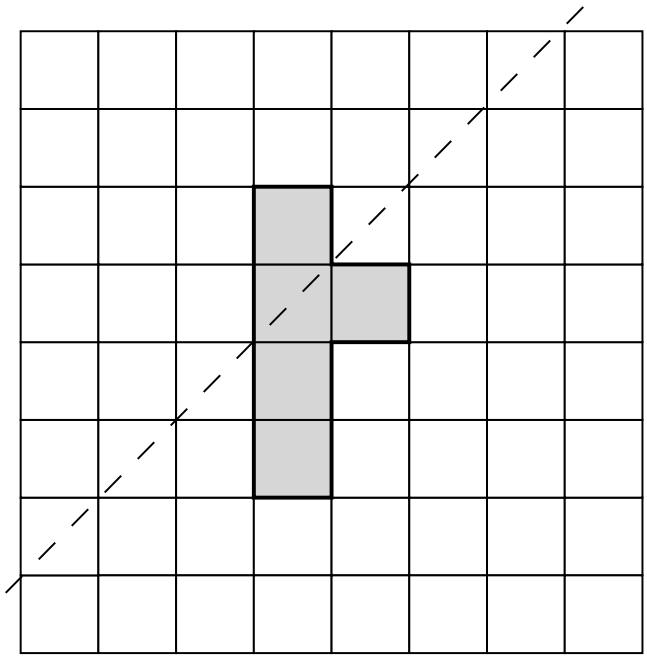
Make a shape with:

a a horizontal line of symmetry only
b a vertical line of symmetry only
c a diagonal line of symmetry only
d diagonal, horizontal and vertical lines of symmetry
e no lines of symmetry (different from the original shape).

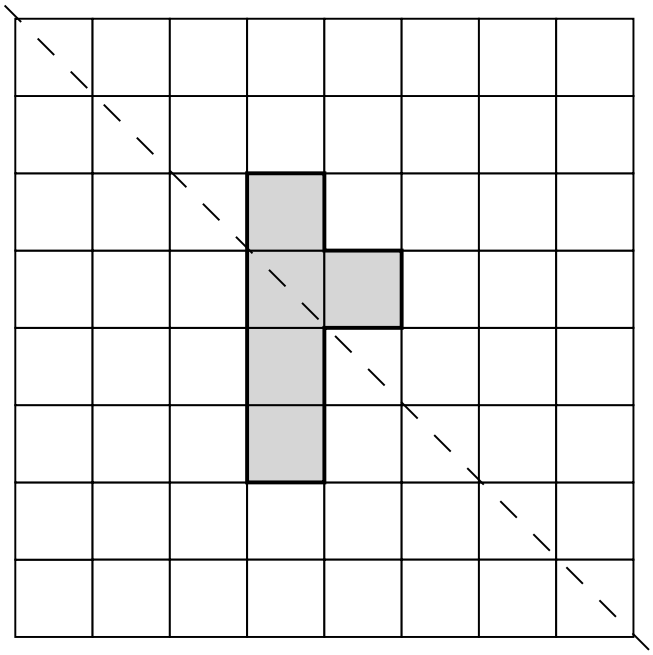
Symmetry

2 On each of the diagrams below add two more squares to the shape so that the dashed line becomes a line of symmetry.

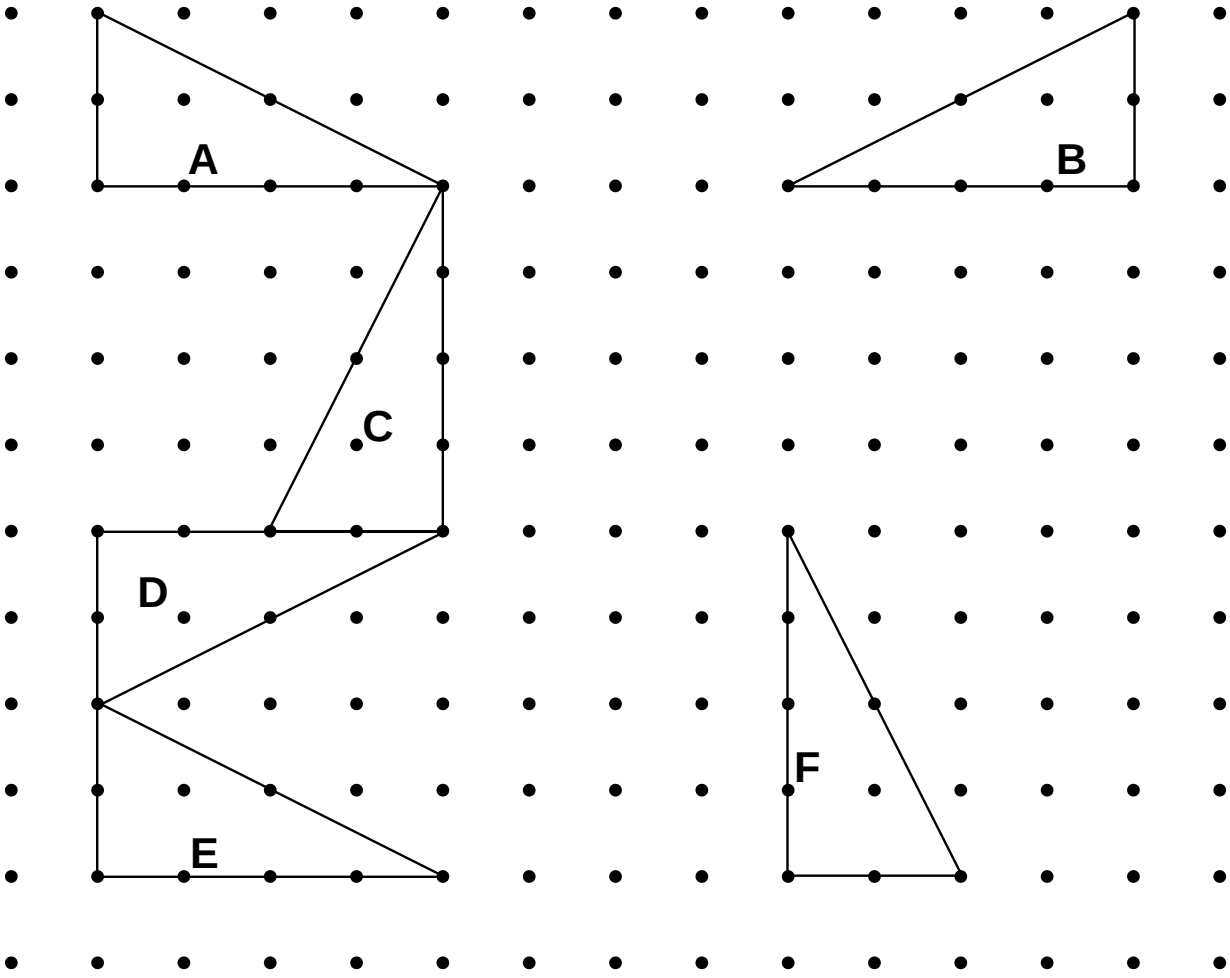
a



b



Reflecting triangles



Lesson 11 Sequences

Oral and mental starter 15 minutes

Objectives

Recognise and extend number sequences (Y6)

Vocabulary

odd, even, triangular, square

Resources

individual whiteboards

Springboard 7 Unit 1

Give pupils practice counting on and back in equal steps from and to zero – this is one way of building up multiplication facts.

Move on to counting on, for example, from 8 in steps of 7: 8 15 22 29 ...; point out the link with the 7 times table.

Pupils will need more practice at counting back.

Q Count back from 41 in steps of 5.

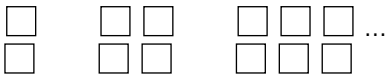
Give similar examples.

Springboard 7 Unit 1 pages 50–51 provides further examples that can be done orally.

Revise even numbers.

Q Think of the even numbers 2, 4, 6, 8 … What picture do you see? Draw it.

Make sure that pupils have a mental image of even numbers.

Pupils need a picture similar to: 

Ask pupils to explain the link between the numbers and the pictures.

Do the same for odd numbers, square numbers and triangular numbers (see Framework supplement of examples page 146).

Emphasise the link between the 'picture' and the numbers..

Main teaching 35 minutes

Objectives

Generate sequences from practical contexts (Y7)

Recognise squares of numbers to at least 12×12 (Y7)

Vocabulary

pattern, position, term

Resources

OHTs 11.1 and 11.2

OHT 11.3 (Plenary)

Introduce the task on **OHT 11.1**, which is based on a test question.

Discuss and establish ways of recording the information, for example:

pattern	1	2	3		
number of tiles	4				

For each question, establish how pupils worked out their answers.

Encourage pupils to move on from describing the pattern as +4 to seeing the link between the pattern number and the number of tiles ($\times 4$). Note, however, that this could lead pupils to a false conclusion: a $+4$ link between terms does not always lead to position-to-term relation of $\times 4$.

Use the example on **OHT 11.2** to clarify this.

Plenary 10 minutes

By the end of the lesson

pupils should be able:

- to generate sequences from spatial situations;
- understand links between a numerical sequence and a spatial pattern.

Framework supplement of examples page 154

Level 4

Investigate 'Growing steps' on **OHT 11.3**.

Q How many tiles will there be in the 5th, 6th and 10th patterns? How did you calculate the values?

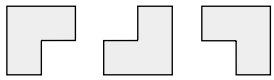
Draw out the link with square numbers.

Q How many squares will there be in the 20th, 60th and 76th patterns?

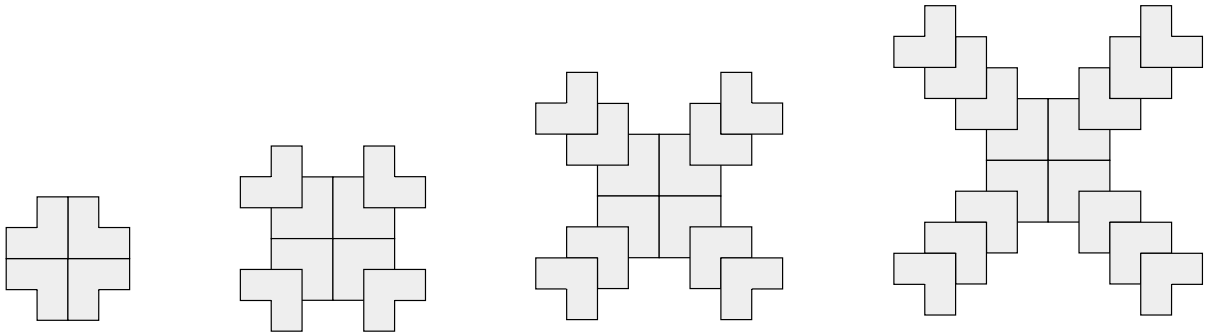
Q How many squares will there be on the 3rd, 5th and 10th 'rows'?

These two questions provide opportunities to revisit mental and/or written methods of multiplication.

Patterns

Owen has some tiles like these: 

He uses the tiles to make a series of patterns.



pattern number 1 **pattern number 2** **pattern number 3** **pattern number 4**

1 Each new pattern has **more tiles** than the one before. The number of tiles goes up by the same amount each time. How many **more** tiles does Owen add each time he makes a new pattern?

2 **How many tiles** will Owen need altogether to make **pattern number 6**?

3 **How many tiles** will Owen need altogether to make **pattern number 9**?

4 Owen uses **40 tiles** to make a pattern. What is the **number** of the **pattern** he makes?

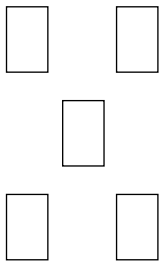
OHT 11.2

Growing patterns

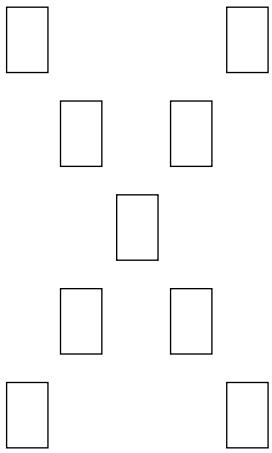
Investigate this growing pattern.

pattern 1

pattern 2



pattern 3



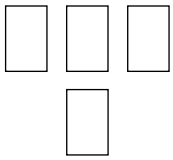
How many tiles will be in **pattern 6**?

If my pattern uses **29 tiles**, which **pattern number** is it?

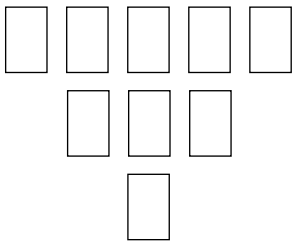
Growing steps

pattern 1

pattern 2



pattern 3



Lesson 12 Perimeter and area

Oral and mental starter 15 minutes

Objectives

Calculate the perimeter and area of shapes made from rectangles (Y7)

Vocabulary

area, perimeter, cm, cm^2

Resources

centimetre-squared paper or tiles

OHT 12.1

Show **OHT 12.1**, pointing out that the sides of each square tile are 1 cm in length.

Q What is the area of one square?

Make sure pupils give the correct units.

Q What is the perimeter of one square?

Make sure pupils give the correct units.

Make sure that pupils understand perimeter and area.

Q What are the area and perimeter of Figure 1?

Q What are the area and perimeter of Figure 2?

Using tiles or centimetre-squared paper, ask pupils to draw other shapes with twelve 1 cm^2 tiles and to calculate the perimeter and area of each shape. Explain that all sides must fully touch another side.

Q What can you say about the areas of the shapes?

Q What is the largest/smallest perimeter you found?

Emphasise that for a fixed area the perimeter may vary.

Main teaching 35 minutes

Objectives

Know and use the formula for the area of a rectangle; calculate the perimeter and area of shapes made from rectangles (Y7)

Use names and abbreviations of units of measurement (Y7)

Vocabulary

area, perimeter, minimum, maximum, cm, cm^2

Resources

centimetre-squared paper

Springboard 7 Unit 3

OHT 12.2

OHT 12.3 (Plenary)

Ask pupils to visualise a rectangle with an area of 36 cm^2.

Q What could the length and width of the rectangle be?

Make sure that pupils identify all the integer pairs.

Q Is a 3×12 rectangle different from a 12×3 rectangle?

Q What is the perimeter of a 3×12 rectangle?

Q What is special about a 6×6 rectangle?

Q Which one has the smallest perimeter? Which one has the largest perimeter?

Using centimetre-squared paper, ask pupils to draw different shapes with a perimeter of 24 cm. Make sure they do not use diagonal lines.

Q What shape with a perimeter of 24 cm has the maximum area?

Q What shape with a perimeter of 24 cm has the minimum area?

Pupils work in pairs and have to convince their partner that they have found the correct shapes. (You will need to check final results.)

Consolidate with questions from Springboard 7 Unit 3 pages 108–112.

Extension: Show **OHT 12.2**.

Ask pupils to work out the perimeters of the shapes, giving their answers in the simplest form.

Take feedback and rectify any misconceptions.

Plenary 10 minutes

By the end of the lesson

pupils should be able to:

- work out the area and perimeter of a rectangle
- work out the area and perimeter of compound shapes based upon rectangles.

Framework supplement of examples 234 and 236

Level 4

Show **OHT 12.3**. Ask pupils to work out the area of the octagon, making sure they give the correct units. Ask pupils to explain how they worked out the area, in particular how they worked out the area for the halved squares.

Ask them to consider the second problem.

Take feedback and discuss why the diagonal sides must be longer than 1 cm.

Ask pupils to write an explanation.

Area and perimeter

Figure 1

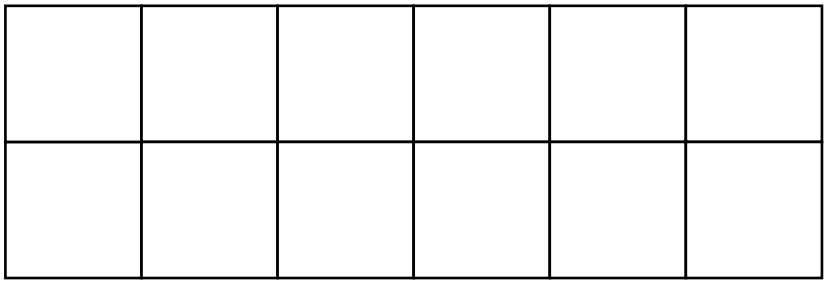
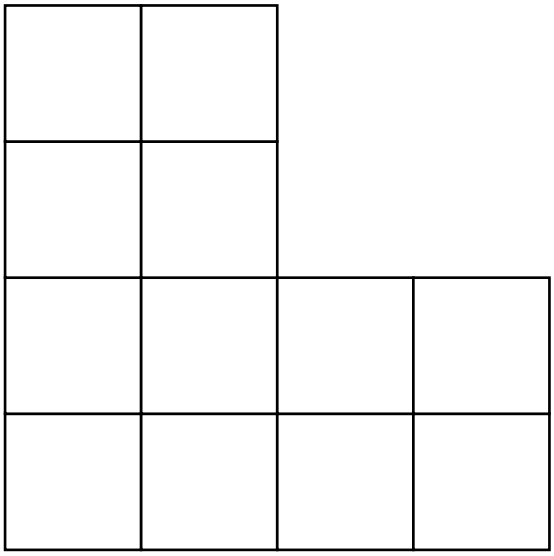
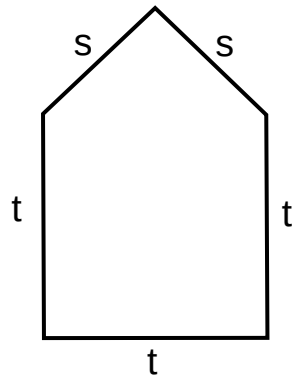


Figure 2



Perimeters



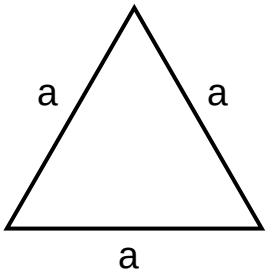
s and t are lengths of the sides in centimetres

The perimeter p of this shape is $3t + 2s$.

$p = 3t + 2s$

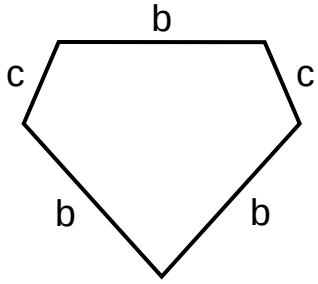
Work out the perimeters of these shapes.

1



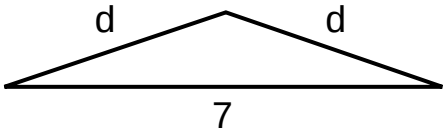
p =

2



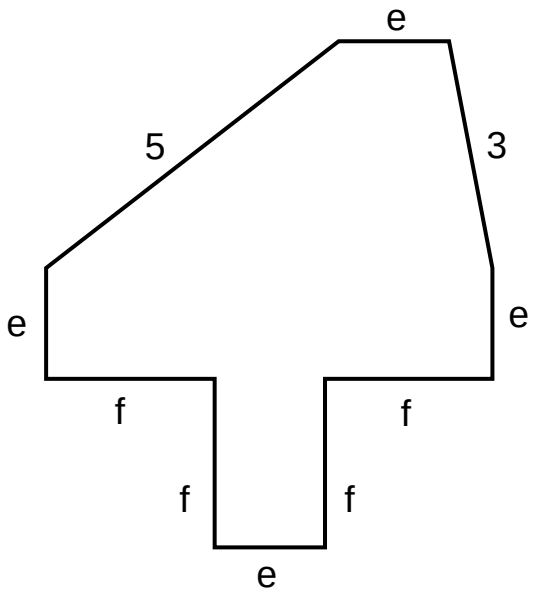
p =

3



p =

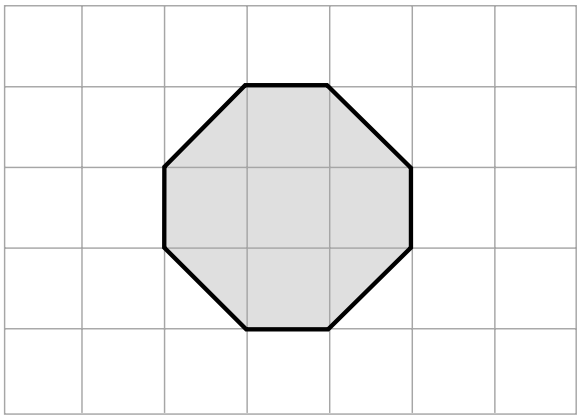
4



p =

Shapes

1 Look at the octagon.
It is drawn on a 1 cm square grid.



What is the area of the octagon?

2 Explain how you know that the perimeter of the octagon is more than 8 cm.

