Measurement: Same Area, Different Perimeter

Aim:	**Success Criteria:**	**Resources:**
I can recognise that shapes with the same areas can have different perimeters and vice versa. I can find shapes with the same area but different perimeters.	I can find squares and rectangles which have the same area. I can organise my results to ensure I have found all possible variations.	**Lesson Pack** Squared paper
	Key/New Words: Area, perimeter, investigate, order.	**Preparation:** Differentiated **Area and Perimeter Activity Sheet** – one per child **Extra Challenge Activity Sheet** – as needed

Prior Learning: It will be helpful if children know how to calculate area and perimeter.

Learning Sequence

Calculating Area: Children calculate the area of a variety of squares and rectangles shown on the **Lesson Presentation**, using cm^2 and m^2. They also calculate the area of composite rectilinear shapes.

Area and Perimeter: Using whole-number measurements, children find squares and rectangles which have areas of $36cm^2$. Use the **Lesson Presentation** to explain how using an ordered table helps to find all possibilities. They then find all squares and rectangles which have areas of $24cm^2$, using whole-number measurements.

Linking Area and Perimeter: Children complete the differentiated **Area and Perimeter Activity Sheet**, finding squares and rectangles with a given area.

- ★ Using whole-number measurements, children find all the possible rectangles and squares with areas of $12cm^2$ and $20cm^2$.
- ★★ Using plain paper, so they calculate rather than count squares, children find all the possible rectangles and squares with areas of $32mm^2$ and $28mm^2$. Children answer a reasoning question, working out the dimensions of a shape, with clues given.
- ★★★ Children predict all the possible rectangles and squares with areas of $44mm^2$ and $66mm^2$, then test their predictions by drawing. Children answer a reasoning question, proving whether a statement is correct or not and explaining why. An **Extra Challenge Activity Sheet** is also included.

Diving into Mastery: Schools using a mastery approach may prefer to use the following as an alternative activity. These sheets might not nwecessarily be used in a linear way. Some children might begin at the 'Deeper' section and in fact, others may 'dive straight in' to the 'Deepest' section if they have already mastered the skill and are applying this to show their depth of understanding.

- Children use their knowledge of how to calculate with the area and perimeter of rectilinear shapes in order to complete fluency problems.
- Children explore answering reasoning problems which involve calculating with the area and perimeter of rectilinear shapes.
- Children use problem solving skills in order to answer an open-ended task that involves a greater depth of thinking when calculating with the area and perimeter of rectilinear shapes.

Factors, Area, Perimeter: Children discuss how finding factors helps with the investigations in this lesson. They use knowledge of factors to find all the possible shapes which have an area of 36 square units.

Exploreit

Factorit: Children use their knowledge of factors to find all the possible shapes with different areas.

Playit: Children play a game in pairs. They take turns to roll two dice and multiply the numbers rolled to create a new number. They then find all the shapes they can which have an area equal to this number. In each round, the player who finds the most shapes scores one point. If both players find the same number of shapes, each player scores one point.

Maths

Measurement

Same Area, Different Perimeter

Aim

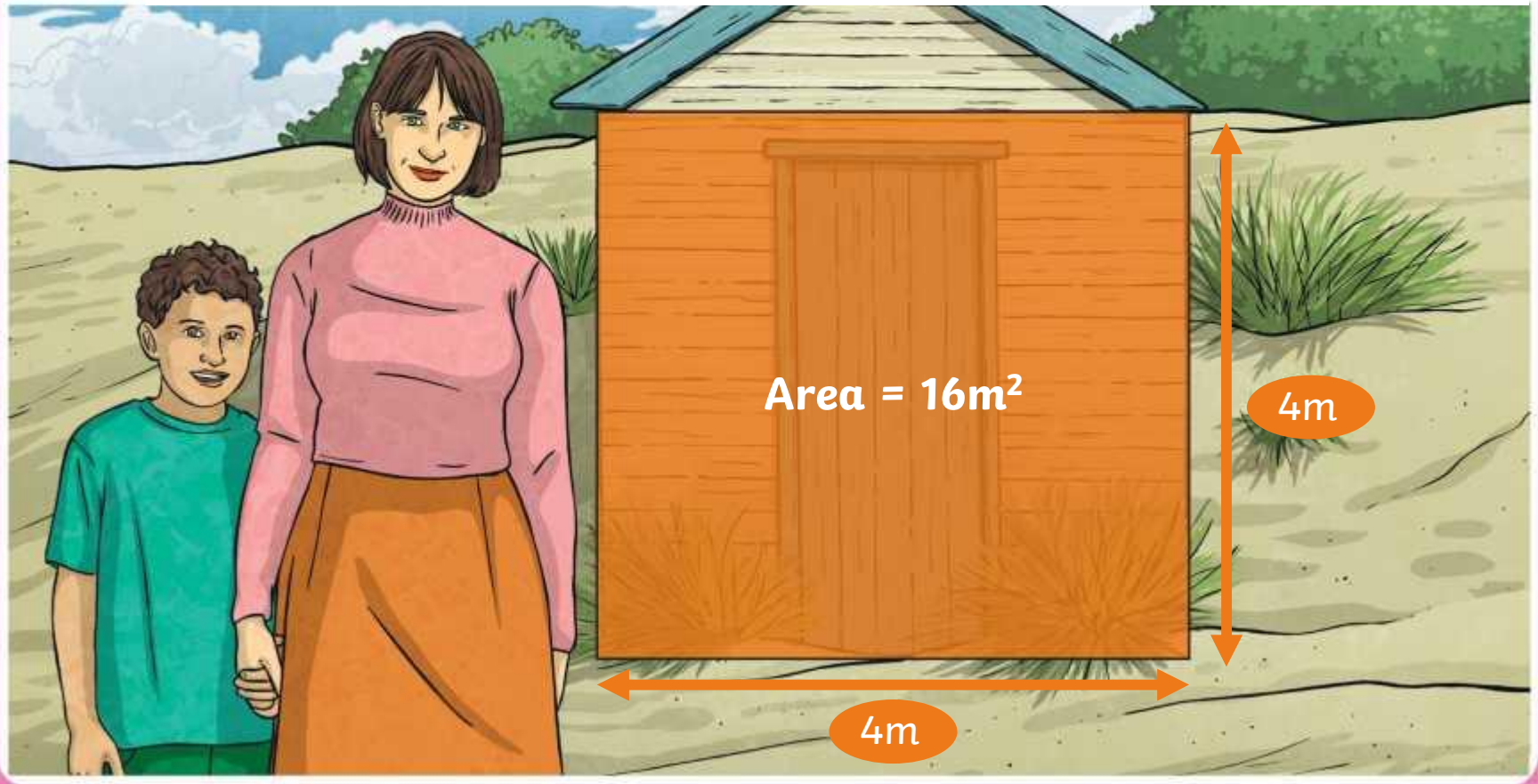
- I can investigate shapes with the same area but different perimeters.

Success Criteria

- I can find squares and rectangles which have the same area.
- I can organise my results to ensure I have found all possible variations.

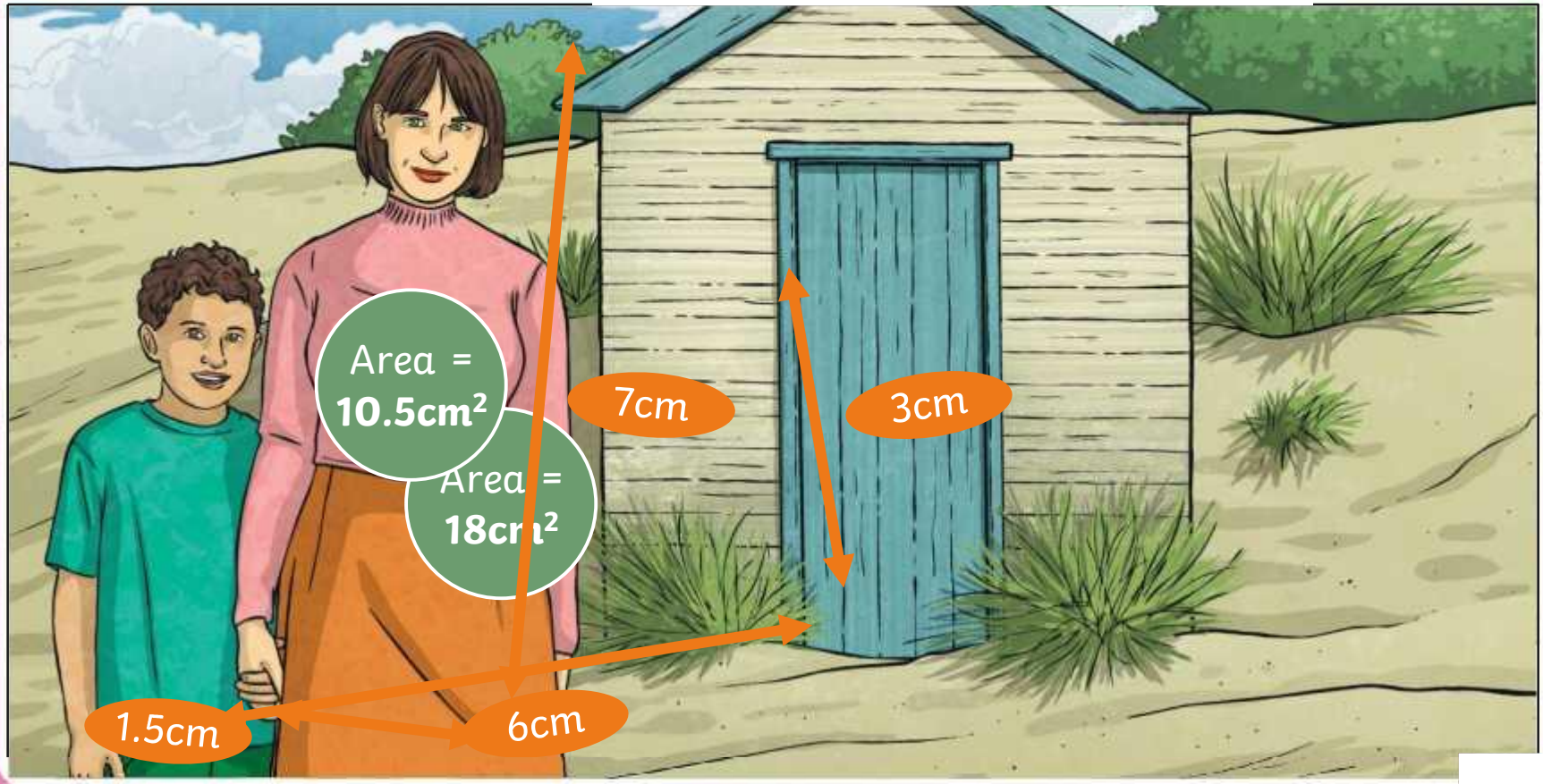
Calculating Area

Calculate the area of these shapes. If the unit measurements are centimetres, the answer will be in **cm²**. If the measurements are metres, the answer will be in **m².**



Calculating Area

Calculate the area of these shapes. If the unit measurements are centimetres, the answer will be in **cm²**. If the measurements are metres, the answer will be in **m².**



Calculating Area

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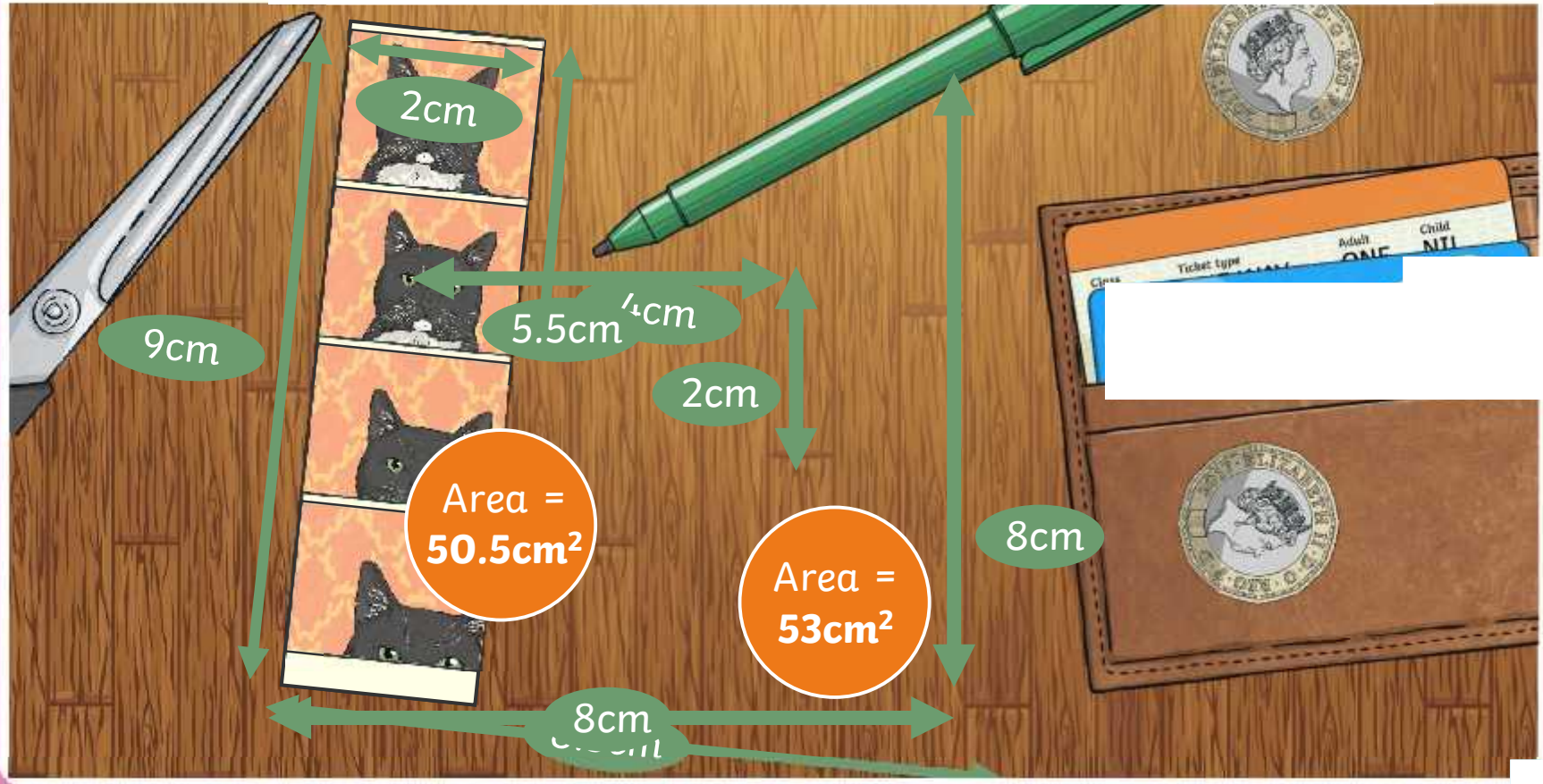


Area and Perimeter

How do you calculate the perimeter of a rectangle?

(length + width) × 2

32cm

12cm

4cm

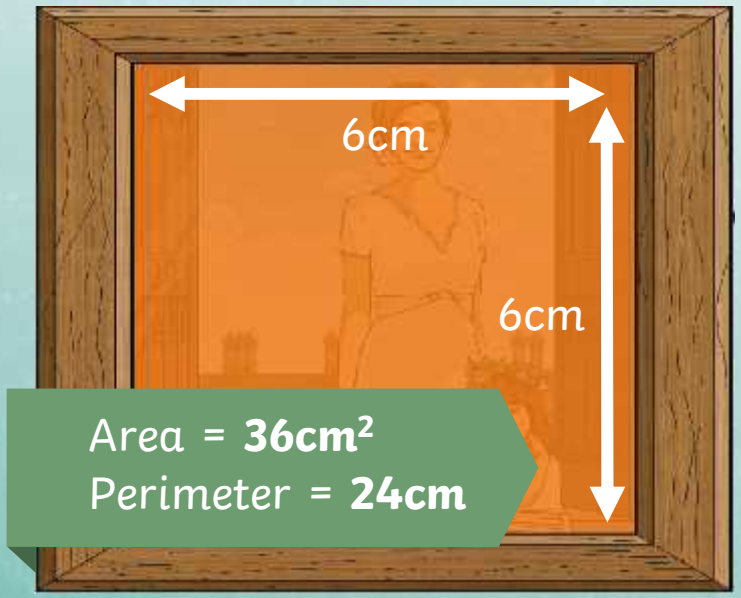
The answer is in centimetres as it refers to the space inside a two-dimensional shape.

What is the perimeter of the shape? (all around the outside of the rectangle).

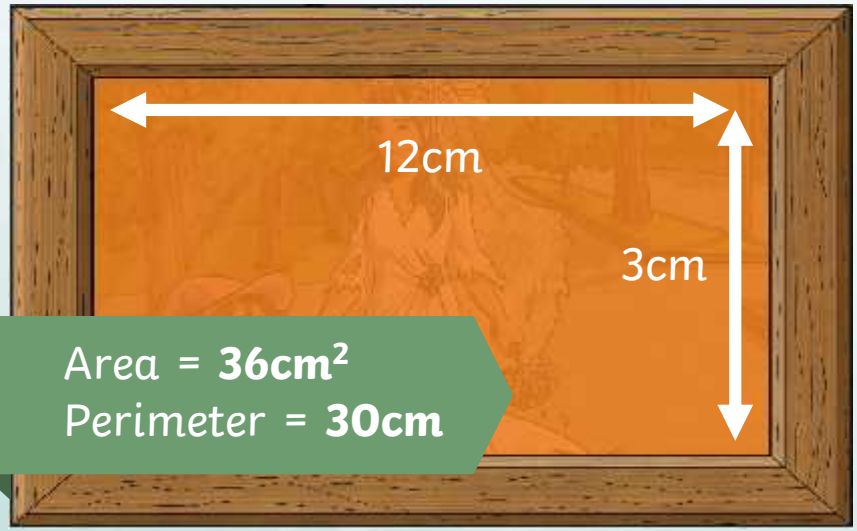
The answer is in square centimetres as it refers to the space inside a two-dimensional shape.

Area and Perimeter

Calculate the areas and perimeters of these shapes.



Area = **36cm²**
Perimeter = **24cm**



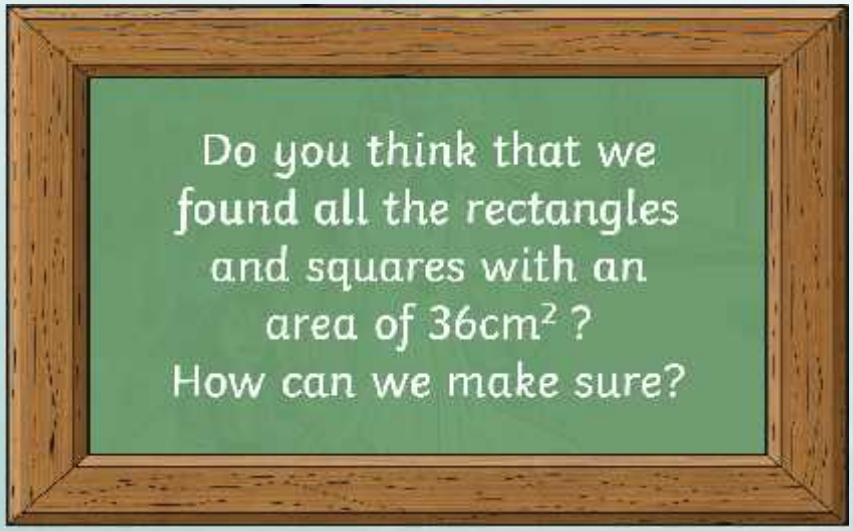
Area = **36cm²**
Perimeter = **30cm**

What did you notice?

Both shapes had the same area, but different perimeters.

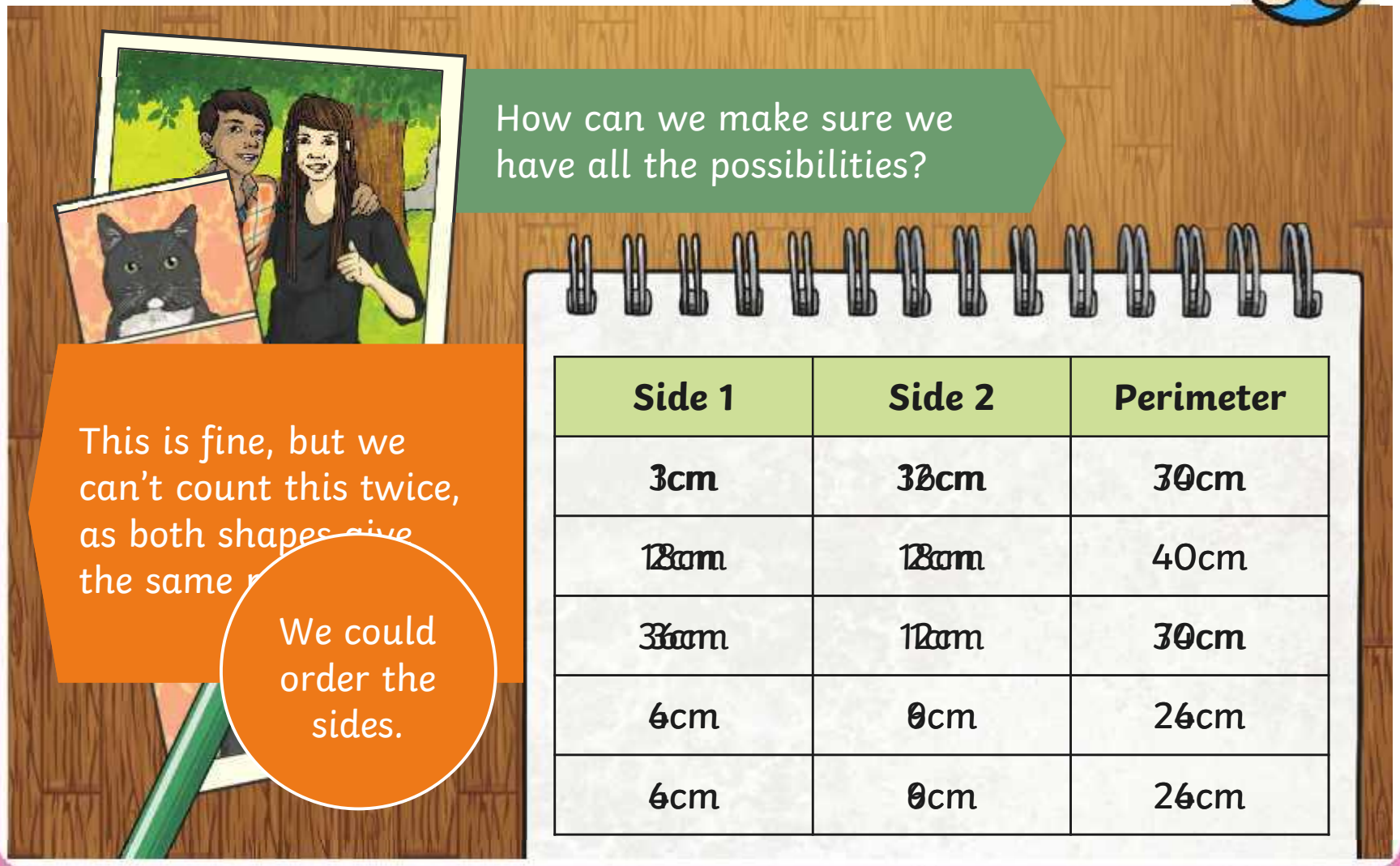
Area and Perimeter

On the previous slide, both shapes had areas of 36cm^2, but different perimeters (24cm and 30cm). Using whole-number measurements, how many other rectangles or squares can you find that have an area of 36cm^2 but different perimeters?



We could record our results in a table.

Area and Perimeter



How can we make sure we have all the possibilities?

This is fine, but we can't count this twice, as both shapes give the same r

We could order the sides.

Side 1	Side 2	Perimeter
3cm	32cm	30cm
12cm	12cm	40cm
36cm	12cm	30cm
6cm	0cm	26cm
6cm	0cm	26cm

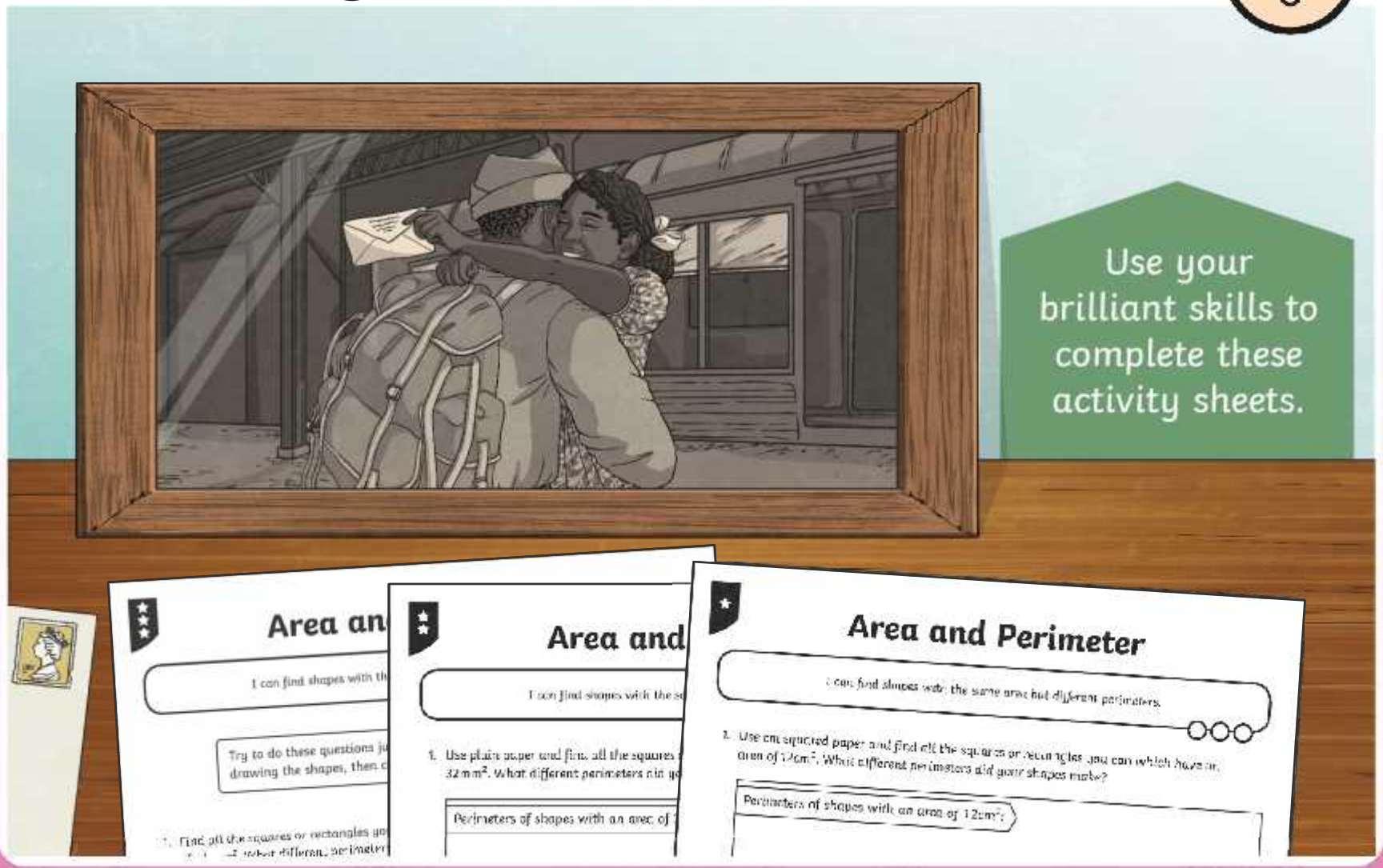
Area and Perimeter

Using whole-number measurements, find as many squares and rectangles you can which have an area of 24cm^2, but have different perimeters.

There are 4 shapes with an area of 24cm^2.

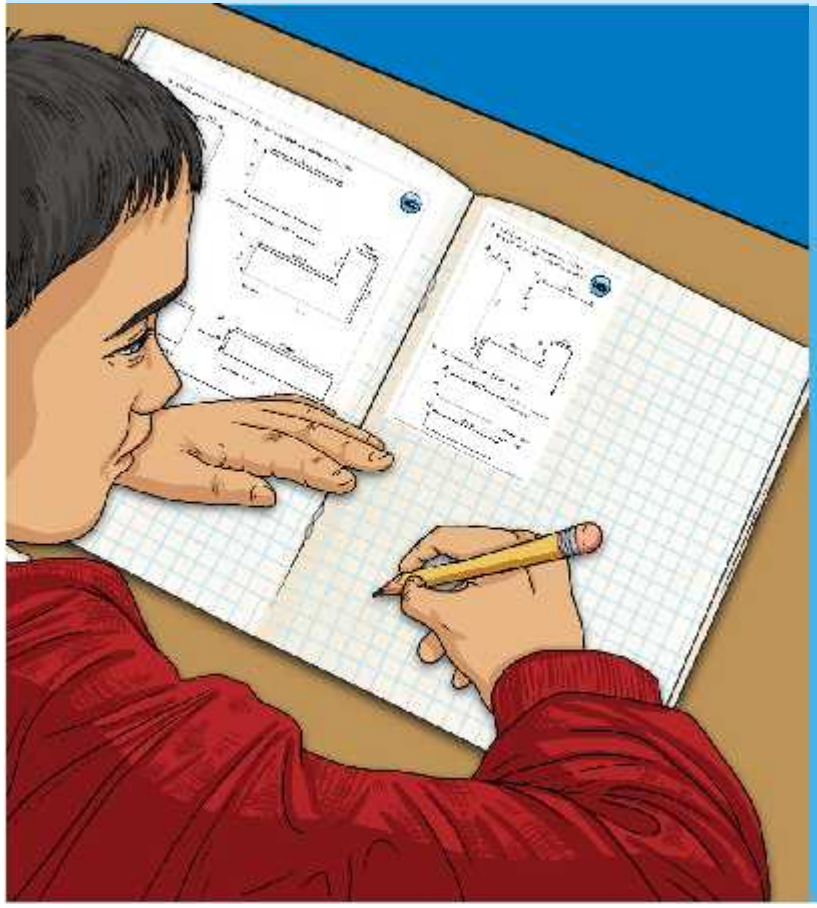
Side 1	Side 2	Perimeter
4cm	6cm	20cm
3cm	8cm	22cm
2cm	12cm	28cm
1cm	24cm	50cm

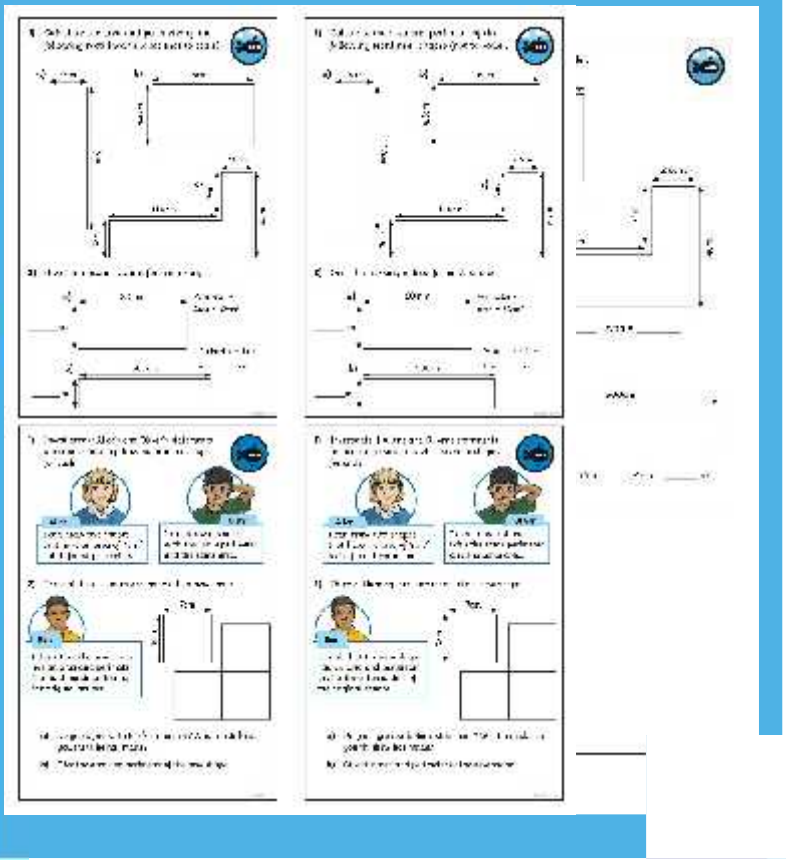
Linking Area and Perimeter



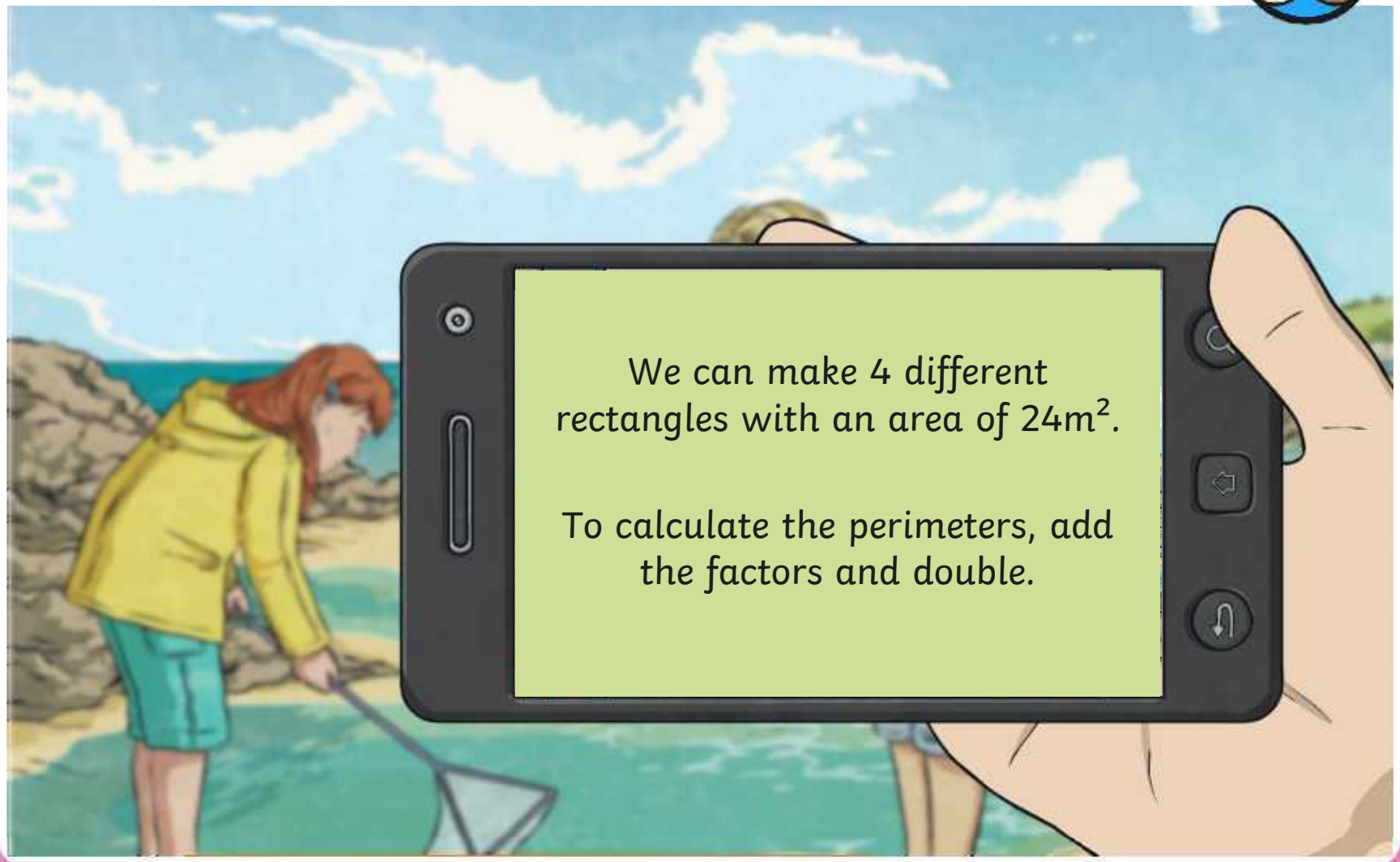
Diving into Mastery

Dive in by completing your own activity!

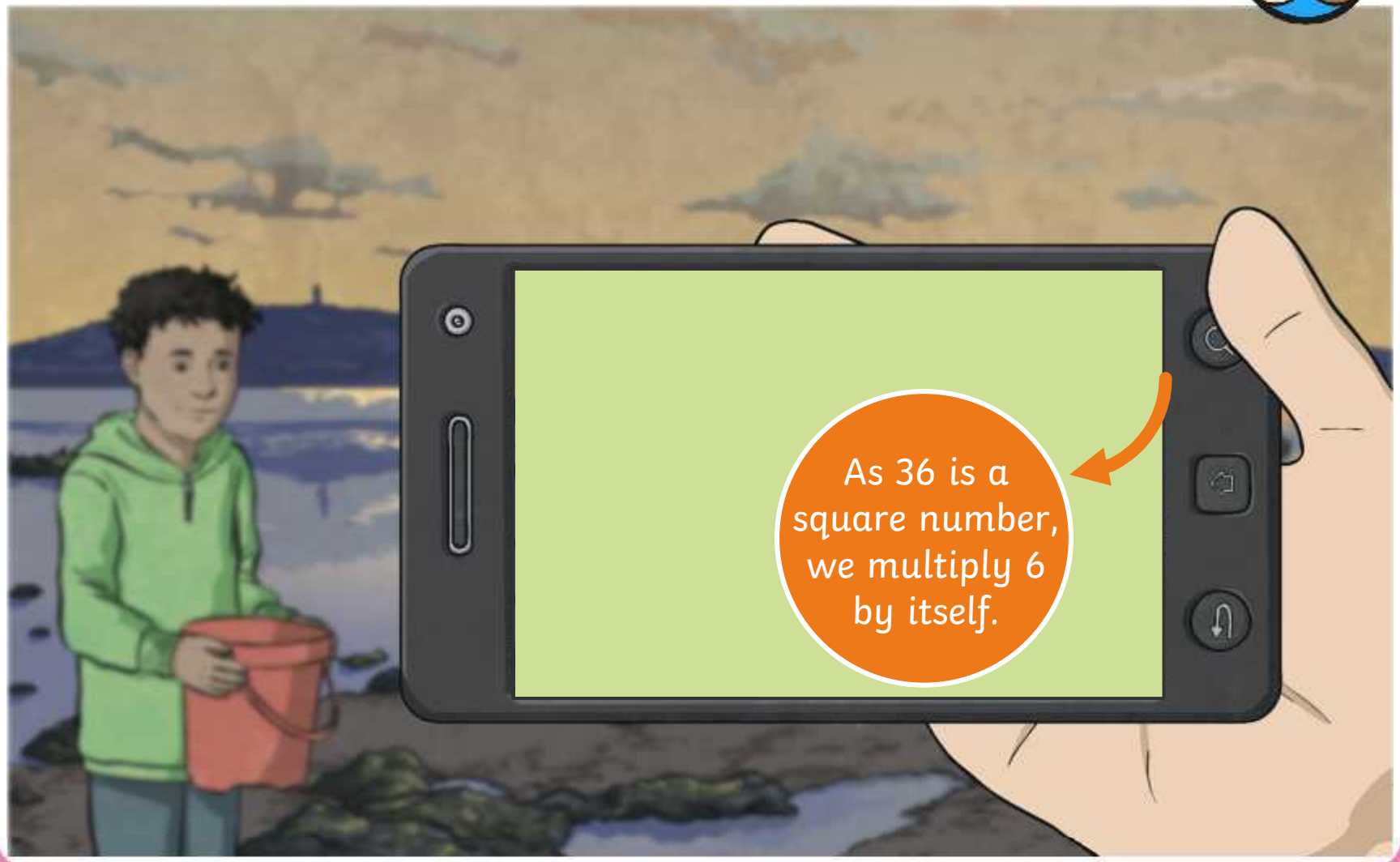




Factors, Area, Perimeter



Factors, Area, Perimeter

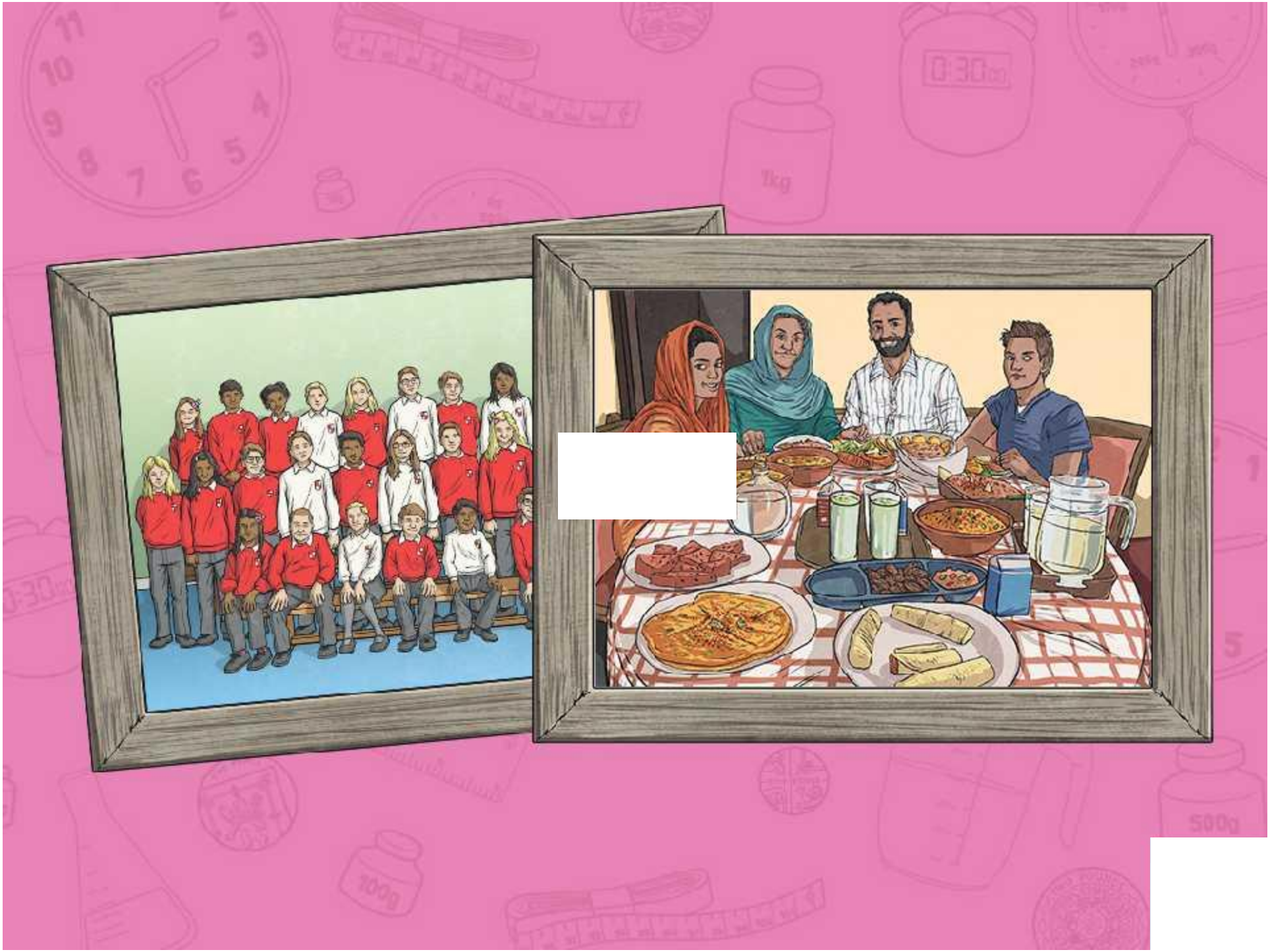


Aim

- I can investigate shapes with the same area but different perimeters.

Success Criteria

- I can find squares and rectangles which have the same area.
- I can organise my results to ensure I have found all possible variations.



Aim: I can find shapes with the same area but different perimeters.				**Date:**					
				Delivered By:			**Support:**		
Success Criteria	**Me**	**Friend**	**Teacher**	**T**	**PPA**	**S**	**I**	**AL**	**GP**
I can find squares and rectangles which have the same area.				**Notes/Evidence**					
I can organise my results to ensure I have found all possible variations.									

Next Steps

- _____
- _____

T	Teacher	**I**	Independent
PPA	Planning, Preparation and Assessment	**AL**	Adult Led
S	Supply	**GP**	Guided Practice

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Next Steps

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Area and Perimeter

I can find shapes with the same area but different perimeters.

1. Use cm squared paper and find all the squares or rectangles you can which have an area of 12cm^2. What different perimeters did your shapes make?

Perimeters of shapes with an area of 12cm^2:

2. Record the shapes in this table, ordering them so that you are sure that you have found all the squares and rectangles with an area of 12cm^2:

Side 1	Side 2	Perimeter

3. Find and record all the squares or rectangles you can find with an area of 20cm^2.

Side 1	Side 2	Perimeter

Area and Perimeter **Answers**

1. Use cm squared paper and find all the squares or rectangles you can which have an area of 12cm^2. What different perimeters did your shapes make?
   Perimeters: 14cm, 16cm, 26cm (in any order)

2. Record the shapes in this table, ordering them so that you are sure that you have found all the squares and rectangles with an area of 12cm^2:

Side 1	Side 2	Perimeter
12cm	1cm	26cm
6cm	2cm	16cm
4cm	3cm	14cm

or

Side 1	Side 2	Perimeter
1cm	12cm	26cm
2cm	6cm	16cm
3cm	4cm	14cm

or it could also be written the other way:

Side 1	Side 2	Perimeter
4cm	3cm	14cm
6cm	2cm	16cm
12cm	1cm	26cm

or

Side 1	Side 2	Perimeter
3cm	4cm	14cm
2cm	6cm	16cm
1cm	12cm	26cm

3. Find and record all the squares or rectangles you can find with an area of 20cm^2.

Side 1	Side 2	Perimeter
20cm	1cm	42cm
10cm	2cm	24cm
5cm	4cm	18cm

or

Side 1	Side 2	Perimeter
1cm	20cm	42cm
2cm	10cm	24cm
4cm	5cm	18cm

or it could also be written the other way:

Side 1	Side 2	Perimeter
5cm	4cm	18cm
10cm	2cm	24cm
20cm	1cm	42cm

or

Side 1	Side 2	Perimeter
4cm	5cm	18cm
2cm	10cm	24cm
1cm	20cm	42cm

Area and Perimeter

I can find shapes with the same area but different perimeters.

1. Use plain paper and find all the squares or rectangles you can which have an area of $32mm^2$. What different perimeters did your shapes make?

Perimeters of shapes with an area of $32mm^2$:

2. Record the shapes in this table, ordering them so that you are sure that you have found all the squares and rectangles with an area of $32mm^2$. (You may not need all the rows in the table).

Side 1	Side 2	Perimeter

3. Find and record all the squares or rectangles you can find with an area of 28mm^2.
(You may not need all the rows in the table).

Side 1	Side 2	Perimeter

4. A shape has an area of 40cm^2. One of its sides has a length more than 5cm^2 and less than 10cm^2. What are the dimensions of the shape?

Challenge - try to answer this question without drawing the shape.

_____

Area and Perimeter **Answers**

1. *Perimeters: 66mm, 36mm, 24mm (in any order)*

2.

Side 1	Side 2	Perimeter
32mm	1mm	66mm
16mm	2mm	36mm
8mm	4mm	24mm

or

Side 1	Side 2	Perimeter
1mm	32mm	66mm
2mm	16mm	36mm
4mm	8mm	24mm

or it could also be written the other way:

Side 1	Side 2	Perimeter
8mm	4mm	24mm
16mm	2mm	36mm
32mm	1mm	66mm

or

Side 1	Side 2	Perimeter
4mm	8mm	24mm
2mm	16mm	36mm
1mm	32mm	66mm

3.

Side 1	Side 2	Perimeter
28mm	1mm	58mm
14mm	2mm	32mm
7mm	4mm	22mm

or

Side 1	Side 2	Perimeter
1mm	28mm	58mm
2mm	14mm	32mm
4mm	7mm	22mm

or it could also be written the other way:

Side 1	Side 2	Perimeter
7mm	4mm	22mm
14mm	2mm	32mm
28mm	1mm	58mm

or

Side 1	Side 2	Perimeter
4mm	7mm	22mm
2mm	14mm	32mm
1mm	28mm	58mm

4. A shape has an area of 40cm^2. One of its sides has a length more than 5cm^2 and less than 10cm^2. What are the dimensions of the shape?

   8cm × 5cm

Area and Perimeter

I can find shapes with the same area but different perimeters.

Try to do these questions just by calculating without drawing the shapes, then check by drawing.

1. Find all the squares or rectangles you can which have an area of 44mm^2. What different perimeters did your shapes make?

Perimeters of shapes with an area of 44mm^2:

2. Record the shapes in this table, ordering them so that you are sure that you have found all the squares and rectangles with an area of 44mm^2. (You may not need all the rows in the table).

Side 1	Side 2	Perimeter

3. Find and record all the squares or rectangles you can find with an area of 66mm^2.
(You may not need all the rows in the table).

Side 1	Side 2	Perimeter

4. A rectangle or square with an odd number area (for example, 45cm^2) will always have an even numbered perimeter. Is this correct? Give at least 2 examples to show if this is correct or not. Can you explain why?

_____

Area and Perimeter **Answers**

1. *Perimeters: 90mm, 48mm, 30mm (in any order)*

2.

Side 1	Side 2	Perimeter
44mm	1mm	90mm
22mm	2mm	48mm
11mm	4mm	30mm

or

Side 1	Side 2	Perimeter
1mm	44mm	90mm
2mm	22mm	48mm
4mm	11mm	30mm

or it could also be written the other way:

Side 1	Side 2	Perimeter
11mm	4mm	30mm
22mm	2mm	48mm
44mm	1mm	90mm

or

Side 1	Side 2	Perimeter
4mm	11mm	30mm
2mm	22mm	48mm
1mm	44mm	90mm

3.

Side 1	Side 2	Perimeter
66mm	1mm	134mm
33mm	2mm	70mm
22mm	3mm	50mm
11mm	6mm	34mm

or

Side 1	Side 2	Perimeter
1mm	66mm	134mm
2mm	33mm	70mm
3mm	22mm	50mm
6mm	11mm	34mm

or it could also be written the other way:

Side 1	Side 2	Perimeter
11mm	6mm	34mm
22mm	3mm	50mm
33mm	2mm	70mm
66mm	1mm	134mm

or

Side 1	Side 2	Perimeter
6mm	11mm	34mm
3mm	22mm	50mm
2mm	33mm	70mm
1mm	66mm	134mm

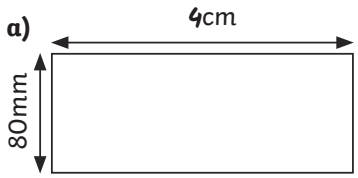
4. *Children give 2 examples where the area has an odd number and the perimeter is even. Explanation shows that the perimeter will always be even, because if you add together the length and the width and multiply it by 2, the answer will always be even. Multiplying by 2 always gives an even multiple.*

1) a) Perimeter = 52cm Area =153cm^2

b) Perimeter = 21m Area = 27 m^2

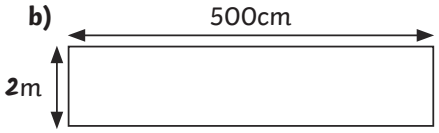
c) Perimeter = 56cm Area = 116.2cm^2

2) a)



Perimeter = 24cm
Area = 32cm^2

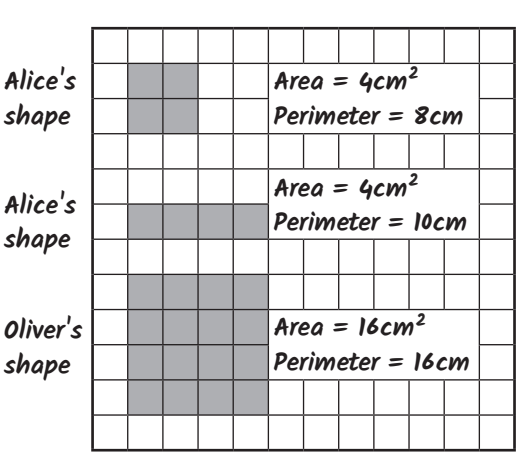
b)



Perimeter = 14m
Area = 10m^2

1) Alice's statement is true. A 2cm × 2cm square will give an area of 4cm^2 and a perimeter of 8cm. A 1cm × 4cm rectangle will give an area of 4cm^2 and a perimeter of 10cm. Shapes with different dimensions are also possible.

Oliver's statement is true. A 4cm × 4cm square will give an area of 16cm^2 and a perimeter of 16cm. Another solution is a 6cm × 3cm rectangle which will give an area of 18 cm^2 and a perimeter of 18cm.



2) a) Ben is partly correct. He is correct in thinking that the area will be three times that of the original square, however, the new shape has four of the original sides inside the shape, therefore its perimeter will not be three times as large as the original square's perimeter.

b) The area of the new shape will be 147cm^2 as
7 × 7 = 49cm^2 and
3 × 49cm^2 = 147cm^2
The new shape has four of the original square's sides inside the shape, therefore its perimeter is 56cm.

1) a) 1m^2 of a fence panel = £20 per m^2

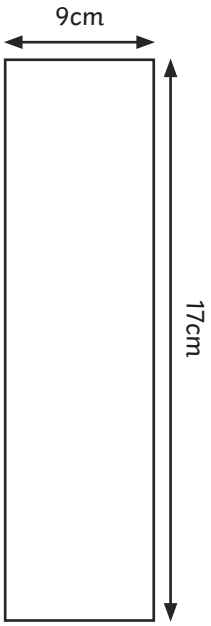
b) 1 metre of the length of wooden frame around the panel = £10 per metre

2) a) £280 = 4m × 2m or 2m × 4m panel

b) £300 = 7m × 1m or 1m × 7m panel or 3m × 3m panel.

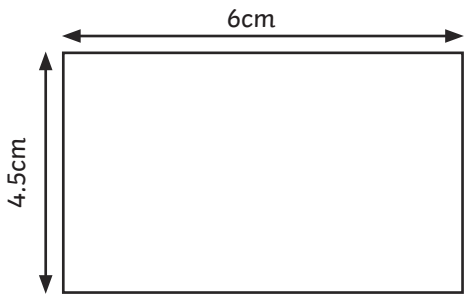
1) Calculate the area and perimeter of the following rectilinear shapes (not to scale).

a)



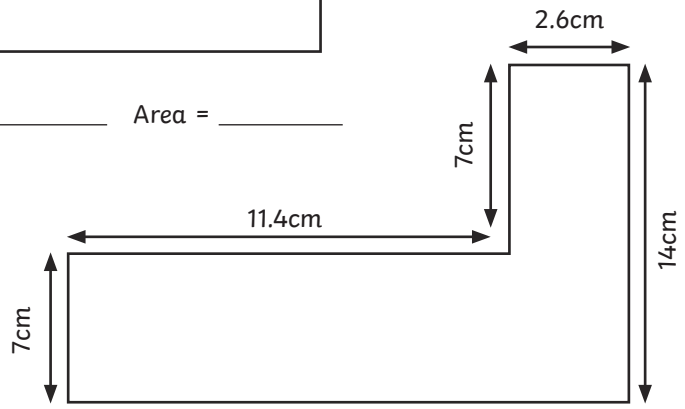
Perimeter = _____ Area = _____

b)



Perimeter = _____ Area = _____

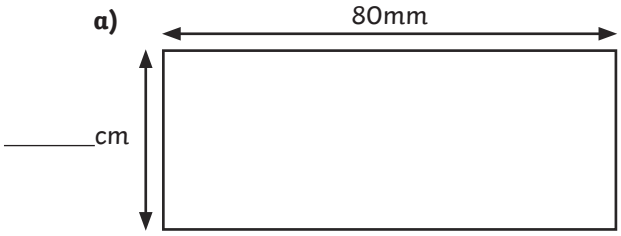
c)



Perimeter = _____ Area = _____

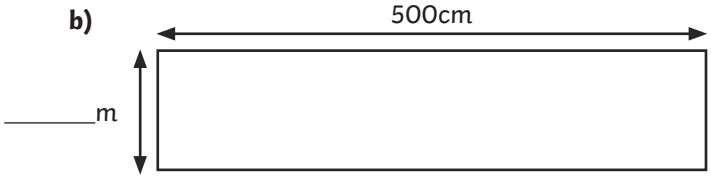
2) Give the missing values for each shape.

a)



Perimeter = _____ Area = 32cm^2

b)



Perimeter = 14m Area = _____m^2

1) Investigate if Alice's and Oliver's statements are true or false by drawing example shapes for each.

Oliver

I can draw a shape with the same perimeter and the same area.

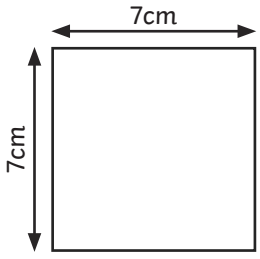
Alice

I can draw two shapes that have an area of $4cm^2$ but different perimeters.

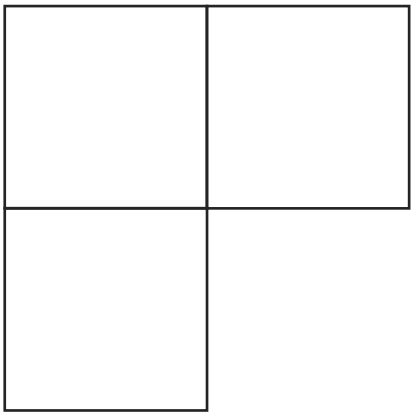
2) Three of these squares are made into a new shape.

Ben

I think that the new shape has an area and perimeter that is three times that of the original square.



a) Do you agree with Ben's statement? What mistake do you think he has made?



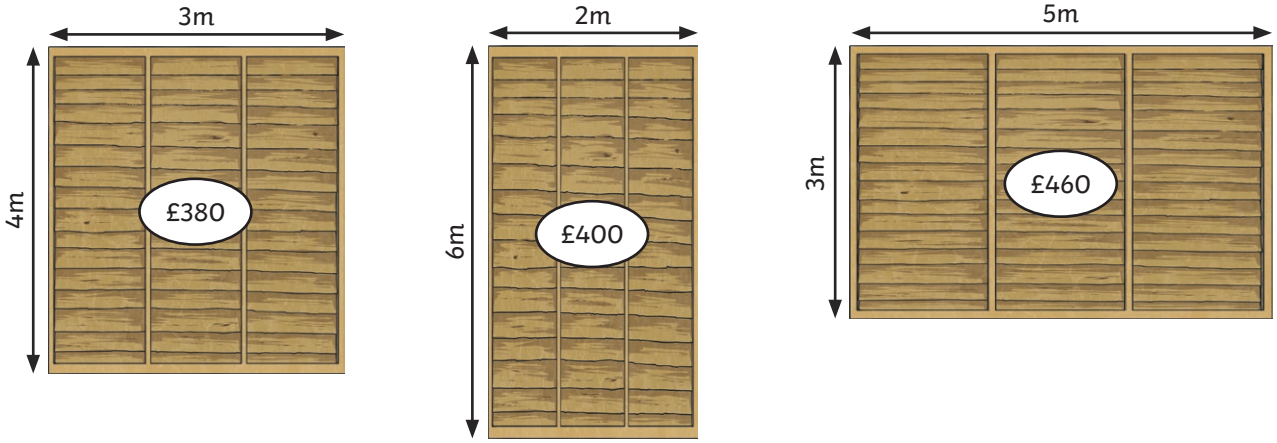
b) Give the area and perimeter of the new shape.

1) A shop sells fence panels with a wooden frame going all the way round each panel. The price of each panel is based on the area of the panel and the length of the wooden frame around the panel.

Use the prices given to investigate how much the shop charges per square metre of the panel and per metre for the wooden frame.

a) Each $1m^2$ of fence panel costs:

b) 1 metre of wooden frame costs:



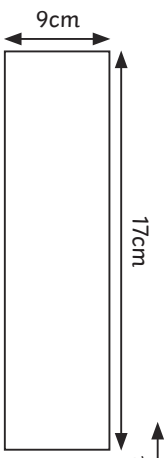
2) Give the size of rectilinear fence panel you could buy from the shop with the following amounts of money. (Remember the shop only sells fence panels which have sides measuring a **whole number** of metres.)

a) £280

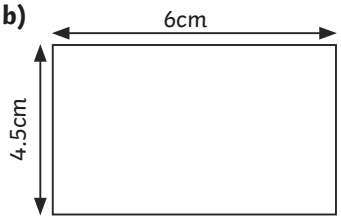
b) £300

1) Calculate the area and perimeter of the following rectilinear shapes (not to scale).

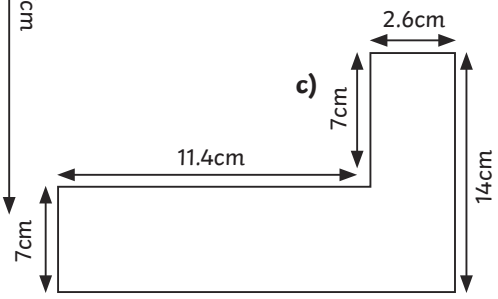
a)



b)

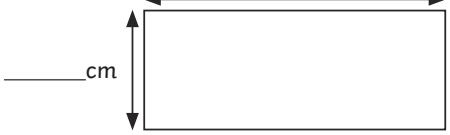


c)



2) Give the missing values for each shape.

a)

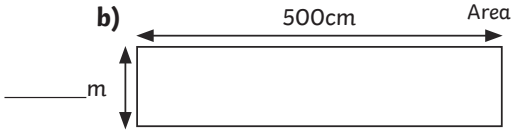


Perimeter = _____

Area = 32cm²

Perimeter = 14m

b)



Area = ____m²

1) Investigate if Alice's and Oliver's statements are true or false by drawing example shapes for each.

Alice

I can draw two shapes that have an area of 4cm² but different perimeters.

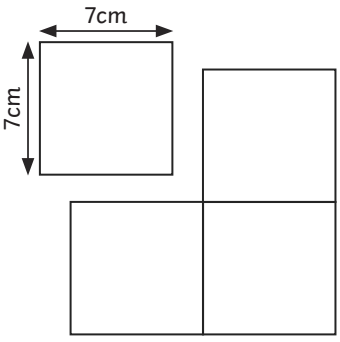
Oliver

I can draw a shape with the same perimeter and the same area.

2) Three of these squares are made into a new shape.

Ben

I think that the new shape has an area and perimeter that is three times that of the original square.

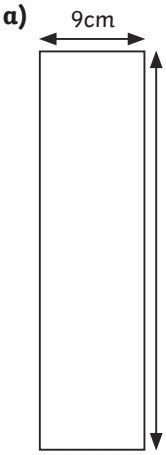


a) Do you agree with Ben's statement? What mistake do you think he has made?

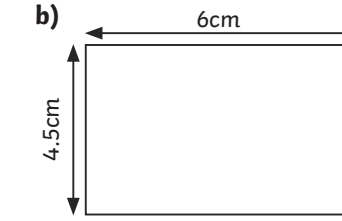
b) Give the area and perimeter of the new shape.

1) Calculate the area and perimeter of the following rectilinear shapes (not to scale).

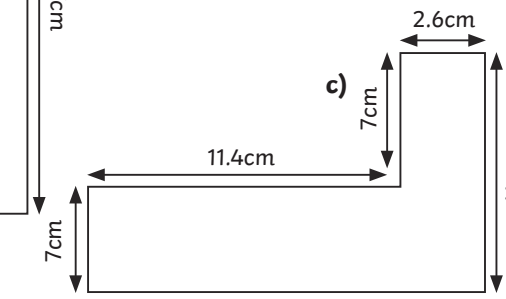
a)



b)

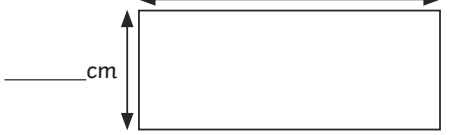


c)



2) Give the missing values for each shape.

a)

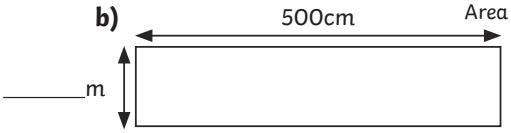


Perimeter = _____

Area = 32cm²

Perimeter = 14m

b)



Area = ____m²

1) Investigate if Alice's and Oliver's statements are true or false by drawing example shapes for each.

Alice

I can draw two shapes that have an area of 4cm² but different perimeters.

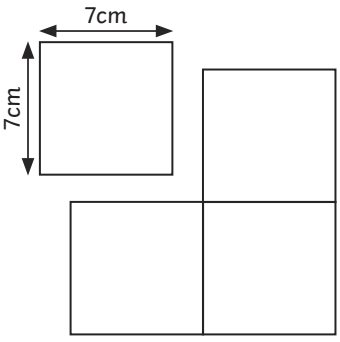
Oliver

I can draw a shape with the same perimeter and the same area.

2) Three of these squares are made into a new shape.

Ben

I think that the new shape has an area and perimeter that is three times that of the original square.



a) Do you agree with Ben's statement? What mistake do you think he has made?

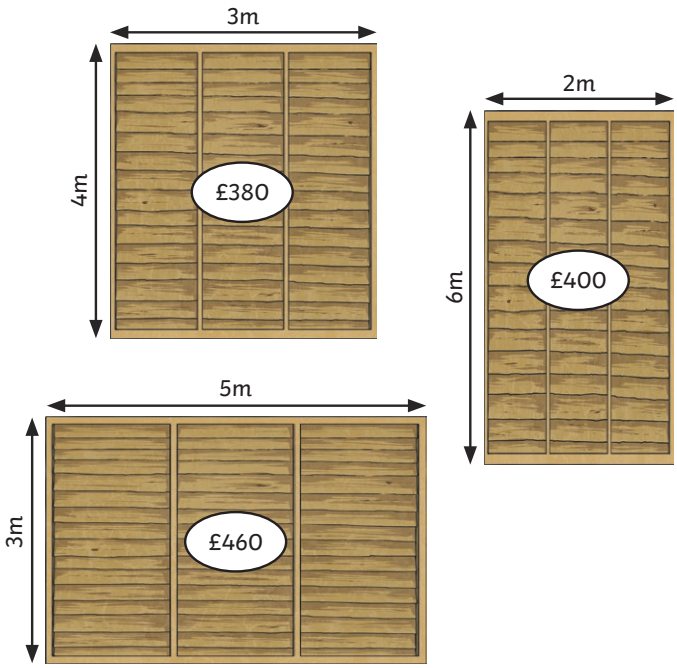
b) Give the area and perimeter of the new shape.

1) A shop sells fence panels with a wooden frame going all the way round each panel. The price of each panel is based on the area of the panel and the length of the wooden frame around the panel.

Use the prices given to investigate how much the shop charges per square metre of the panel and per metre for the wooden frame.

a) Each $1m^2$ of fence panel costs:

b) 1 metre of wooden frame costs:



2) Give the size of rectilinear fence panel you could buy from the shop with the following amounts of money. (Remember the shop only sells fence panels which have sides measuring a **whole number** of metres.)

a) £280

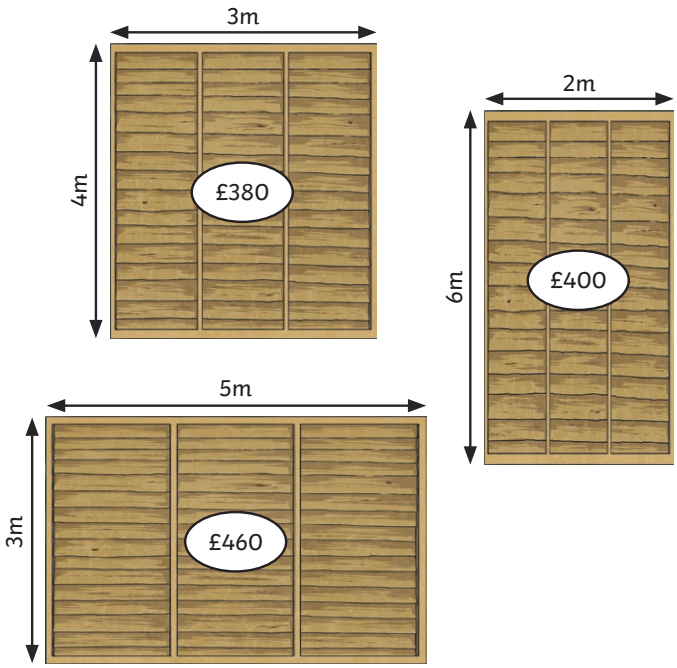
b) £300

A shop sells fence panels with a wooden frame going all the way round each panel. The price of each panel is based on the area of the panel and the length of the wooden frame around the panel.

Use the prices given to investigate how much the shop charges per square metre of the panel and per metre for the wooden frame.

a) Each $1m^2$ of fence panel costs:

b) 1 metre of wooden frame costs:



1) Give the size of rectilinear fence panel you could buy from the shop with the following amounts of money. (Remember the shop only sells fence panels which have sides measuring a **whole number** of metres.)

a) £280

b) £300

Area and Perimeter Using Half Units

I can investigate shapes with the same area but different perimeters.

1. Find and record all the squares or rectangles you can find with an area of 24cm^2. Use both whole and half units for the measurements of sides.

Side 1	Side 2	Perimeter

2. Find and record all the squares or rectangles you can find with an area of 36cm^2. Use both whole and half units for the measurements of sides.

Side 1	Side 2	Perimeter

3. Find and record all the squares or rectangles you can find with an area of 30cm^2.
   Use both whole and half units for the measurements of sides.

Side 1	Side 2	Perimeter

Area and Perimeter Using Half Units

Answers

1.

Side 1	Side 2	Perimeter
48cm	0.5cm	97cm
24cm	1cm	50cm
16cm	1.5cm	35cm
12cm	2cm	28cm
8cm	3cm	22cm
6cm	4cm	20cm

2.

Side 1	Side 2	Perimeter
0.5cm	72cm	145cm
1cm	36cm	74cm
1.5cm	24cm	51cm
2cm	18cm	40cm
3cm	12cm	30cm
4cm	9cm	26cm
4.5cm	8cm	25cm
6cm	6cm	24cm

3.

Side 1	Side 2	Perimeter
0.5cm	60cm	121cm
1cm	30cm	62cm
1.5cm	20cm	43cm
2cm	15cm	34cm
2.5cm	12cm	29cm
3cm	10cm	26cm
5cm	6cm	22cm
7.5cm	4cm	23cm

Measurement | Same Area, Different Perimeter

I can find shapes with the same area but different perimeters.		
I can find squares and rectangles which have the same area.		
I can organise my results to ensure I have found all possible variations.		

Measurement | Same Area, Different Perimeter

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