White Rose Maths

Perimeter & Area

Overview

Small Steps

Notes for 2020/21

Measure perimeter

Perimeter on a grid (R)

Perimeter of rectangles (R)

Perimeter of rectilinear shapes (R)

Calculate perimeter

Counting squares (R)

Area of rectangles

Area of compound shapes

Area of irregular shapes

A recap of key learning from Year 4 may be useful here.

It is important that children understand perimeter and area on a grid before moving on to shapes with just side lengths marked.

Measure Perimeter

Notes and Guidance

Children measure the perimeter of rectilinear shapes from diagrams without grids.

They will recap measurement skills and recognise that they need to use their ruler accurately in order to get the correct answer.

They could consider alternative methods when dealing with rectangles e.g. $l + w + l + w$ or $(l \times w) \times 2$

Mathematical Talk

What is perimeter of a shape?

What's the same/different about these shapes?
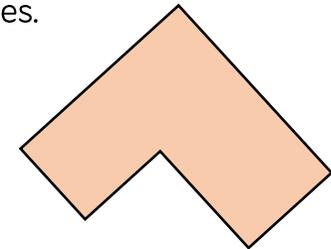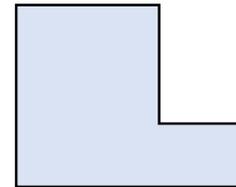
Do we need to measure every side?

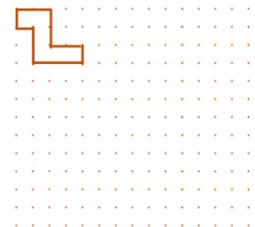Once we have measured each side, how do we calculate the perimeter?

Varied Fluency

Measure the perimeter of the rectangles.

Measure the perimeter of the shapes.

Make this shape double the size using dot paper.
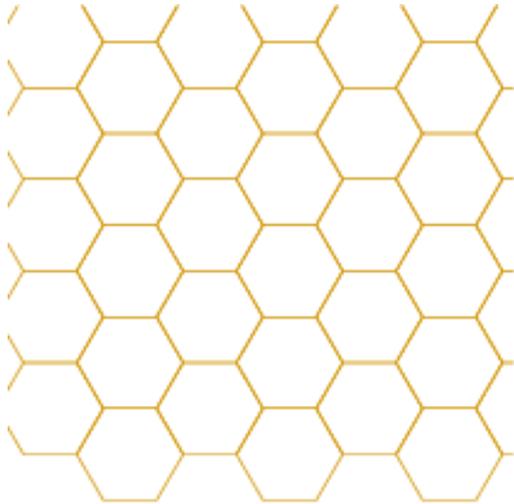
Measure the perimeter of both shapes.

What do you notice about the perimeter of the larger one? Why?
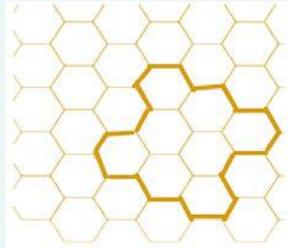
3

Measure Perimeter

Reasoning and Problem Solving

Each regular hexagon has a side length of 2 cm

Can you construct a shape with a perimeter of 44 cm?

Possible answer:

Discuss how many sides the shape must have with the children. Encourage their reasoning that there must be 22 2 cm sides to make a total perimeter of 44 cm.

Activity

Investigate different ways you can make composite rectilinear shapes with a perimeter of 54 cm.

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Perimeter on a Grid

Notes and Guidance

Children calculate the perimeter of rectilinear shapes by counting squares on a grid. Rectilinear shapes are shapes where all the sides meet at right angles.

Encourage children to label the length of each side and to mark off each side as they add the lengths together. Ensure that children are given centimetre squared paper to draw the shapes on to support their calculation of the perimeter.

Mathematical Talk

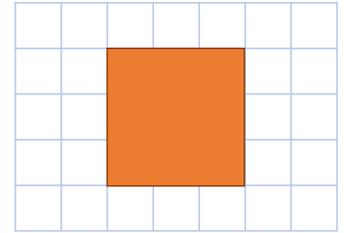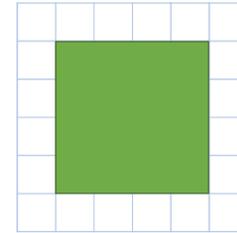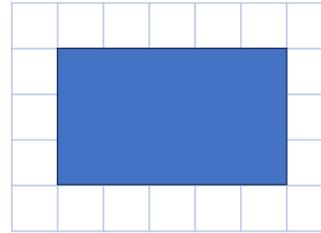What is perimeter? How can we find the perimeter of a shape?

What do you think rectilinear means? Which part of the word sounds familiar?

If a rectangle has a perimeter of 16 cm, could one of the sides measure 14 cm? 8 cm? 7 cm?
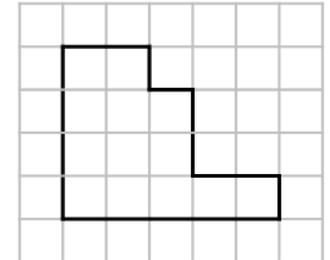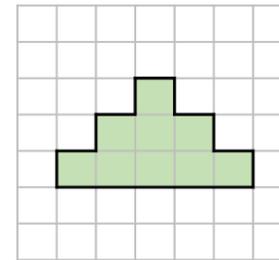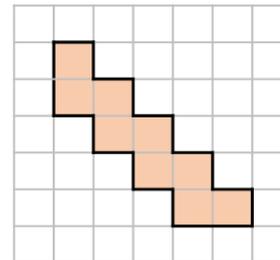
Varied Fluency

Calculate the perimeter of the shapes.

Using squared paper, draw two rectilinear shapes, each with a perimeter of 28 cm.
What is the longest side in each shape? What is the shortest side in each shape?
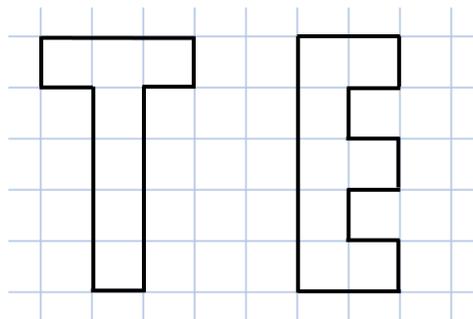
Draw each shape on centimetre square paper.

Order the shapes from smallest to largest perimeter.

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Perimeter on a Grid

Reasoning and Problem Solving

Which of these shapes has the longest perimeter?

Explore other letters which could be drawn as rectilinear shapes.

Put them in order of shortest to longest perimeter.

Can you make a word?

E has a greater perimeter, it is 18 compared to 16 for T.
Open ended.
Letters which could be drawn include:
B C D F I J L
O P
Letters with diagonal lines would be omitted.
If heights of letters are kept the same, I or L could be the shortest.
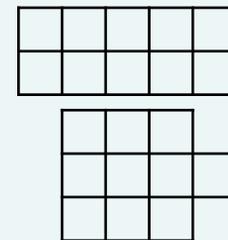
You have 10 paving stones to design a patio. The stones are one metre square.

The stones must be joined to each other so that at least one edge is joined corner to corner.
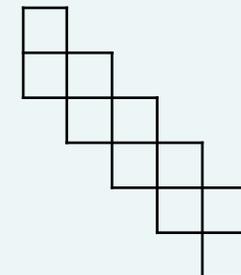

Use squared paper to show which design would give the longest perimeter and which would give the shortest.

The shortest perimeter would be 14 m in a 2 × 5 arrangement or 3 × 3 square with one added on.

The longest would be 22 m.

Perimeter of a Rectangle

Notes and Guidance

Children calculate the perimeter of rectangles (including squares) that are not on a squared grid. When given the length and width, children explore different approaches of finding the perimeter: adding all the sides together, and adding the length and width together then multiplying by 2
Children use their understanding of perimeter to calculate missing lengths and to investigate the possible perimeters of squares and rectangles.

Mathematical Talk

If I know the length and width of a rectangle, how can I calculate the perimeter? Can you tell me 2 different ways? Which way do you find the most efficient?

If I know the perimeter of a shape and the length of one of the sides, how can I calculate the length of the missing side?

Can a rectangle where the length and width are integers, ever have an odd perimeter? Why?

Varied Fluency

Calculate the perimeter of the rectangles.

2 cm
5 cm

10 cm
4 cm

8 cm
8 cm

___ cm + ____ cm + ___ cm + ____ cm = ____ cm

Eva is finding the perimeter of the rectangle.

I added the length and width together and then multiplied by 2

5 cm
10 cm

5 cm + 10 cm = 15 cm
15 cm × 2 = 30 cm

Use Eva's method to find the perimeter of the rectangles.

6 m
16 m

9 cm
9 cm

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Perimeter of a Rectangle

Reasoning and Problem Solving

R

The width of a rectangle is 2 metres less than the length.
The perimeter of the rectangle is between 20 m and 30 m.
What could the dimensions of the rectangle be?
Draw all the rectangles that fit these rules.
Use 1 cm = 1 m.

If the perimeter is:
20 m
Length = 6 m
Width = 4 m
24 m
Length = 7 m
Width = 5 m
28 m
Length = 8 m
Width = 6 m

Each of the shapes have a perimeter of 16 cm.
Calculate the lengths of the missing sides.

? cm

4 cm

? cm

2 cm

4 cm

---

4 cm

6 cm

Always, Sometimes, Never

When all the sides of a rectangle are odd numbers, the perimeter is even.
Prove it.

Always because when adding an odd and an odd they always equal an even number.

Here is a square. Each of the sides is a whole number of metres.
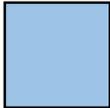
Which of these lengths could be the perimeter of the shape?
24 m, 34 m, 44 m, 54 m, 64 m, 74 m

Why could the other values not be the perimeter?

24 cm

Sides = 6 cm

44 cm

Sides = 11 cm

64 cm

Sides = 16 cm

They are not divisible by 4

Perimeter of Rectilinear Shapes

Notes and Guidance

Children will begin to calculate perimeter of rectilinear shapes without using squared paper. They use addition and subtraction to calculate the missing sides. Teachers may use part-whole models to support the understanding of how to calculate missing sides.
Encourage children to continue to label each side of the shape and to mark off each side as they calculate the whole perimeter.

Mathematical Talk

Why are opposite sides important when calculating the perimeter of rectilinear shapes?

If one side is 10 cm long, and the opposite side is made up of two lengths, one of which is 3 cm, how do you know what the missing length is? Can you show this on a part-whole model?

If a rectilinear shape has a perimeter of 24 cm, what is the greatest number of sides it could have? What is the least number of sides it could have?
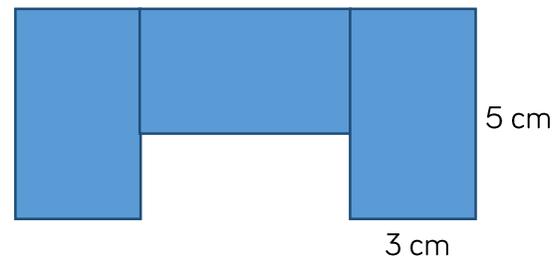
Varied Fluency

Find the perimeter of the shapes.

4 cm

4 cm

8 cm

4 cm

10 cm

3 cm

5 cm

3 cm
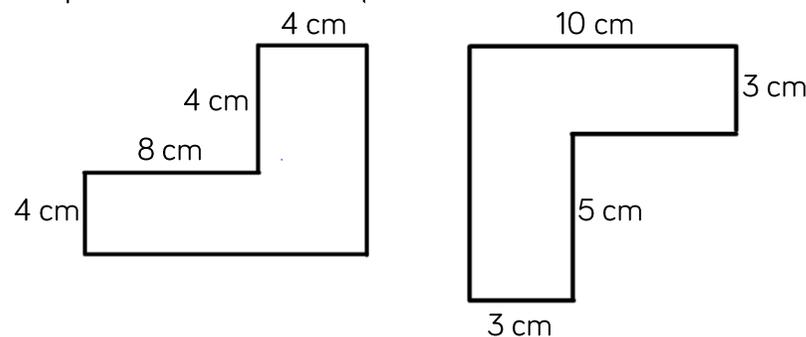
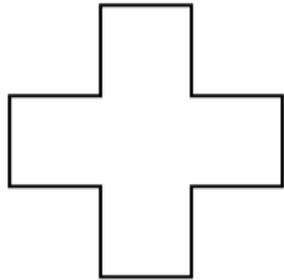The shape is made from 3 identical rectangles. Calculate the perimeter of the shape.

5 cm

3 cm

How many different rectilinear shapes can you draw with a perimeter of 24 cm? How many sides do they each have? What is the longest side? What is the shortest side?

Perimeter of Rectilinear Shapes

Reasoning and Problem Solving

Here is a rectilinear shape. All the sides are the same length and are a whole number of centimetres.

Which of these lengths could be the perimeter of the shape?

48 cm, 36 cm, 80 cm, 120 cm, 66 cm

Can you think of any other answers which could be correct?

48 cm, 36 cm or 120 cm as there are 12 sides and these numbers are all multiples of 12

Any other answers suggested are correct if they are a multiple of 12

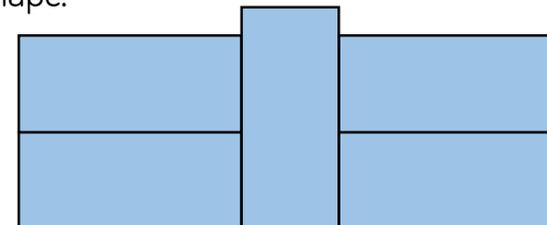Amir has some rectangles all the same size.

3 cm

8 cm
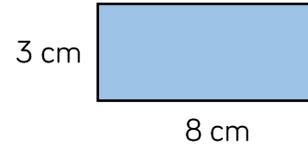
He makes this shape using his rectangles. What is the perimeter?
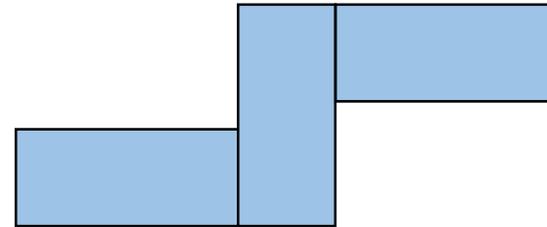
54 cm

He makes another shape using the same rectangles. Calculate the perimeter of this shape.

54 cm

Calculate Perimeter

Notes and Guidance

Children apply their knowledge of measuring and finding perimeter to find the unknown side lengths.

They find the perimeter of shapes with and without grids.

When calculating perimeter of shapes, encourage children to mark off the sides as they add them up to prevent repetition of counting/omission of sides.

Mathematical Talk

What can you tell me about the sides of a square/rectangle? How does this help you work out this question?
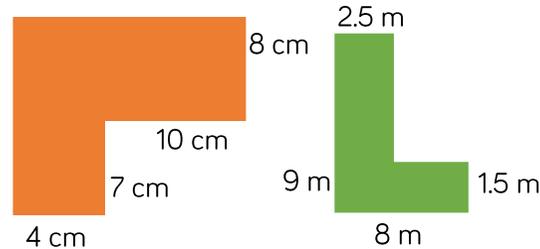
How can you use the labelled sides to find the length of the unknown sides?

What strategies can you use to calculate the total perimeter?

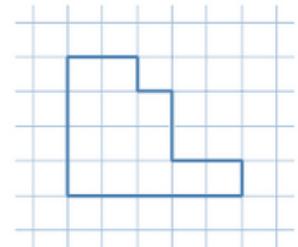What does regular mean? Why are rectangles irregular?

Varied Fluency

Find the perimeter of the following shapes.

8 cm
10 cm
7 cm
4 cm

2.5 m
9 m   1.5 m
8 m

$8\frac{3}{4}$ cm
12 cm
19 cm
16 cm

Each square has an area of 4 square cm.

What is the length of each square?
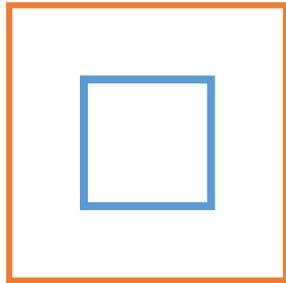
What is the perimeter of the whole shape?

How many _____ can you draw with a perimeter of ___ cm? e.g. rectangles, other rectilinear shapes.

How many regular shapes can you make with a perimeter of ___ cm?

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Calculate Perimeter

Reasoning and Problem Solving

Here is a square inside another square.

The perimeter of the inner square is 16 cm

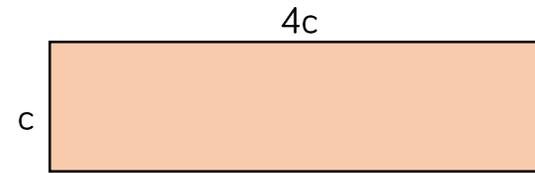The outer square's perimeter is four times the size of the inner square.

What is the length of one side of the outer square?

How do you know? What do you notice?

Small square = 16 cm

Large square = 64 cm

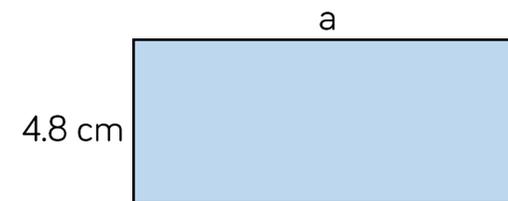Length of one of the outer sides is 8 cm, because 64 is a square number.

4c

c

The value of c is 14 m.
What is the total perimeter of the shape?

$4c + 4c + c + c$
$= 10c$

$10 \times 14 = 140$ m

---

a

4.8 cm

The blue rectangle has a perimeter of 38 cm.
What is the value of a?

Total perimeter = 38 cm

$38 - (4.8 + 4.8)$
$= 28.4$

So 28.4 divided by 2 = 14.2 cm

12

Counting Squares

Notes and Guidance

Once children understand that area is measured in squares, they use the strategy of counting the number of squares in a shape to measure and compare the areas of rectilinear shapes.

They explore the most efficient method of counting squares and link this to their understanding of squares and rectangles.

Mathematical Talk

What strategy can you use to ensure you don't count a square twice?
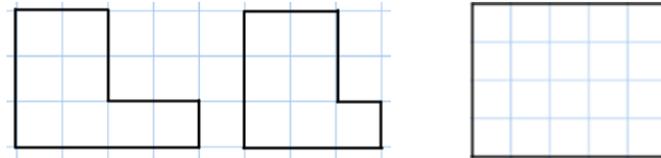
Which colour covers the largest area of the quilt?
Which colour covers the smallest area of the quilt?

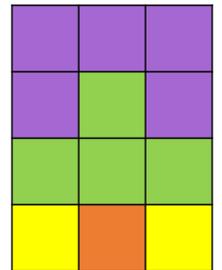Will Jack's method work for every rectilinear shape?

Varied Fluency

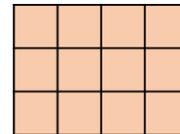Complete the sentences for each shape.

The area of the shape is ____ squares.

Here is a patchwork quilt.
It is made from different coloured squares.
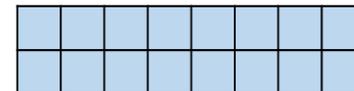Find the area of each colour.

Purple = ___ squares   Green = ___ squares
Yellow = ___ squares   Orange = ___ squares

Jack uses his times-tables to count the squares more efficiently.

There are 4 squares in 1 row.
There are 3 rows altogether.
3 rows of 4 squares = 12 squares

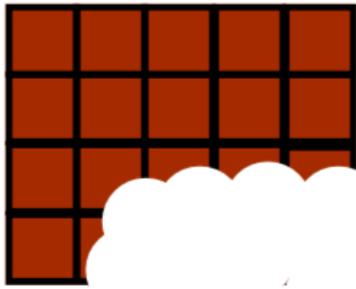Use Jack's method to find the area of this rectangle.

Counting Squares

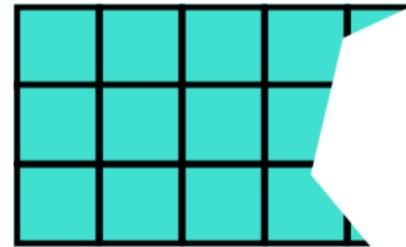## Reasoning and Problem Solving

Dexter has taken a bite of the chocolate bar.

The chocolate bar was a rectangle. Can you work out how many squares of chocolate there were to start with?

There were 20 squares. You know this because two sides of the rectangle are shown.

This rectangle has been ripped.

What is the smallest possible area of the original rectangle?

What is the largest possible area if the length of the rectangle is less than 10 squares?

Smallest area – 15 squares.

Largest area – 30 squares.

Area of Rectangles

Notes and Guidance

Children build on previous knowledge in Year 4 by counting squares to find the area. They then move on to using a formula to find the area of rectangles.

Is a square a rectangle? This would be a good discussion point when the children are finding different rectangles with a given area. For example, a rectangle with an area of 36 cm² could have four equal sides of 6 cm.

Mathematical Talk

What properties of these shapes do you need to know to help you work this out?

What can you tell me about the sides of a square/rectangle? How does this help you work out this question?

Will the formula 'Area = length × width' work for any shape, or only squares and rectangles?

Varied Fluency

🟦 How many rectangles can you draw with an area of ____ cm²?

🟦 What is the area of this shape if:

- each square is 2 cm in length?

- each square is 3.5 cm in length?
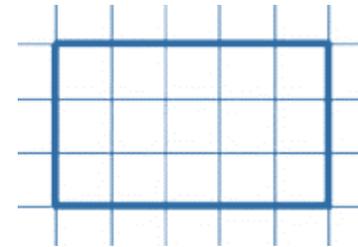
🟦 Mo buys a house with a small back garden, which has an area of 12 m².
His house lies in a row of terraces, all identical.
If there are 15 terraced houses altogether, what is the total area of the garden space?
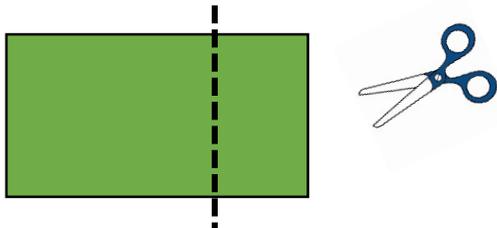
Area of Rectangles

Reasoning and Problem Solving

Investigate how many ways you can make different squares and rectangles with the same area of 84 cm^2
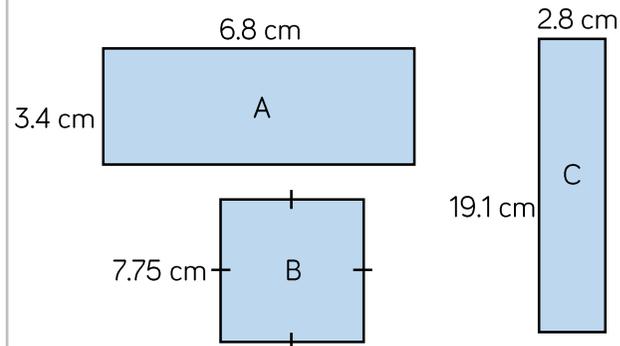What strategy did you use?
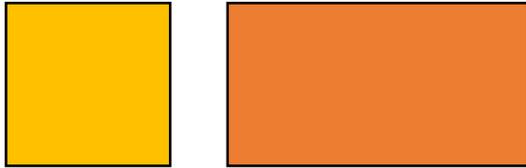
True or False?

If you cut off a piece from a shape, you reduce its area and perimeter.
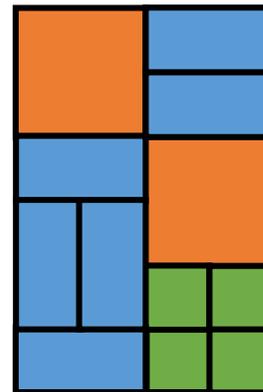Draw 2 examples to prove your thinking.

True

6.8 cm

3.4 cm — A

2.8 cm

C

19.1 cm

7.75 cm — B

Estimate the area of each shape and then order from largest to smallest.

Answer: A = 3cm × 7cm = 21cm²
B = 8cm × 8cm = 64cm
C = 3cm × 19cm = 57cm²

Order: B, C, A

Each orange square has an area of 24 cm².
Calculate the total orange area.
Calculate the blue area.
Calculate the green area.
What is the total area of the whole shape?

Answer:

Orange = 48 cm^2

Blue = 72 cm^2

Green = 24 cm^2

Total = 144 cm^2

Area of Compound Shapes

Notes and Guidance

Children learn to calculate area of compound shapes. They need to be careful when splitting shapes up to make sure they know which lengths correspond to the whole shape, and which to the smaller shapes they have created. They will discover that the area remains the same no matter how you split up the shapes.

Children need to have experience of drawing their own shapes in this step.

Mathematical Talk

What formula do we use to find the area of a rectangle?

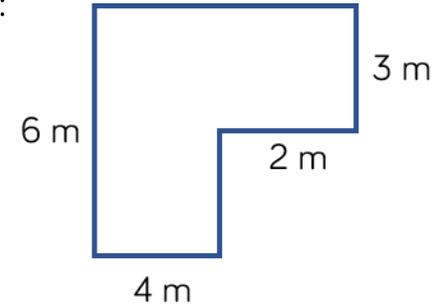Can you see any rectangles within the compound shapes?

How can we split the compound shape?
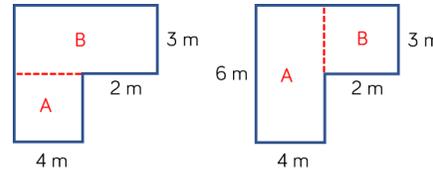
Is there more than one way?

Do we get a different answer if we split the shape differently?

Varied Fluency

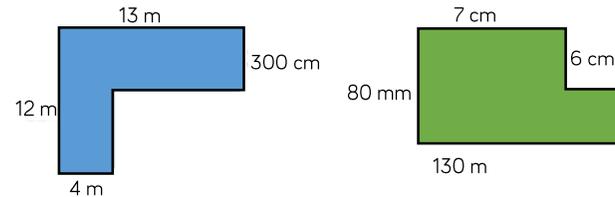Find the area of the compound shape: How many ways can we split the compound shape? Is there more than one way?
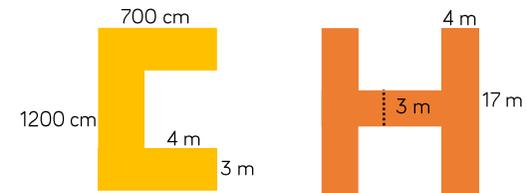
Could we multiply $6 m \times 6 m$ and then subtract $2 m \times 3 m$?
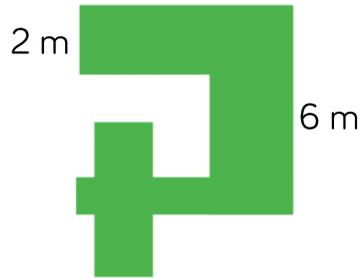
Calculate the area.

Calculate the area of these symmetrical shapes.

Area of Compound Shapes

Reasoning and Problem Solving

How many different ways can you split this shape to find the area?

2 m

6 m

Add more values and work out the area.
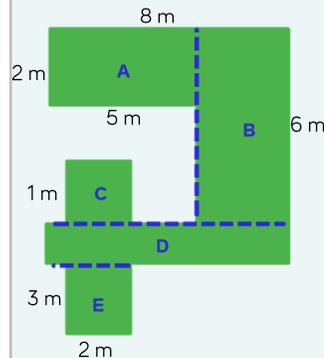
Possible solution:

$A = 2\,m \times 5\,m$
$= 10\,m^2$
$B = 6\,m \times 3\,m$
$= 18\,m^2$
$C = 1\,m \times 2\,m$
$= 2\,m^2$
$D = 1\,m \times 8\,m$
$= 8\,m^2$
$E = 3\,m \times 2\,m$
$= 6m^2$
Total area $= 36m^2$

8 m

2 m | A

5 m

B | 6 m

1 m | C

D

3 m | E

2 m

Jack says this shape has an area of $34\,cm^2$.

2 cm

5 cm

8 cm

6 cm

4 cm

2 cm
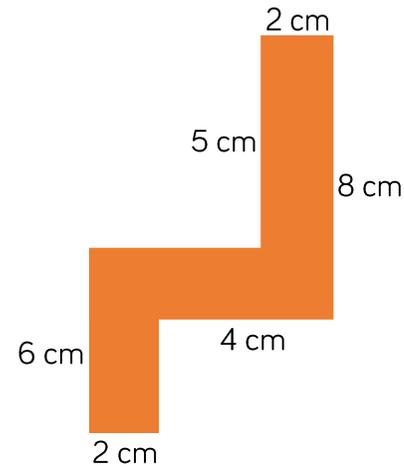
Show that Jack is correct.

Find three more possible compound shapes that have an area of $34\,cm^2$.

Possible solution:

8 cm

6 cm

4 cm

2 cm

2 cm

18
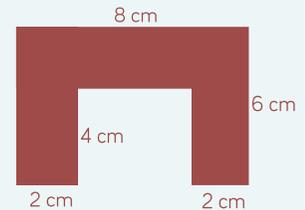
Area of Irregular Shapes

Notes and Guidance

Children use their knowledge of counting squares to estimate the areas of shapes that are not rectilinear. They use their knowledge of fractions to estimate how much of a square is covered and combine different part-covered squares to give an overall approximate area.

Children need to physically annotate to avoid repetition when counting the squares.

Mathematical Talk

How many whole squares can you see?

How many part squares can you see?

Can you find any part squares that you could be put together to make a full square?

What will we do with the parts?
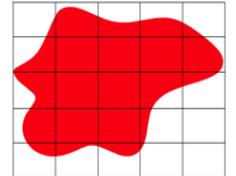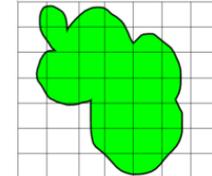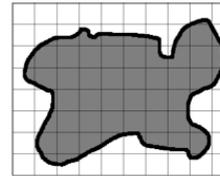
What does approximate mean?

Varied Fluency

Estimate the area of the pond.
Each square = 1 m²

Ron's answer is 4 whole squares and 11 parts.
Is this an acceptable answer?
What can we do with the parts to find an approximate answer?

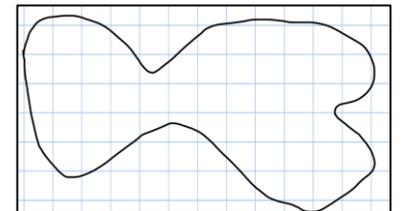If all of the squares are 1 cm in length, which shape has the greatest area?

Is the red shape the greatest because it fills more squares?
Why or why not?
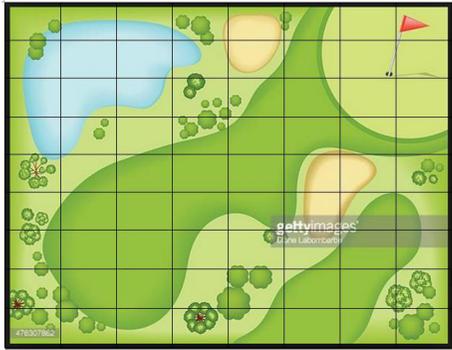What is the same about each image? What is different about the images?

Each square is ____ m²
Work out the approximate area of the shape.

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Area of Irregular Shapes

Reasoning and Problem Solving

Draw a circle on 1 cm² paper. What is the estimated area?

Can you draw a circle that has area approximately 20 cm²?

If each square represents 3 m², what is the approximate area of:

- The lake
- The bunkers
- The fairway
- The rough
- Tree/forest area

Can you construct a 'Pirate Island' to be used as part of a treasure map for a new game? Each square represents 4 m².

The island must include the following features and be of the given approximate measure:

- Circular Island 180 m²
- Oval Lake 58 m²
- Forests with a total area of 63 m² (can be split over more than one space)
- Beaches with a total area of 92 m² (can be split over more than one space)
- Mountains with a total area of 57 m²
- Rocky coastline with total area of 25 m²

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