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Year 6

Small Steps Guidance and Examples

Block 5: Perimeter, Area & Volume



Year 6 – Yearly Overview

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	Number- Place Value		Number- Addition, Subtraction, Multiplication and Division				Fractions				Geometry- Position and Direction	Consolidation
Spring	Number- Decimals		Number- Percentages		Number- Algebra		Measurement Converting units	Measurement Perimeter, Area and Volume		Number- Ratio		Consolidation
Summer	Geometry- Properties of Shapes		Problem solving			Statistics		Investigations				Consolidation

Overview

Small Steps

Shapes – same area

Area and perimeter

Area of a triangle (1)

Area of a triangle (2)

Area of a triangle (3)

Area of a parallelogram

Volume – counting cubes

Volume of a cuboid

NC Objectives

Recognise that shapes with the same areas can have different perimeters and vice versa.

Recognise when it is possible to use formulae for area and volume of shapes.

Calculate the area of parallelograms and triangles.

Calculate, estimate and compare volume of cubes and cuboids using standard units, including cm^3 , m^3 and extending to other units (mm^3 , km^3)

Shapes – Same Area

Notes and Guidance

Children will find and draw rectilinear shapes that have the same area.

Children will use their knowledge of factors to draw rectangles with different areas. They will use their knowledge of factors to then predict the length of sides.

Mathematical Talk

What do we need to know in order to work out the area of a shape?

Why is it useful to know your times tables when calculating area?

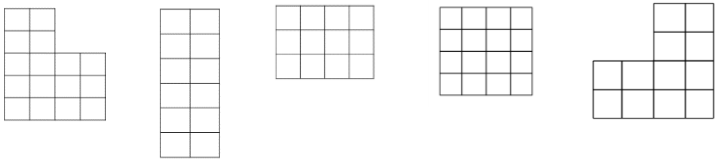
Can you have a square with an area of 48 cm²? Why?

How can factors help us draw rectangles with a specific area?

Varied Fluency

1 Sort the shapes into the Carroll diagram.

	Quadrilateral	Not a quadrilateral
Area of 12 cm ²		
Area of 16 cm ²		



Can you draw an extra shape in each section of the diagram?

2 How many rectangles can you draw with an area of 24 cm²?

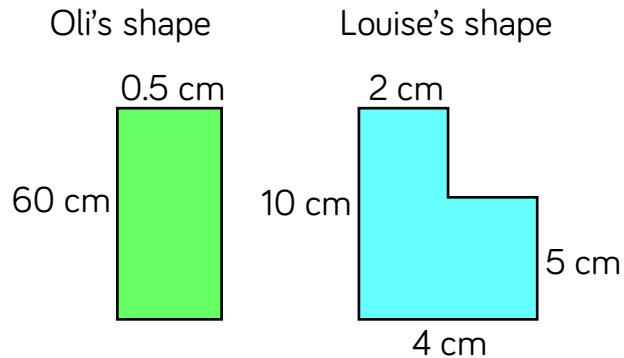
What do you notice about the lengths of their sides?

Can you use this information to calculate the lengths of sides for rectangles with an area of 96 cm²?

Shapes – Same Area

Reasoning and Problem Solving

Louise and Oli have are drawing shapes with an area of 30cm^2



Who is correct?

Explain your reasoning.

Both are correct.

Oli's shape

$$60\text{ cm} \times 0.5\text{ cm} = 30\text{ cm}^2$$

Louise's shape

$$2\text{ cm} \times 10\text{ cm} = 20\text{ cm}^2$$

$$5\text{ cm} \times 2\text{ cm} = 10\text{ cm}^2$$

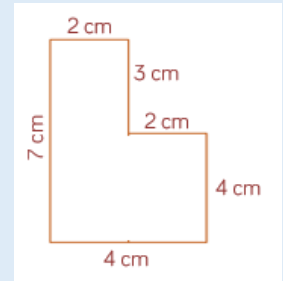
$$20\text{ cm}^2 + 10\text{ cm}^2 = 30\text{ cm}^2$$

Three children are given the same shape to draw.

Kate says, "The smallest length is 2 cm."
Lucy says, "The area is less than 30 cm^2 "
Ash says, "The perimeter is 22 cm."

What could the shape be?

Possible answer:



Area and Perimeter

Notes and Guidance

Children should use a formula to work out the area and perimeter of rectilinear shapes.

Children explore that shapes with the same area can have the same or different perimeters.

Mathematical Talk

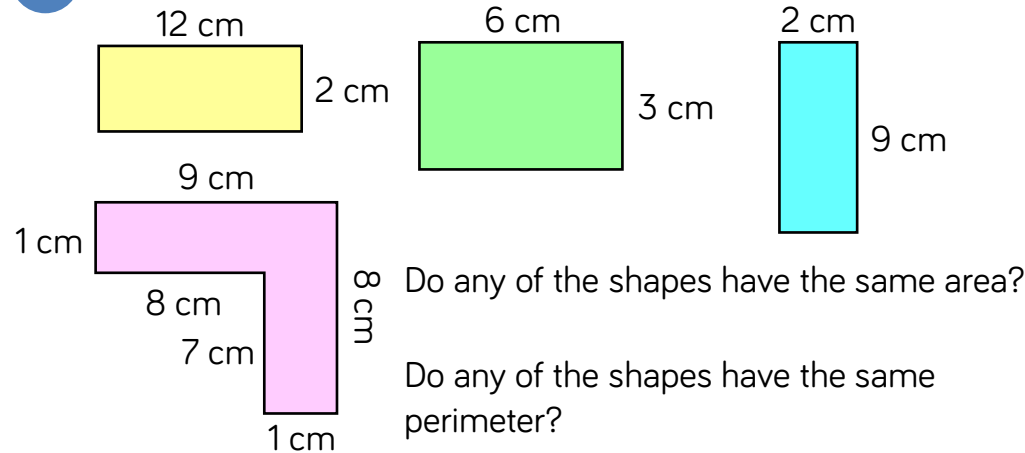
What is the difference between the area and perimeter of a shape?

How do we work out the area and perimeter of shapes?
Can you show this as a formula?

Can you have 2 rectangles with an area of 36 cm^2 but different perimeters?

Varied Fluency

1 Look at the shapes below.



2 Work out the missing values.



3 Draw two rectilinear shapes that have an area of 36 cm^2 but have a different perimeter.

State what the perimeter of each shape is.

Area and Perimeter

Reasoning and Problem Solving

True or false?

Two rectangles with the same perimeter can have different areas.

Explain your answer.

True e.g.

5 cm by 3 cm has an area of 15 cm^2 and a perimeter of 16 cm.

6 cm by 2 cm has an area of 12 cm^2 and a perimeter of 16 cm.

A farmer has 60 metres of perimeter fencing.

For every 1 m^2 he can keep 1 chicken.



How can he arrange his fence so that the enclosed area gives him the greatest area?

The greatest area is created when the fencing is arranged into a 15 m by 15 m square, giving 225 m^2

Children may create rectangles by increasing one side by 1 unit and decreasing one side by 1 unit e.g.

$$16 \text{ m} \times 14 \text{ m} = 224 \text{ m}^2$$
$$17 \text{ m} \times 13 \text{ m} = 221 \text{ m}^2$$

Area of a Triangle (1)

Notes and Guidance

Children will use their previous knowledge of approximating and estimating to work out the area of different triangles by counting.

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

Children will begin to see the link between the area of a triangle and the area of a rectangle or square.

Mathematical Talk

How many whole squares can you see?

How many part squares can you see?

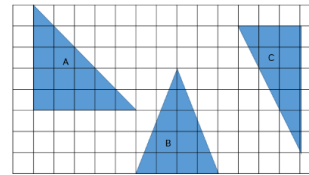
What will we do with the parts?

What does approximate mean?

Why will this be useful when working out the area of a triangle?

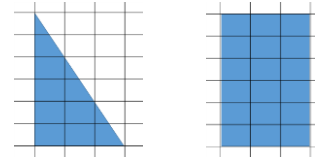
Varied Fluency

- 1 How could you calculate the area of each triangle?



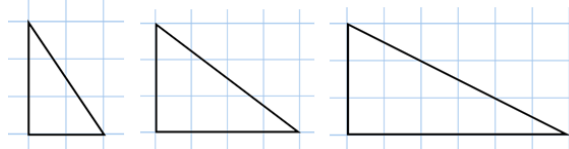
Which triangle has the largest area?

- 2 Calculate the area of the shapes by counting the squares.



What do you notice about the area of the triangle and the area of the rectangle?

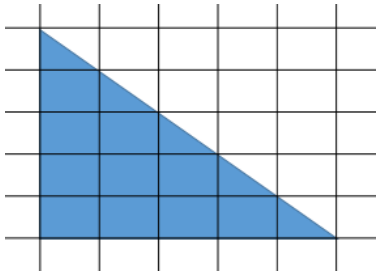
- 3 Find the area of each triangle.



Can you draw and calculate the area of the next triangle in the sequence?

Area of a Triangle (1)

Reasoning and Problem Solving



Simon says the area of this triangle is 13cm^2

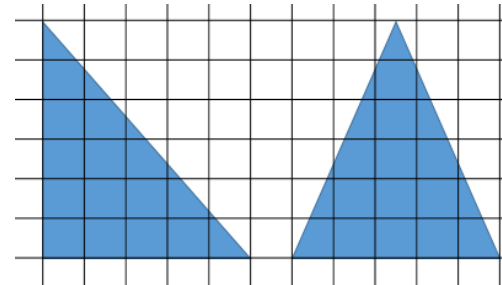
Is Simon correct?

If not, work out the correct answer and explain his mistake.

There are 10 whole squares and 5 half squares, therefore the correct answer is 12.5 cm^2 . Simon has gone wrong because he has worked out that the 5 half squares make 3 whole squares instead of 2 and a half.

What is the same about these two triangles?

What is different?



Can you create a different right angled triangle with the same area?

Both triangles have an area of 15 cm^2

The triangle on the left is a right angled triangle and the triangle on the right is an isosceles triangle.

Children could draw a triangle with a height of 10 cm and a base of 3 cm, or a height of 15 cm and a base of 2 cm.

Area of a Triangle (2)

Notes and Guidance

Children use their knowledge of finding the area of a rectangle to find the area of a right-angled triangle. They see that a right-angled triangle with the same length and perpendicular height as a rectangle will have an area half the size.

Using the link between the area of a rectangle and a triangle, children will learn and use the formula to calculate the area of a triangle.

Mathematical Talk

What is the relationship between the area of a rectangle and the area of a right-angled triangle?

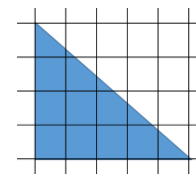
What is the formula for working out the area of a rectangle or square?

How can you use this formula to work out the area of a right-angled triangle?

Varied Fluency

- 1 Calculate the area of the triangle by counting the squares. Make the triangle into a rectangle with the same height and width, and calculate the area of the rectangle.

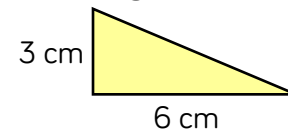
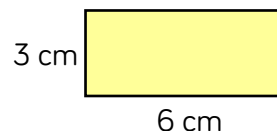
Complete: The area of the triangle is _____ the area of the rectangle.



- 2 If l represents length and h represents height:

$$\text{Area of a rectangle} = l \times h$$

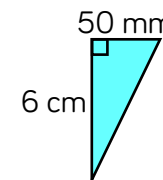
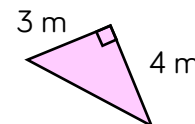
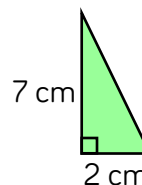
Use this to calculate the area of the rectangle.



What do you need to do to your answer to work out the area of the triangle?

Therefore, what is the formula for the area of a triangle?

- 3 Calculate the area of the triangles.



Area of a Triangle (2)

Reasoning and Problem Solving

Jade is calculating the area of a right-angled triangle.

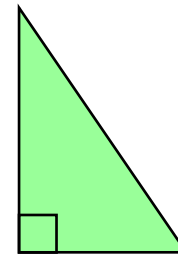


I only need to know the length of two sides to calculate the area of a triangle.

Do you agree with Jade? Explain your answer.

Jade is correct as long as the two sides you have been given are the base and the height of the triangle.

Children should give an example to show when they do need two sides, and when they need more information.



$$\text{Area} = 54 \text{ cm}^2$$

What could the length and the height of the triangle be?

Is this the only possibility?

Try to think of at least three ways.

Possible answers:

Height: 18 cm
Base: 6 cm

Height: 27 cm
Base: 4 cm

Height: 12 cm
Base: 9 cm

Area of a Triangle (3)

Notes and Guidance

Children will use their knowledge of working out the area of a right-angled triangle to work out the area of any triangle.

They use the formula, $\text{base} \times \text{height} \div 2$ to calculate the area of a variety of triangles where different side lengths are given and where more than one triangle make up a shape.

Mathematical Talk

What formula can you use to calculate the area of a triangle?

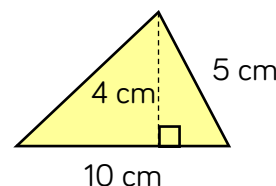
If there is more than one triangle making up a shape, how can we use the formula to find the area of the whole shape?

How do we know which length tells us the height of the triangle?

Varied Fluency

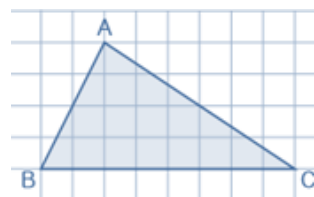
- 1 To calculate the height of a triangle, you can use the formula:
 $\text{base} \times \text{height} \div 2$

Choose the correct calculation to find the area of the triangle.



- $10 \times 5 \div 2$
- $10 \times 4 \div 2$
- $5 \times 4 \div 2$

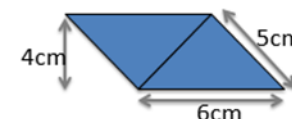
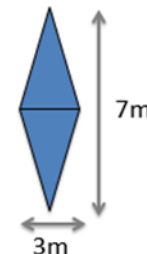
- 2 Calculate the area of the triangle.



How did you calculate the area?

Could you do it another way?

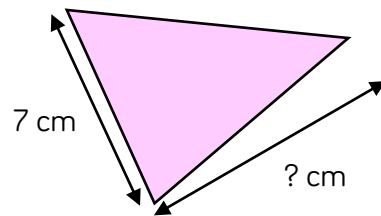
- 3 Calculate the area of each shape.



Area of a Triangle (3)

Reasoning and Problem Solving

The area of this triangle is 42cm^2



Two children worked out the height. Here are their answers:

Simon: $42 \div 7 = 6 \text{ cm}$

Jade: $42 \times 2 = 84$

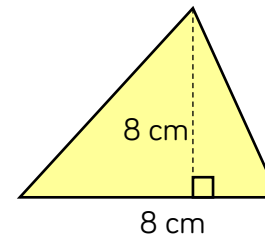
$$84 \div 7 = 12 \text{ cm}$$

Who is correct?

Explain how you know.

Jade is correct. She has understood that to work out the missing value she will need to change the triangle into a rectangle by doubling the area. She has then divided the total area by the value she has (7cm) to work out the missing value.

Macey and Lainey are working out the area of this triangle:



Macey says, "To work out the area, you multiply 8 by 8, then you divide your answer by 2"

Lainey says, "To work out the area you only need a half of the base, so you multiply 8 by 4, then divide it by 2"

Who do you agree with?

Explain your reasoning.

Macey is correct as she has found the area of the square and then divided by 2

Lainey has divided by 2 twice, once on the sides and once on the area of the square.

The area should be 32 cm^2

Area of a Parallelogram

Notes and Guidance

Children apply their knowledge of finding the area of a rectangle to find the area of a parallelogram.

Children investigate how they can make a rectangle and a parallelogram using a rectangle and two identical triangles. This will help them understand why the formula to find the area of parallelograms works.

Mathematical Talk

Can you describe a parallelogram?

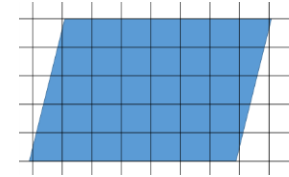
Can you make a parallelogram in to a rectangle?

What do you notice about the area of a rectangle and a parallelogram?

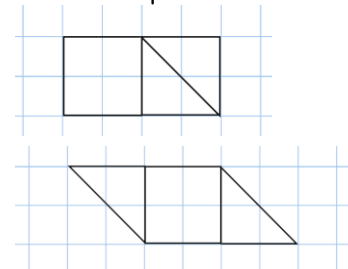
What formula can you use to work out the area of a parallelogram?

Varied Fluency

- 1 Work out the approximate area of the parallelogram by counting squares.

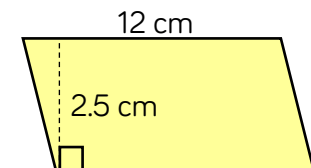
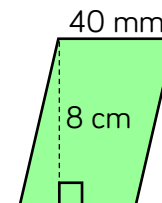


- 2 Here are two quadrilaterals made up of two identical triangles and a square.



- What is the same about the quadrilaterals?
- What's different?
- What is the area of each quadrilateral?

- 3 Use the formula base \times perpendicular height to calculate the area of the parallelograms.



Area of a Parallelogram

Reasoning and Problem Solving

The base of a flower planter is a parallelogram.

The area is greater than 44m^2 but less than 48m^2

What could the dimensions of the base of the flower planter be?

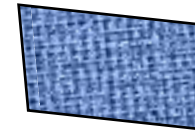
The total area needs to be between 44 m^2 and 48 m^2 therefore the dimensions could be, e.g.

9 m by 5 m
 $= 45\text{ m}^2$

6.5 m by 7 m
 $= 45.5\text{ m}^2$

11 m by 4.2 m
 $= 46.2\text{ m}^2$

Lucy has a piece of fabric in the shape of a parallelogram.



The height of the fabric is 12 m and the base is 18 m.

She cuts the fabric into four equal parallelograms by cutting the base and the height in half.

What is the area of each new parallelogram?

Children could work out the answer in two ways:

$$\begin{aligned} 12\text{ m} \times 18\text{ m} &= 216\text{ m}^2 \\ 216\text{ m}^2 \div 4 &= 54\text{ m}^2 \end{aligned}$$

OR

They could divide 18 and 12 by 2 first, then do

$$9\text{ m} \times 6\text{ m} = 54\text{ m}^2$$

Volume – Counting Cubes

Notes and Guidance

Children should understand that volume is the 3D space an object takes up.

Children will start by counting cubic units (1 cm^3) to find the volume of 3D shapes. They will then use cubes to build their own models and describe the volume of the models they make.

Mathematical Talk

What's the same and what's different between area and volume?

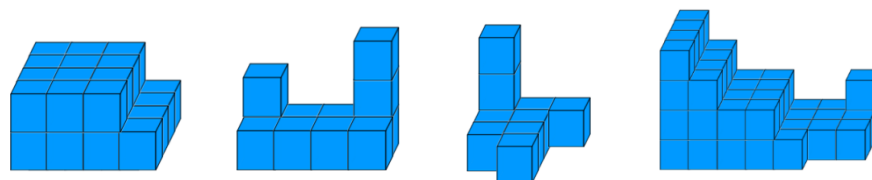
Can you explain how you worked out the volume?
What did you visualise?

Varied Fluency

- 1 If each cube has a volume of 1 cm^3 , find the volume of each solid.



- 2 Calculate the number of cubic units in each shape.



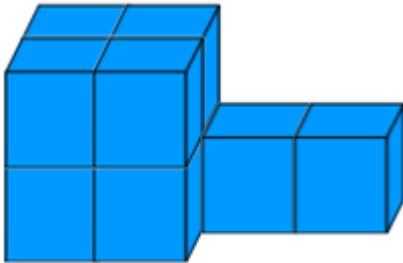
- 3 If one multilink cube = one cubic unit, make as many models as you can with 12 cubic units.

Volume – Counting Cubes

Reasoning and Problem Solving

Ibrahim says he will need 8 cm^3 to build this shape.

Aleena says she will need 10 cm^3



Who do you agree with?

Explain why.

Aleena is correct because there are 8 cm^3 making the shape, then there are an additional 2 cm^3

Reuben is making cubes using multilink.

He has 64 multilink cubes altogether.

How many cubes could he make?

Reuben could make:

- $1 \times 1 \times 1$
- $2 \times 2 \times 2$
- $3 \times 3 \times 3$
- $4 \times 4 \times 4$

Or a combination of these such as two $3 \times 3 \times 3$ cubes, one $2 \times 2 \times 2$ cube and two $1 \times 1 \times 1$ cubes.

Volume of a Cuboid

Notes and Guidance

Children make links with counting cubic units to understand how to use the formula ($l \times w \times h$) for calculating the volume of cuboids.

Children understand that when using the formula $l \times w$ will tell you the area of the base then to calculate the volume of the whole shape, you then need to multiply this by the height.

Mathematical Talk

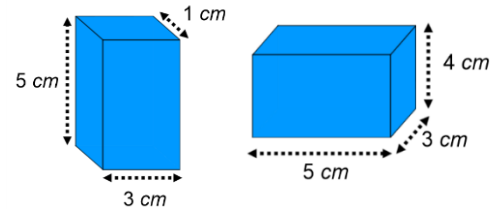
Can you identify the length, width and height of the cuboid?

If the length of a cuboid is 5 cm and the volume is 100 cm^3 , what could the width and height of the cuboid be?

What knowledge can I use to help me calculate the missing lengths?

Varied Fluency

1 Complete the sentences for each cuboid.



The length is: _____
The width is: _____
The height is: _____

The area of the base is: $___ \times ___ = ___$

Volume = The area of the base \times $___ = ___$

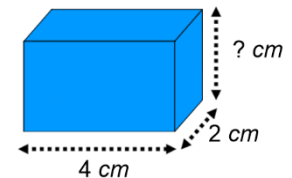
2 What is the volume of a cube with:

- 2 metre edges?
- 160 mm edges?

Give your answers in cm^3

3 The volume of the cuboid is 32 cm^3

What is the missing height?



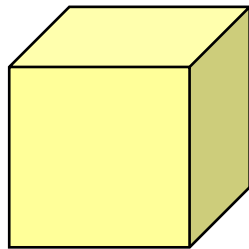
Volume of a Cuboid

Reasoning and Problem Solving

Clare says,



You can't calculate the volume of the cube because you don't know the width or the height.



2 cm

Do you agree?

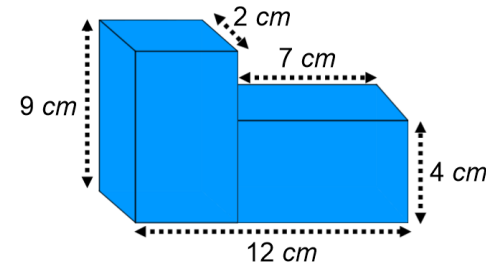
Explain why.

You don't need the rest of the measurements because it's a cube and all the edges of a cube are equal.

Therefore, the width would be 2 cm and the height would be 2 cm.

The volume of the cube is 8 cm^3

Calculate the volume of the shape:



146 cm^3

How many different ways can you make a cuboid with a volume of 48 cm^3 ?

Possible answers:

$$24 \times 2 \times 1$$

$$2 \times 6 \times 4$$

$$6 \times 8 \times 1$$

etc.