Links to prior learning/ objectives	Resources	Vocabulary:
~ Understanding of strategies for addition, subtraction, multiplication and division. ~ Multiplication facts up to 12 x 12. ~Multiples knowledge. ~ Knowledge of how to find the area of a shape. ~ Squared and cubed numbers. ~ Estimation skills. ~ Knowledge of angles and how to identify them and their properties.	Shapes, cubes, protractor, angles, **Mastery:** (where to find some resources) • Teaching for Mastery • White Rose **New and old documents** • Mastery maths stickers • Nrich (curriculum mapping)	Multiplication, division, multiply, divide, scale, scaling, scale factor, fractions Area, rectangles, standard units, centimetres, square, metres, irregular shapes, properties, estimate. Volume, cube, cuboids, capacity, cubed, Angles, measure, accuracy, degrees, point, whole turn, right angle, straight line, multiples,

Objectives and Teaching	
Barriers to ARE (misconceptions) **Week 1** Children may forget/ mix up the names for certain shapes- hexagon/ pentagon. Children may confuse or forget the name for certain properties of shape. Children may struggle to identify a shape that is irregular, deducing it from the properties. Children may struggle to visualise 3-D shapes from a 2-D representation.	Distinguish between regular and irregular polygons based on reasoning about equal sides and angles. Identify 3-D shapes, including cubes and other cuboids, from 2-D representations • To know the difference between regular and irregular polygons. • To develop the skill of recognizing regular and irregular polygons. • To know how to identify 3-D shapes. • To know how to identify 3-D shapes from 2-D representations.

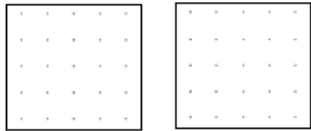L.E.A.D. Academy Trust
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Fluency
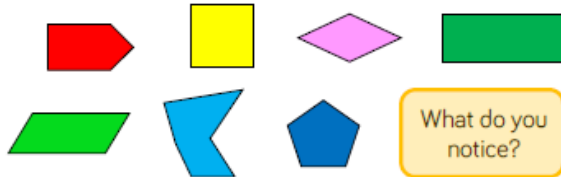
Sort the shapes in to irregular and regular polygons.

What's the same? What's different?

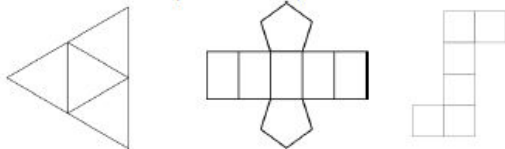Draw a regular polygon and an irregular polygon on the grids.

Look at the 2D shapes. Decide whether the shape is a regular or irregular polygon. Measure the angles in each one.

What do you notice?

Look at the different nets. Describe the 2D shapes used to make them and identify the 3D shape.
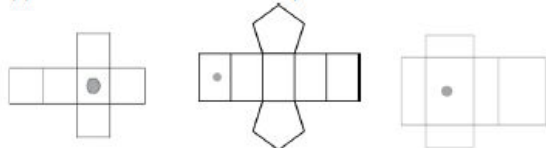
Use equipment, such as Polydron, or 2D shapes to build the 3D solids being described.
- My faces are made up of a square and four triangles.
- My faces are made up of rectangles and triangles.
Can the descriptions make more than one shape?

Draw another dot on the nets so they have a dot on the opposite face when the 3D shape is constructed.
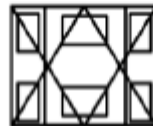
Reasoning

Decide which statements are true, sometimes true or false.

- A regular polygon has equal sides but not equal angles.
- A triangle is a regular polygon.
- A rhombus and square are regular polygons.
- The number of angles is the same as the number of sides in any polygon.

Prove it!

How many regular and irregular polygons can you find in this picture?

Albie says,

If two 3D shapes have the same number of edges, then they also have the same number of vertices.

Do you agree?
Explain why.

Problem solving

Cut out lots of different regular and irregular shapes. Ask children to work in pairs and sort them into groups. Once they have sorted them, can they find a different way to sort them again?
Children could use Venn diagrams and Carroll diagrams to deepen their understanding, for example:
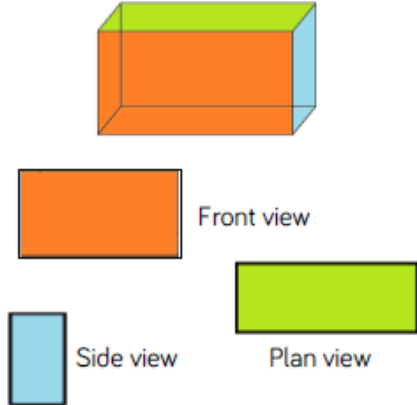
Quadrilaterals
Kites
Parallelograms
Trapezoids
Rhomb
Square
Rectangle
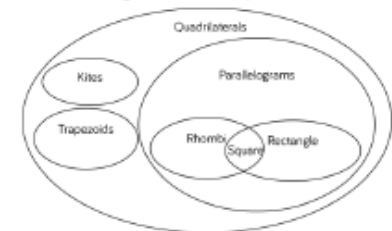
	Regular polygon	Irregular polygon
Has right angles		
Doesn't have any right angles		

Create cubes and cuboids by using multilink.
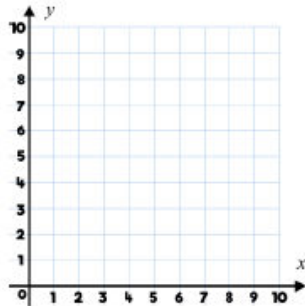Can you draw these on isometric paper?
Which part is difficult?
Would it be harder if you had to draw something other than squares or rectangles?

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Using different 3D solids, can you represent them from different views? Can your partner work out which representation goes with which solid?

For example,

Front view

Side view   Plan view

| **Week 2**	Identify, describe and represent the position of a shape following a reflection or translation, using the appropriate language with only small inaccuracies in positioning.	
Children may forget/ mix up the names for certain shapes- hexagon/ pentagon. Children may confuse or forget the name for certain properties of shape. Children may struggle to identify a shape that is irregular, deducing it from the properties. Children may struggle to understand what reflection and translation mean. Children may struggle to remember and complete strategies to support reflection and translation (tracing paper or counting the square in the background).	• To know how to interpret co-ordinates. • To develop the skill of interpreting co-ordinates. • To know how to reflect shapes along a mirror line. • To develop the skill of reflecting shapes. • To know how to translate shapes.	
Fluency	**Reasoning**	**Problem solving**

Plot the following points on the grid.

(3, 5)   (5, 3)

(4, 4)   (6, 5)
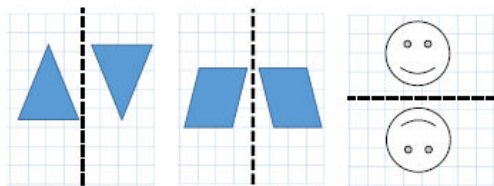
(0, 2)   (2, 0)
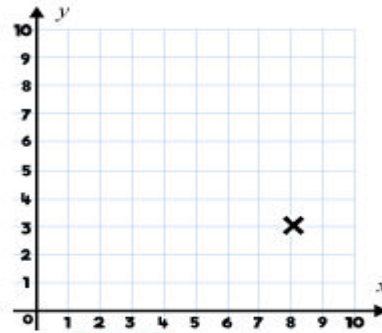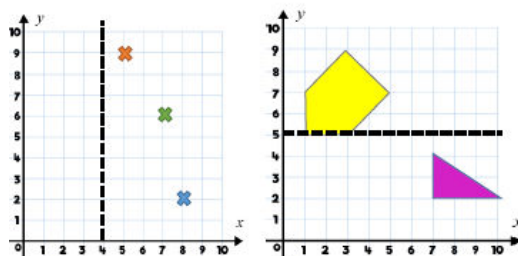
What are the coordinates of the vertices of the rectangle?

(,)   (,)

(,)   (,)
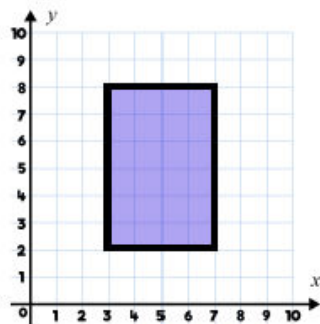
Which of the images have been reflected in the mirror line?

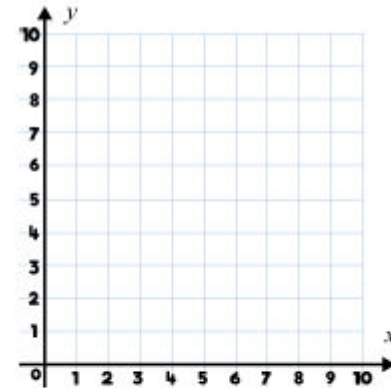Reflect the shapes and coordinates in the mirror line.

The point is at (8, 3)

Sam

The point is at (3, 8)

Holly

Who do you agree with? Can you spot the mistake the other child has made?

When you reflect a shape, its dimensions change.

Amina

Do you agree with Amina? Explain your thinking.

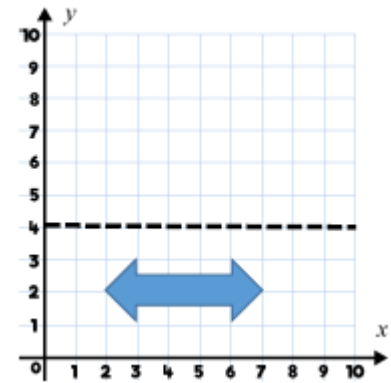Tanya is finding co-ordinates whose digits add up to 8.

For example: $(3, 5) \rightarrow 3 + 5 = 8$

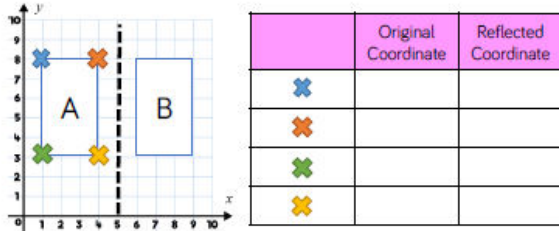Find all of Tanya's co-ordinates and plot them on the grid.

What do you notice?

What would happen if the digits summed to other numbers?

Reflect the shape in the mirror line.

Shape A is reflected in the mirror line to position B.
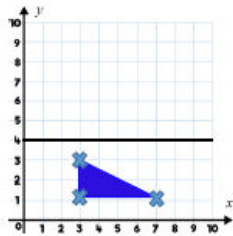Write the coordinates of the vertices for each shape.

	Original Coordinate	Reflected Coordinate
✖		
✖		
✖		
✖		

Write the coordinates of the shape after it has been reflected in the mirror line.
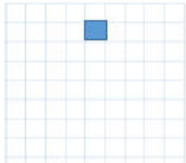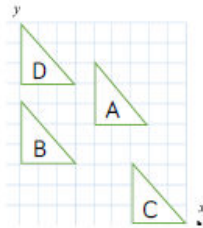
(,)

(,)

(,)

A square is translated two squares to the right and three down.
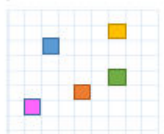Draw the new position of the square.

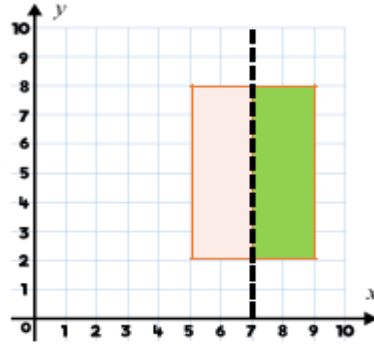Describe the translation of shape A to the different positions.

Shape A has been translated _____ left/right and _____ up/down.
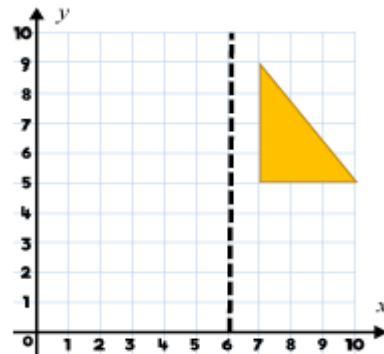
Match the translations.

	to			(5 right, 5 up)
	to			(2 left, 3 up)
	to			(5 left, 5 down)

The rectangle is pink and green.
The rectangle is reflected in the mirror line.
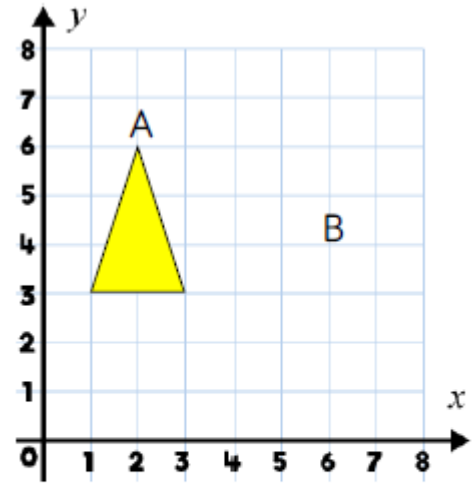What would its reflection look like?

Maggie reflects the shape in the mirror line.
She calculates the coordinates for the vertices of the reflected shape as:

(5, 5)   (2, 5)   (2, 9)

Is Maggie is correct?
Explain why.

A triangle is drawn on the grid.
It is translated so that point A becomes point B.

Draw the new triangle.

Some coordinates have all been translated in the same way.
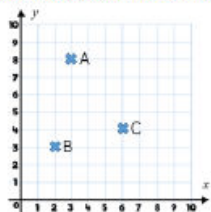
(_,_) ➝ (3 , 1)

(_, 5) ➝ (4 , 3)

(4 ,_) ➝ (6 , 1)

Can you work out the translation and the missing coordinates?

Translate each coordinate 2 places down, 1 place to the right. Record the coordinate of its new position.

(3, 8) → [   ]

[   ] → [   ]

[   ] → [   ]
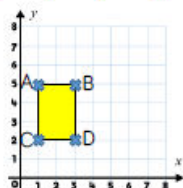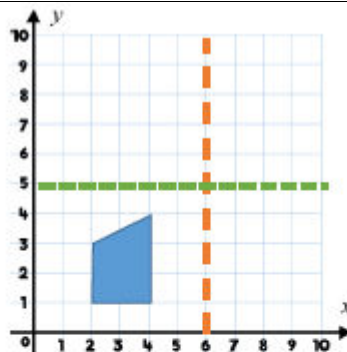
[   ] → (3, 8)

Rectangle ABCD is translated so vertex C moves to vertex B. What is the translation and what are the coordinates of the translated rectangle?

Translate the coordinates below.
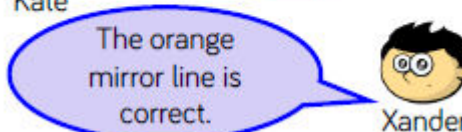
(3, 6) → 3 left → (,) → 1 up → (,)

(5, 7) → 2 right → (,) → 4 down → (,)

This is a shape after it has been reflected.
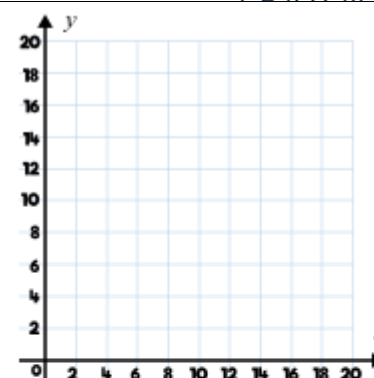
The green mirror line is correct.

Kate

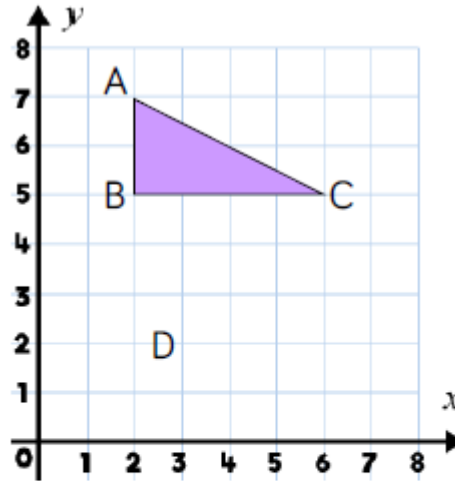The orange mirror line is correct.

Xander

Who is correct? Explain and prove it. What would the coordinates be of the original shape?
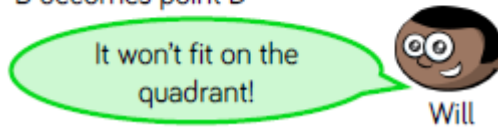

A rectangle is translated 3 squares up and two squares to the left.

Three of the coordinates of the translated rectangle are: (5, 7) (10, 14) (10, 7).

What are the coordinates of the original rectangle?

Triangle ABC is translated so that point B becomes point D

It won't fit on the quadrant!

Will

Do you agree with Will?
Explain your thinking.

| **Week 3** Children may struggle to know the properties of given shapes. Children may not understand what the area is. Children may confuse area and perimeter. Children may not recognise irregular shapes. Children may forget to use squared when writing the area. Children may struggle to make an informed estimate.	~ Calculate and compare the area of rectangles (including squares), and including using standard units, square centimetres (cm2) and square metres (m2) and estimate the area of irregular shapes • To know how to calculate the area of rectangles. • To develop the skill of calculating areas of rectangles. • To understand how to calculate areas of rectangles. • To know how to estimate the area of irregular shapes. • To develop the skill of estimating the area of irregular shapes.	
Fluency	**Reasoning**	**Problem Solving**

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

What is the area of this shape if:
If each square is 2cm in length, what is the area of the shape?
If each square is 3.5cm in length, what is the area of the shape?
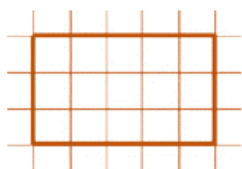
Simon buys a house with a small back garden, which measures 12m². His house lies in a row of terraces, all identical. Simon's house lies in a row of 15 terraced houses. What is the total area of the garden space?

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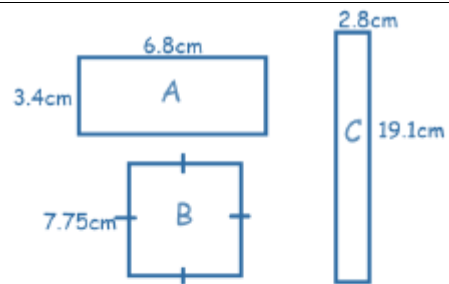Is there more than one way?
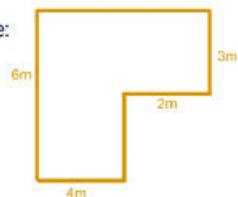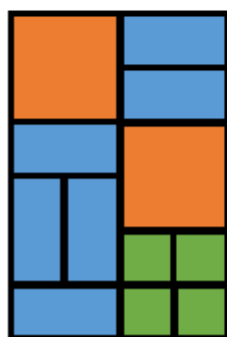
Could we multiply 6m × 6m and then subtract 2m × 3m?

Find the area of the following shapes:

Find the area of the following shapes:

Approximate the area of each shape an then order from largest to smallest.

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

How many different ways can you split this shape to find the area?
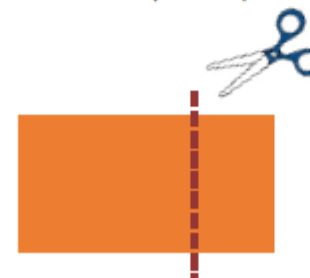
Add more values and work out the area.

Investigate how many ways you can make different squares and rectangles with the same area of 84cm²
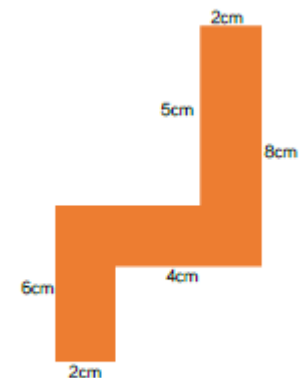What strategy did you use?

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

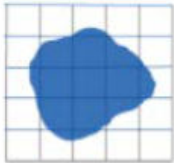Jack has a shape with an area of 36cm².

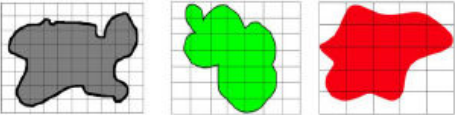Find 3 possible compound shapes that have an area of 36cm².

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

The answer is 6 whole and 4 parts is this an acceptable answer? What can we do with the parts?
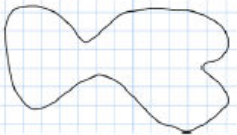
If all of the squares are 1cm in length, which shape has the greatest area?

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

Each square is ☐ m²
what is the approximate area?

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

Can you draw a circle that is approximately 20cm²?
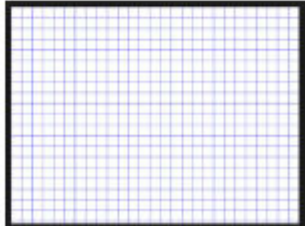
If each square represents 3m², what is the approximate area of:
- The lake
- The bunkers
- The fairway
- The rough
- Tree/forest area

Can you construct a 'Pirate Island' to be used as part of a treasure map for a new game? Each square represents 4m².
The island must include the following features and be of the given approximate measure:
Circular Island 180m²
Oval Lake 58m²
Forests with a total area of 63m² (can be split over more than one space)
Beaches with a total area of 92m² (can be split over more than one space)
Mountains with a total area of 57m²
Rocky coastline with total area of 25m²

Week 4	~ Estimate volume [for example, using 1 cm3 blocks to build cuboids (including cubes)] and capacity [for example, using water]	
Children may struggle with the concept of volume. Children may confuse volume with area. Children may forget to use cubed when writing the volume. Children may struggle to recognise the difference between the volume and the capacity.	• To know what volume is. • To know how to calculate volume. • To know how to estimate volume. • To know how to estimate capacity.	
Fluency	**Reasoning**	**Problem Solving**

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• Drive

Take 4 cm cubes. How many different solids can you make? What's the same? What's different?

Make these shapes.

Complete the table to describe your shapes.

Shape	Width	Height	Length	Volume (cm³)
A				
B				
C				

Compare the capacity and the volume. Use the sentence stems to help you.
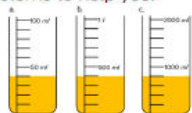
Container ___ has a capacity of ___ ml
The volume of juice in container ___ is ___ cm³

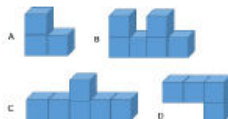Work out the volume of each solid.
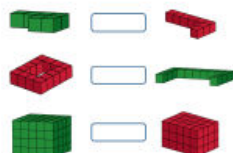
Shape A   Shape B

Shape A has a volume of ___ cm³
Shape B has a volume of ___ cm³

Which has the greatest volume?

Look at the 4 solids below. Put the shapes in ascending order based on their volume.

Count the cubes to find the volume of the shapes and use 'greater than', 'less than' or 'equal to' to make the statements correct.

My shape is made up of 10 centimetre cubes.

The height and length are the same size.

Three layers have at least 1 centimetre cube.

What could my shape look like?

David, Jennifer and Owen have all build a shape using cubes.
Owen has lost his shape, but knows that it's volume was greater than Jennifer's, but less than David's.

David's   Jennifer's

What could the volume of Owen's shape be?

Lucy has built this solid:

Tom has built this solid:

Lucy thinks that her shape must have the greatest volume because it is taller.
Do you agree?
Explain your answer.

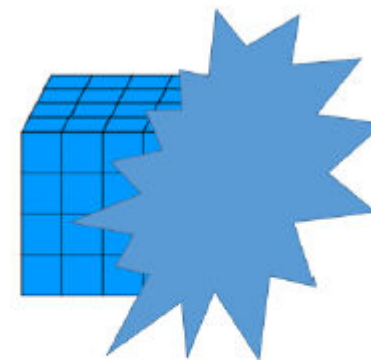Sam has built a shape that has a volume of 12 cm³

Using 1 cm³ blocks, build a shape that has:

- The same volume as Sam's.
- Half the volume of Sam's.
- Three times the volume of Sam's.

Laura has made a shape from centimetre cubes.
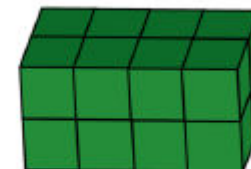
How many other shapes can you make that have the same volume?

Each cube has a volume of 1 m³
The volume of the whole shape is between 64 m³ and 96 m³
What could the shape look like?

Estimate and match the object to the correct volume.

| 3,600 cm³ | 1,000 cm³ | 187,500 cm³ |

Take 3 different chocolate boxes.

Use cubes to estimate the volume and capacity of each box.

Estimate then work out the volume of your classroom.

Use five tumblers and rice.
- Fill a tumbler half full.
- Fill a tumbler one quarter full.
- Full a tumbler three quarters full.
- Fill a tumbler, leaving one third empty.
- Fill a tumbler that has more than the first but less than the third, what fraction could be filled?

Show children 5 different containers.
Which containers has the largest/smallest capacity?
Can we order the containers?
If I had ___ ml/l, which container would I need and why?
Fill each container with rice/water and estimate then measure how much each holds.

Match the containers to their estimated capacity.

| 5,000 ml | 500 ml | 5 ml |

Use this to help you compare other containers. Use 'more' and 'less' to help you.

Stephen is using cubes to estimate the volume of his money box.

He says the volume will be 20 cm³

Do you agree with Stephen?
Explain your answer.

What would the approximate volume of the money box be?

Give children a container.
Using rice, water and cotton wool balls, can children estimate how much of each they will need to fill it?

Discuss what' the same? What's different?
Will everyone's amount of cotton wool be the same? Will everyone have the same amount of rice? Will everyone have the same amount of water?

Give children a container.
Using rice/water and a different container e.g. cups, discuss how many cups of rice/water we will need to fill the containers.
Link this to the capacity of the containers.

| **Week 5** | ~ Draw given angles, and measure them in degrees (°)
Identify:
~ angles at a point and one whole turn (total 360°)
~ angles at a point on a straight line and   a turn (total 180°) |

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Children may struggle to use a protractor- using the correct numbers, measuring the angles, using the correct 0 as a starting point. Children may not recall facts relating to angles. Children may not be able to use their multiples of 9/90 to find the total of angles around a point/ straight line/ quarter/ three quarters. Children may make errors with calculating.	~ other multiples of 90° • To know that angles are measured in degrees. • To know how to identify and use 90' angles. • To know that angles on a straight line total 180' • To know that angles around a point total 360' • To be able to identify missing angles. **This may need to stretch over two weeks.**

| Fluency	Reasoning	Problem Solving
Use the sentence stem to describe the turns made by the minute hand. Compare the turn to a right angle. The turn from 12 to 4 is larger than a right angle. It is an obtuse angle. The turn from ___ to ___ is _____ than a right angle. It is an _____ angle. Use the compass to complete the table. <table><tr><td>Turn</td><td>Degrees</td><td>Type of Angle</td><td>Fraction of a turn</td></tr><tr><td>North East to South East Clockwise</td><td>90°</td><td>Right Angle</td><td>1/4 of a turn</td></tr><tr><td>North West to North West Clockwise</td><td></td><td></td><td></td></tr><tr><td>South West to South East Anti-clockwise</td><td></td><td></td><td></td></tr><tr><td>South West to _____ clockwise</td><td>180°</td><td></td><td></td></tr><tr><td>North East to East Clockwise</td><td></td><td></td><td>1/8 of a turn</td></tr></table>	Which angle is the odd one out? 180° 45° 79° 270° Could another angle be the odd one out for a different reason? Always, sometimes, never. • If I turn from North East to North West it will be 180° • If I turn from East to North West it will be an obtuse angle. • If I turn from South West to South my turn will be larger than 350°	Pick a starting point on the compass and describe a turn to your partner. Use the mathematical words to write your clues: • Clockwise • Anticlockwise • Degrees • Acute • Obtuse • Reflex • Right angle Can your partner guess where you will finish?

Column 1

Discuss how angles are measured using the protractor. Where can we see acute angles on the protractor? Why are there two sets of numbers?
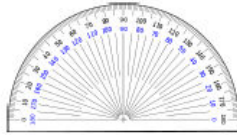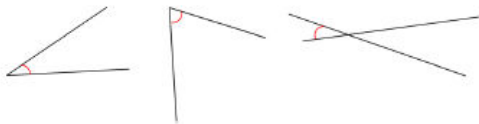
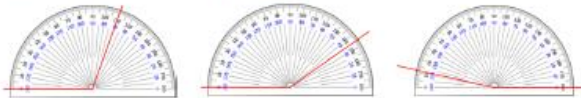Read the angles shown on the protractor.
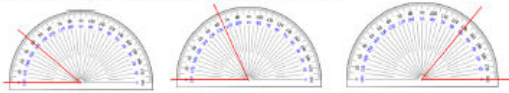
What's the same? What's different?

Estimate the size of the angles and then use a protractor to measure them to the nearest degree.

Read the angles on the protractor.

Estimate the size of the angles and then use a protractor to measure them to the nearest degree.

Identify obtuse angles in the image. Can you estimate the size of the angles and measure them?

Column 2

I have measured the angle correctly because my protractor is the right way round. Byron
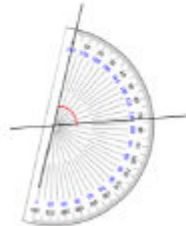
Evie
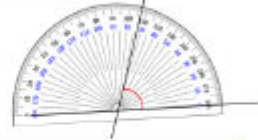
I have measured the angle correctly because my protractor is on the line accurately.
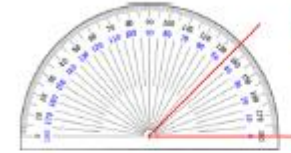
Who do you agree with? Explain why.

Tamira is measuring an obtuse angle. What's her mistake?

Draw a range of angles for a friend. Estimate the angles to order them order from smallest to largest. Then measure to check to see if they were correct.
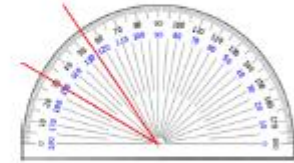
Column 3

Three children are measuring angles. Can you spot and explain their mistake?
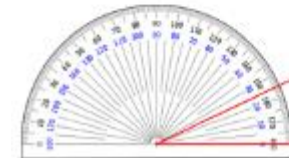
My angle measures 135° Mo

My angle measures 55° Zoe

Hannah

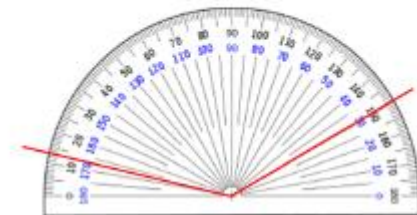My angle measures 35°

How many ways can you find the value of the angle?

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Column 1

Draw lines that measure:

| 4 cm and 5 mm | 450 mm | 4.5 cm |

What's the same? What's different?

Draw:
- an angle that measures 45°
- an acute angle and an obtuse angle that is a multiple of 3 and 5
- an obtuse angle that has a factor of 4 and 6

Can your partner check you are accurate?

Draw:
- an acute angle that measures 56° with one line that measures 5.6 cm
- an obtuse angle that measures more than 130° but less than 140° with a line that measures 6.7 cm
- an obtuse angle that is equivalent to two 36° angles and with a line that has 49 mm
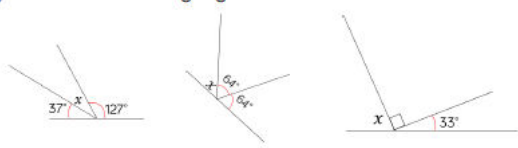
Can your partner check you are accurate?
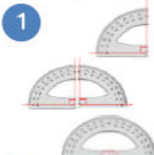
1

There are _____ degrees in a right angle.

There are _____ right angles on a straight line.

There are _____ degrees on a straight line.
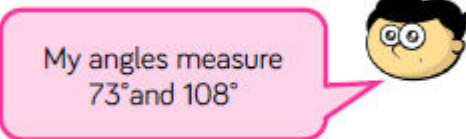
2 Calculate the missing angles.

x 33°

x 127°

x 94°
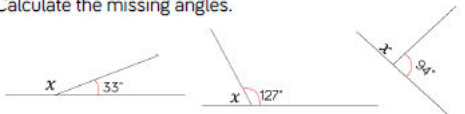
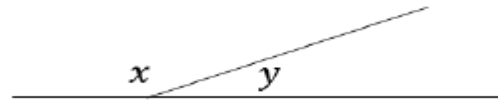**3** Calculate the missing angles.

37° x 127°

x 64° 64°

x 33°

Can you find more than one way to calculate the missing angles?

Column 2

Bradley is measuring two angles on a straight line.

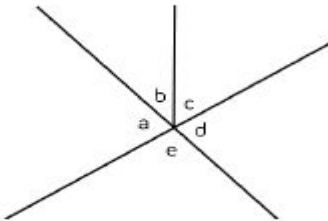My angles measure 73° and 108°

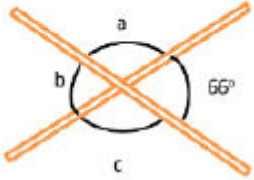Explain why Bradley's angles must be wrong.
_____
Here are two angles.

x y

Use the clues to calculate what the missing angles could be worth.

Angle x is larger than 130°
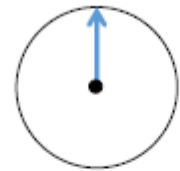Angle y is a prime number between 40 and 50

b c
a   d
e

$a + b + c + d + e = 360°$
What other sentences can you record?

Two match sticks are on a table. Without measuring, find the three missing angles.

a
b   66°
c

Column 3

Use a cut out of a circle and place a spinner in the centre.

- Point the arrow in the starting position above.
- Turn over a flash card with an angle on.
- Estimate the given angle by moving the spinner.
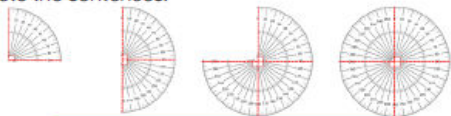- Check how close you are with a protractor.

| 40° | 72° | 154° |

Use Kadinsky's artwork to practice measuring lines and angles.

Create clues for your partner to work out which line or angle you have measured.
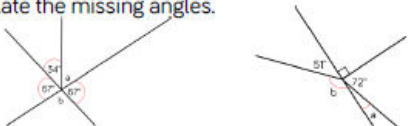
Column 1

Complete the sentences.

$\frac{1}{4}$ of a turn = 1 right angle = 90°

$\frac{1}{2}$ of a turn = ___ right angles = _____°

— of a turn = 3 right angles = _____°

A full turn = ___ right angles = _____

Calculate the missing angles.

238°

a 137°
157°

Calculate the missing angles.

54°
67° 67°
b

51°
72°
b
a

Look at the square and the rectangle.
What's the same? What's different?

Calculate the size of the angles in each shape.

c
a
b e d

c
a
b e d

What's the same? What's different?
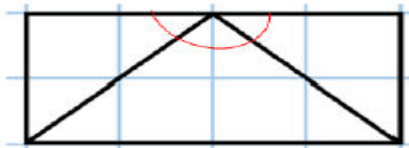
Here is a square.

45 mm

Use the square to calculate the missing lengths.

Use the square to calculate the missing angles.

Column 2

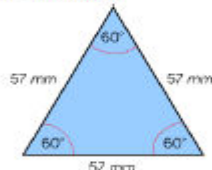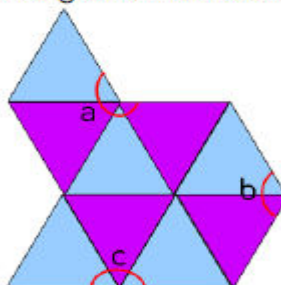Helena is calculating the missing angles in the shape.

She says,

The missing angles are worth 60 because
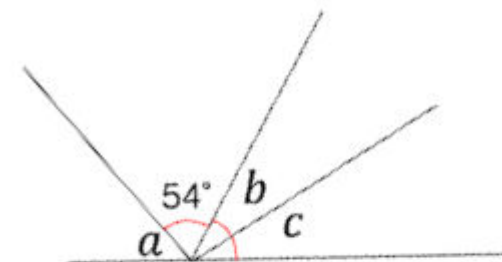180 ÷ 3 = 60

Do you agree?
Explain why.

Alek has this triangle.

60°
57 mm   57 mm
60°   60°
57 mm

He makes this composite shape using identical triangles to the one above.

a
b
c

• Calculate the perimeter of the shape.
• Calculate the missing angles.
Can you use your own triangle, square or rectangle to make a similar problem?

Column 3

54° b
a   c

• The total of angle b and c are the same as angle a
• Angle a is 9° more than the size of the given angle.
• Angle b is 11° more than angle c

What are the angles worth?

Create your own straight line problem like this one for your partner.

The code for the lock is 50, 25, 75, 0, 50

80 90
70   0
60   10
50   20
40 30

Write instructions of the turns in degrees that you must do to open the lock.

Can you create your own combination for your partner to record instructions?

Week 6 | ~ Consolidation- focus on any objective that the children need further help with.

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Fluency	Reasoning	Problem Solving
Week 7	~ Consolidation- focus on any objective that the children need further help with.	
Fluency	Reasoning	Problem Solving
Week 8	~ Consolidation- focus on any objective that the children need further help with.	
Fluency	Reasoning	Problem Solving