Summer Scheme of Learning

Year 6

#MathsEveryoneCan

2020-21

White Rose Maths

New for 2020/21

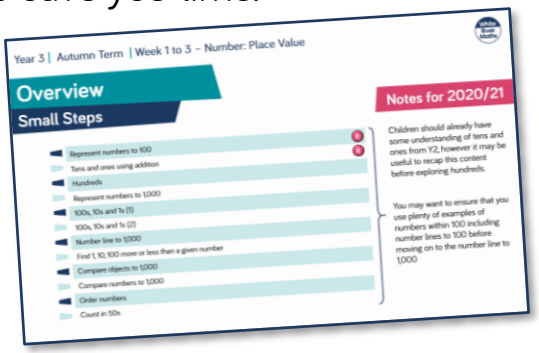
2020 will go down in history. The world has changed for all of us.

We want to do as much as we can to support children, teachers, parents and carers in these very uncertain times.

We have amended our schemes for 2020/21 to:

- ★ highlight key teaching points
- ★ recap essential content that children may have forgotten
- ★ flag any content that you might not have covered during the school closures period.

We hope these changes will add further value to the schemes and save you time.


Year 3 | Autumn Term | Week 1 to 3 – Number: Place Value

Overview

Small Steps

- Represent numbers to 100
- Tens and ones using addition
- Hundreds
- Represent numbers to 1,000
- 100s, 10s and 1s (1)
- 100s, 10s and 1s (2)
- Number line to 1,000
- Find 1, 10, 100 more or less than a given number
- Compare objects to 1,000
- Compare numbers to 1,000
- Order numbers
- Count in 50s

Notes for 2020/21

Children should already have some understanding of tens and ones from Y2, however it may be useful to recap this content before exploring hundreds.

You may want to ensure that you use plenty of examples of numbers within 100 including number lines to 100 before moving on to the number line to 1,000

Lesson-by-lesson overviews

We've always been reluctant to produce lesson-by-lesson overviews as every class is individual and has different needs. However, many of you have said that if blended learning becomes a key feature of school life next year, a weekly plan with linked content and videos could be really useful.

As always, we've listened! We've now produced a complete lesson-by-lesson overview for Y1 to Y9 that schools can use or adapt as they choose. Each lesson will be linked to a free-to-use home learning video, and for premium subscribers, a worksheet. This means that you can easily assign work to your class, whether they are working at home or in school.

Inevitably, this lesson-by-lesson structure won't suit everyone, but if it works for you, then please do make use of this resource as much as you wish.

Teaching for Mastery

These overviews are designed to support a mastery approach to teaching and learning and have been designed to support the aims and objectives of the new National Curriculum.

The overviews:

- have number at their heart. A large proportion of time is spent reinforcing number to build competency
- ensure teachers stay in the required key stage and support the ideal of depth before breadth.
- ensure students have the opportunity to stay together as they work through the schemes as a whole group
- provide plenty of opportunities to build reasoning and problem solving elements into the curriculum.

For more guidance on teaching for mastery, visit the NCETM website:

https://www.ncetm.org.uk/resources/47230

Concrete - Pictorial - Abstract

We believe that all children, when introduced to a new concept, should have the opportunity to build competency by taking this approach.

Concrete – children should have the opportunity to use concrete objects and manipulatives to help them understand what they are doing.

Pictorial – alongside this children should use pictorial representations. These representations can then be used to help reason and solve problems.

Abstract – both concrete and pictorial representations should support children's understanding of abstract methods.

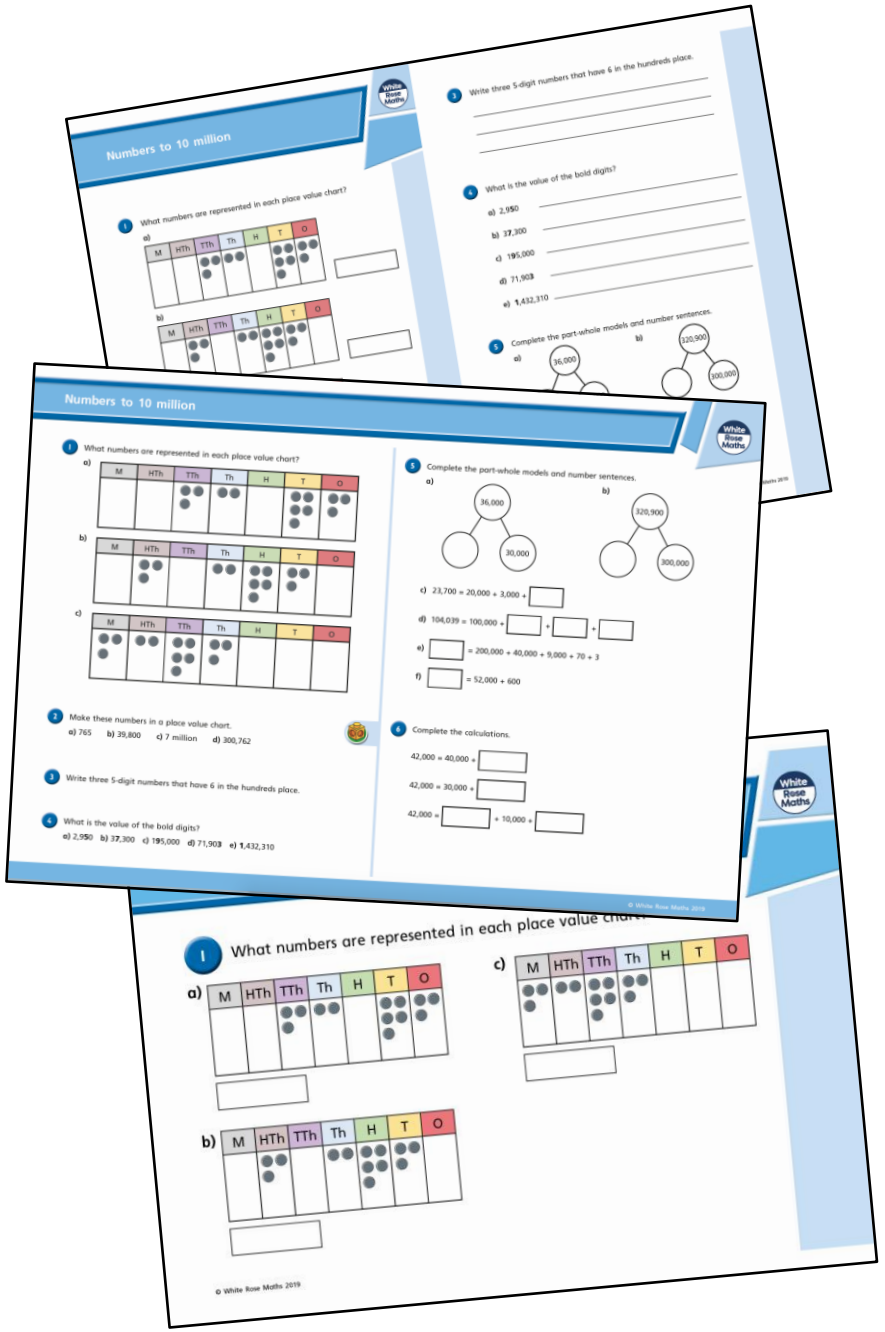
Need some CPD to develop this approach? Visit www.whiterosemaths.com for find a course right for you.

Supporting resources

We have produced supporting resources for every small step from Year 1 to Year 11.

The worksheets are provided in three different formats:

- Write on worksheet – ideal for children to use the ready made models, images and stem sentences.
- Display version – great for schools who want to cut down on photocopying.
- PowerPoint version – one question per slide. Perfect for whole class teaching or mixing questions to make your own bespoke lesson.



For more information visit our online training and resources centre resources.whiterosemaths.com or email us directly at support@whiterosemaths.com

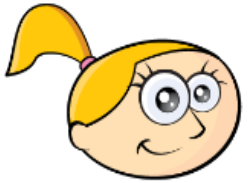
Meet the Characters

Children love to learn with characters and our team within the scheme will be sure to get them talking and reasoning about mathematical concepts and ideas. Who's your favourite?

Teddy

Rosie

Mo



Eva

Alex

Jack

Whitney

Amir

Dora

Tommy

Dexter

Ron

Annie

	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				Number: Fractions					Geometry: Position and Direction
Spring	Number: Decimals		Number: Percentages		Number: Algebra		Measurement: Converting Units	Measurement: Perimeter, Area and Volume		Number: Ratio		Consolidation
Summer	Statistics		Geometry: Properties of shape				Consolidation and themed projects					

White Rose Maths

Summer - Block 1

Statistics

Overview

Small Steps

- Read and interpret line graphs
- Draw line graphs
- Use line graphs to solve problems
- Circles
- Read and interpret pie charts
- Pie charts with percentages
- Draw pie charts
- The mean

Notes for 2020/21

Originally this had been planned in for the end of the Spring term. Due to SATs being cancelled and therefore time gained for year 6 teachers, this can now be covered in more detail at the start of the summer term.

There will be more opportunity to draw pie charts in the next block when children recap measuring and drawing angles.

Read and Interpret Line Graphs

Notes and Guidance

Children will build on their experience of interpreting data in context from Year 5, using their knowledge of scales to read information accurately. Examples of graphs are given but it would be useful if real data from across the curriculum e.g. Science, was also used. Please note that line graphs represent continuous data not discrete data. Children need to read information accurately, including where more than one set of data is on the same graph.

Mathematical Talk

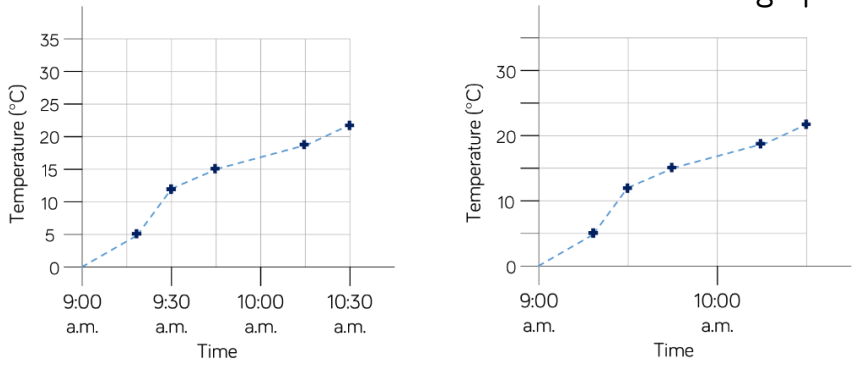
Where might you see a line graph used in real life?

Why is the 'Water Consumption' graph more difficult to interpret?

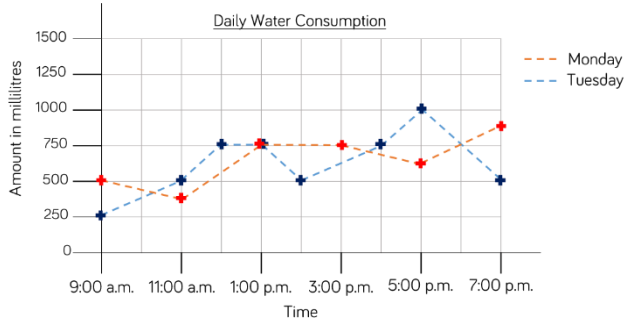
How can you make sure that you read the information accurately?

Varied Fluency

What is the same and what is different about the two graphs?



Here is a graph showing daily water consumption over two days.



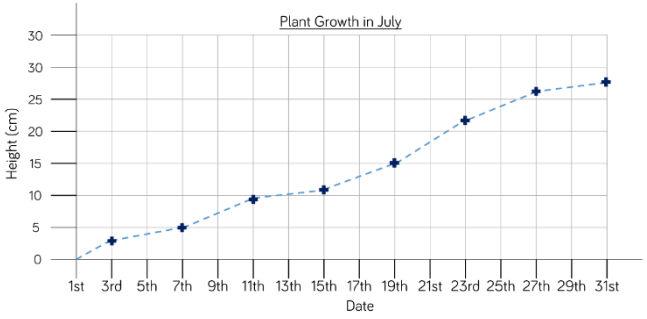
At what times of the day was the same amount of water consumed on Monday and Tuesday?

Was more water consumed at 2 p.m. on Monday or Tuesday morning? How much more?

Read and Interpret Line Graphs

Reasoning and Problem Solving

Eva has created a graph to track the growth of a plant in her house.



Eva recorded the following facts about the graph.

a) On the 9th of July the plant was about 9 cm tall.

b) Between the 11th and 19th July the plant grew about 5 cm.

c) At the end of the month the plant was twice as tall as it had been on the 13th .

Can you spot and correct Eva's mistakes?

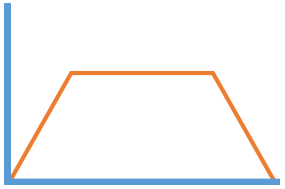
a) On the 9th July a more accurate measurement would be 7.5 cm.

b) Correct.

c) On the 31st the plant was approximately 28 cm tall, but on the 13th it was only 10 cm which is not half of 28 cm. The plant was closer to 14 cm on the 17th July.

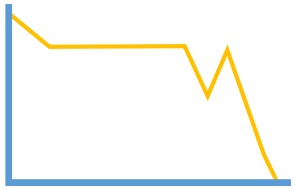
Write a story and 3 questions for each of the 3 graphs below.

a



b

c



Possible context for each story:

a) A car speeding up, travelling at a constant speed, then slowing down.

b) The height above sea level a person is at during a walk.

c) Temperature in an oven when you are cooking something.

Draw Line Graphs

Notes and Guidance

Children will build on their experience of reading and interpreting data in order to draw their own line graphs.

Although example contexts are given, it would be useful if children can see real data from across the curriculum.

Children will need to decide on the most appropriate scales and intervals to use depending on the data they are representing.

Mathematical Talk

What will the x-axis represent? What intervals will you use?

What will the y-axis represent? What intervals will you use?

How will you make it clear which line represents which set of data?

Why is it useful to have both sets of data on one graph?

Varied Fluency

This table shows the height a rocket reached between 0 and 60 seconds.

Create a line graph to represent the information.

Time (seconds)	Height (metres)
0	0
10	8
20	15
30	25
40	37
50	50
60	70

The table below shows the population in the UK and Australia from 1990 to 2015.

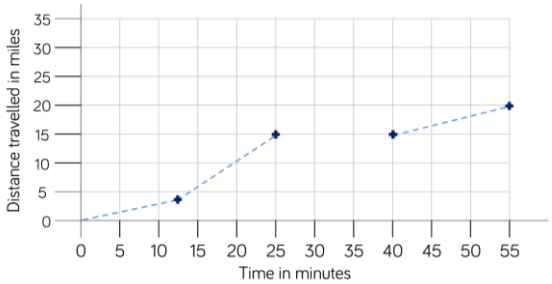
	1990	1995	2000
UK	57,200,000	58,000,000	58,900,000
Australia	17,000,000	18,000,000	19,000,000
	2005	2010	2015
UK	60,300,000	63,300,000	65,400,000
Australia	20,200,000	22,100,000	23,800,000

Create one line graph to represent the population in both countries.
Create three questions to ask your friend about your completed graph.

Draw Line Graphs

Reasoning and Problem Solving

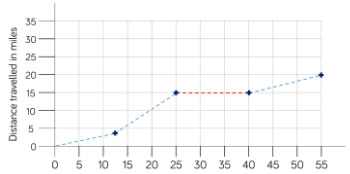
This graph shows the distance a car travelled.



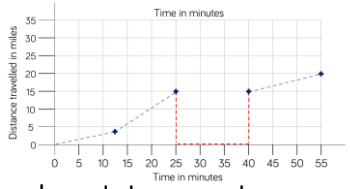
Rosie and Jack were asked to complete the graph to show the car had stopped.

Here are their completed graphs.

Rosie:



Jack:



Who has completed the graph correctly?

Explain how you know.

Rosie has completed the graph correctly. The car has still travelled 15 miles in total, then stopped for 15 minutes before carrying on.

This table shows the distance a lorry travelled during the day.

Time	Distance in miles
7.00 a.m.	10
8.00 a.m.	28
9.00 a.m.	42
10.00 a.m.	58
11.00 a.m.	70
12.00 a.m.	95
1.00 p.m.	95
2.00 p.m.	118

Create a line graph to represent the information, where the divisions along the x-axis are every two hours.

Create a second line graph where the divisions along the x-axis are every hour.

Compare your graphs. Which graph is more accurate?

Would a graph with divisions at each half hour be even more accurate?

Children may find that the second line graph is easier to draw and interpret as it matches the data given directly.

They may discuss that it would be difficult to draw a line graph showing half hour intervals, as we cannot be sure the distance travelled at each half hour.

Line Graphs Problems

Notes and Guidance

Once children can read, interpret and draw lines graphs they need to be able to use line graphs to solve problems.

Children need to use their knowledge of scales to read information accurately. They need to be exposed to graphs that show more than one set of data.

At this point, children should be secure with the terms x and y axis, frequency and data.

Mathematical Talk

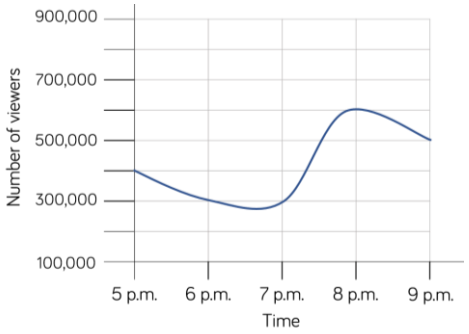
What do you notice about the scale on the vertical axis? Why might it be misleading?
What other scale could you use?

How is the information organised? Is it clear?
What else does this graph tell you? What does it not tell you?

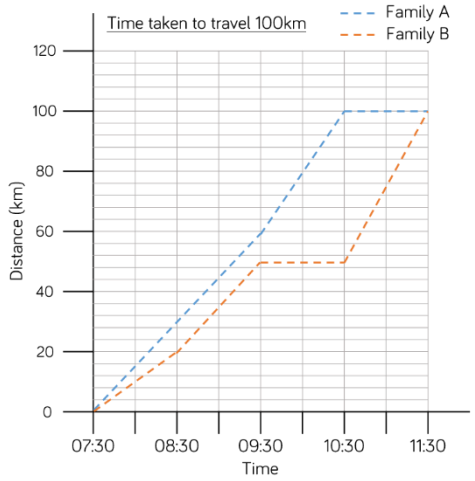
How can you calculate _____?
Why would this information be placed on a line graph and not a different type of graph?

Varied Fluency

Ron and Annie watched the same channel, but at different times. The graph shows the number of viewers at different times.
Ron watched 'Chums' at 5 p.m. Annie watched 'Countup' at 8 p.m.



What was the difference between the number of viewers at the start of each programme? What was the difference in the number of viewers between 6 p.m. and 8 p.m.? Which time had twice as many viewers as 6 p.m.?

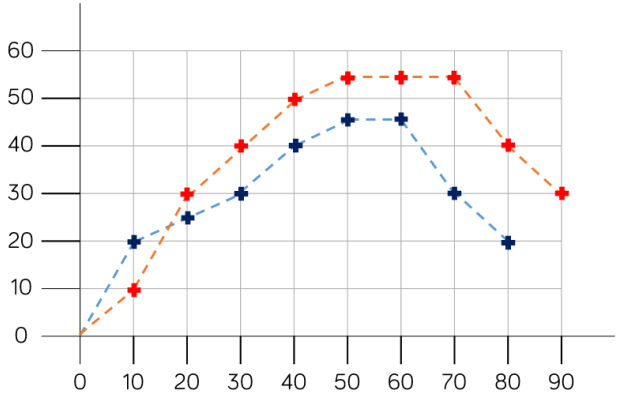


Two families were travelling to Bridlington for their holidays. They set off at the same time but arrived at different times.
What time did family A arrive?
How many km had each family travelled at 08:45?
Which family stopped midway through their journey?
How much further had they left to travel?

Line Graphs Problems

Reasoning and Problem Solving

What could this graph be showing?



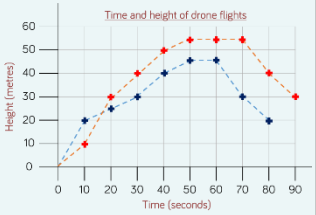
Label the horizontal and vertical axes to show this.

Is there more than one way to label the axes?

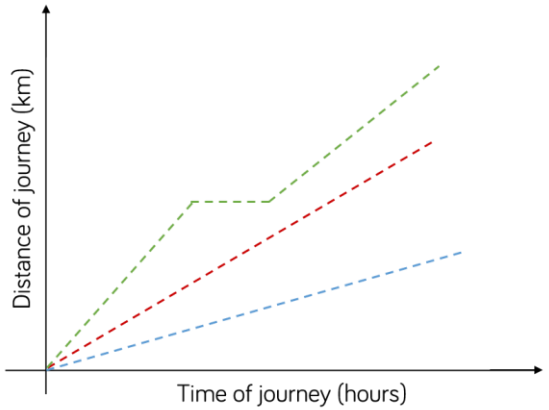
Possible response:

This graph shows the height of two drones and the time they were in the air.

For example:



The graph below shows some of Mr Woolley's journeys.



What is the same and what is different about each of these journeys?

What might have happened during the green journey?

Possible responses:

All the journeys were nearly the same length of time.

The journeys were all different distances.

The red and blue journey were travelling at constant speeds but red was travelling quicker than blue.

During the green journey, Mr Woolley might have been stuck in traffic or have stopped for a rest.

Circles

Notes and Guidance

Children will illustrate and name parts of circles, using the words radius, diameter, centre and circumference confidently.

They will also explore the relationship between the radius and the diameter and recognise the diameter is twice the length of the radius.

Mathematical Talk

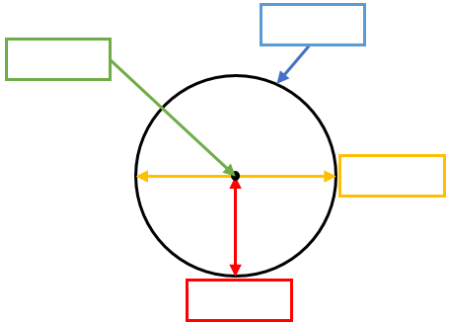
Why is the centre important?

What is the relationship between the diameter and the radius? If you know one of these, how can you calculate the other?

Can you use the vocabulary of a circle to describe and compare objects in the classroom?

Varied Fluency

- Using the labels complete the diagram:



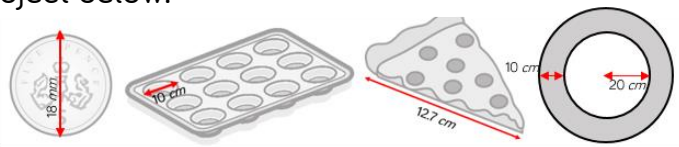
Radius

Diameter

Centre

Circumference

- Find the radius or the diameter for each object below:



The radius is ___. The diameter is ___. I know this because ___.

- Complete the table:

Radius	Diameter
26 cm	
	37 mm
2.55 m	
	99 cm
	19.36 cm

Circles

Reasoning and Problem Solving

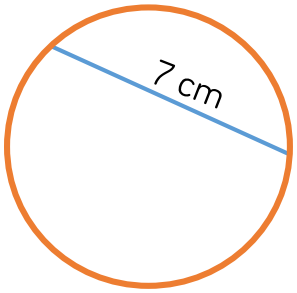
Alex says:

The bigger the radius of a circle, the bigger the diameter.

Do you agree? Explain your reasoning.

I agree with Alex because the diameter is always twice the length of the radius.

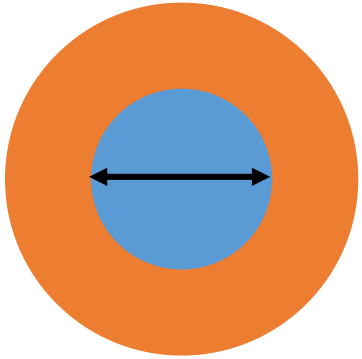
Spot the mistake!
Tommy has measured and labelled the diameter of the circle below.
He thinks that the radius of this circle will be 3.5 cm.



Is Tommy right? Explain why.

Tommy has measured the diameter inaccurately because the diameter always goes through the centre of the circle from one point on the circumference to another.

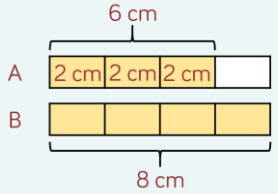
Here are 2 circles. Circle A is blue; Circle B is orange. The diameter of Circle A is $\frac{3}{4}$ the diameter of Circle B.



If the diameter of Circle B is 12 cm, what is the diameter of Circle A?
If the diameter of Circle A is 12 cm, what is the radius of Circle B?
If the diameter of Circle B is 6 cm, what is the diameter of Circle A?
If the diameter of Circle A is 6 cm, what is the radius of Circle B?

a) 9 cm
b) 16 cm
c) 4.5 cm
d) 8 cm

A bar model may support children in working these out e.g.



Read and Interpret Pie Charts

Notes and Guidance

Children will build on their understanding of circles to start interpreting pie charts. They will understand how to calculate fractions of amounts to interpret simple pie charts.

Children should understand what the whole of the pie chart represents and use this when solving problems.

Mathematical Talk

What does the whole pie chart represent? What does each colour represent?

Do you recognise any of the fractions? How can you use this to help you?

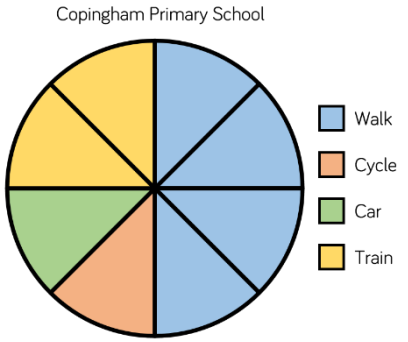
What's the same and what's different about the favourite drinks pie charts?

What other questions could you ask about the pie chart?

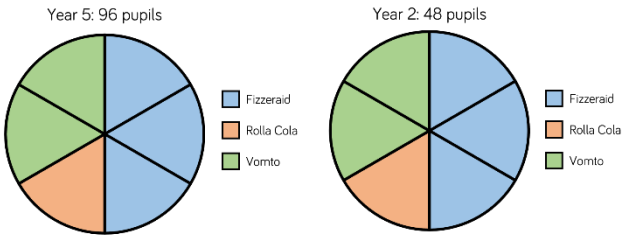
Varied Fluency

There are 600 pupils at Copingham Primary school.
Work out how many pupils travel to school by:

a) Train
b) Car
c) Cycling
d) Walking



Classes in Year 2 and Year 5 were asked what their favourite drink was. Here are the results:



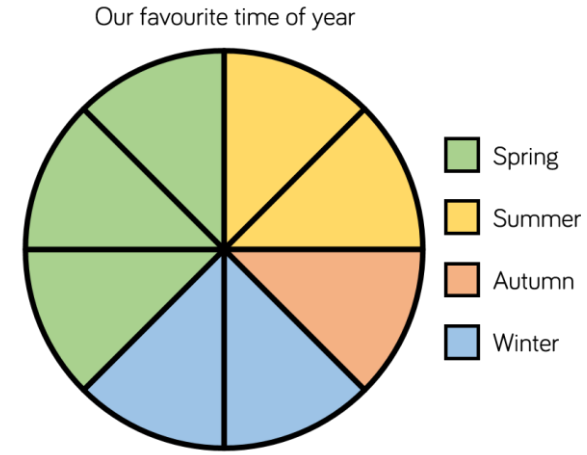
What fraction of pupils in Year 5 chose Fizzeraid?
How many children in Year 2 chose Rolla Cola?
How many more children chose Vomto than Rolla Cola in Year 2?
What other questions could you ask?

Read and Interpret Pie Charts

Reasoning and Problem Solving

In a survey people were asked what their favourite season of the year was. The results are shown in the pie chart below.

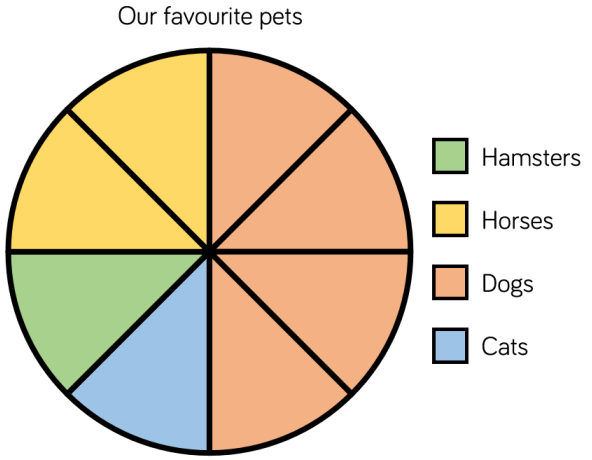
If 48 people voted summer, how many people took part in the survey?



Explain your method.

Summer is a quarter of the whole pie chart and there are 4 quarters in a whole, so $48 \times 4 = 184$ people in total.

96 people took part in this survey.



How many people voted for cats?

$\frac{3}{8}$ of the people who voted for dogs were male. How many females voted for dogs?

What other information can you gather from the pie chart?

Write some questions about the pie chart for your partner to solve.

$\frac{1}{2}$ of $96 = 48$

$\frac{1}{4}$ of $96 = 24$

$\frac{1}{8}$ of $96 = 12$

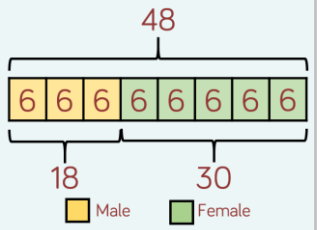
12 people voted cats.

48 people voted dogs.

$\frac{1}{8}$ of $48 = 6$

$6 \times 3 = 18$.

18 females voted for dogs.



Pie Charts With Percentages

Notes and Guidance

Children will apply their understanding of calculating percentages of amounts to interpret pie charts.

Children know that the whole of the pie chart totals 100 %.

Encourage children to recognise fractions in order to read the pie chart more efficiently.

Mathematical Talk

How did you calculate the percentage? What fraction knowledge did you use?

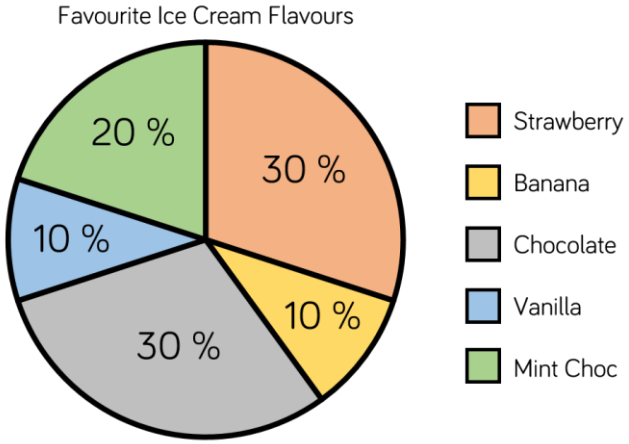
How else could you find the difference between Chocolate and Mint Chocolate?

If you know 5 % of a number, how can you work out the whole number?

If you know what 5 % is, what else do you know?

Varied Fluency

150 children voted for their favourite ice cream flavours. Here are their results:



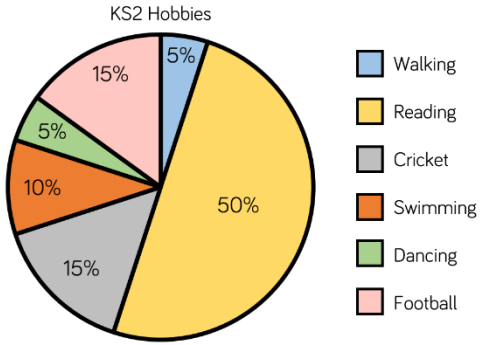
How many people voted for Vanilla?

How many more people voted for Chocolate than Mint Chocolate Chip?

How many people chose Chocolate, Banana and Vanilla altogether?

There are 200 pupils in Key Stage 2 who chose their favourite hobbies.

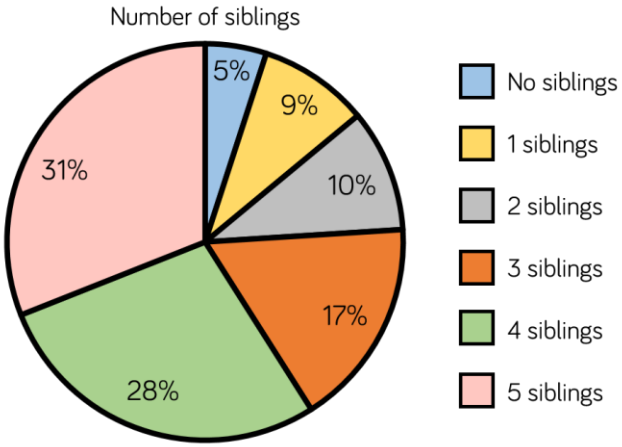
How many pupils chose each hobby?



Pie Charts With Percentages

Reasoning and Problem Solving

15 people in this survey have no siblings. Use this information to work out how many people took part in the survey altogether.

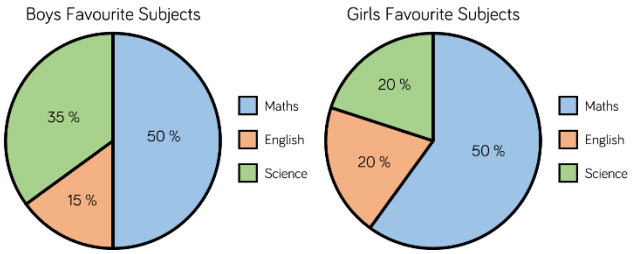


No siblings	15
1 sibling	27
2 siblings	30
3 siblings	51
4 siblings	84
5 siblings	93
Total	**300**

Now work out how many people each segment of the pie chart is worth.

Can you represent the information in a table?

120 boys and 100 girls were asked which was their favourite subject. Here are the results:



Jack says:

More girls prefer Maths than boys because 60 % is bigger than 50 %.

Do you agree? Explain why.

Jack is incorrect because the same amount of girls and boys like maths.

Boys:
50 % of 120 = 60

Girls:
60 % of 100 = 60

Draw Pie Charts

Notes and Guidance

Pupils will build on angles around a point totalling 360 degrees to know that this represents 100 % of the data within a pie chart.

From this, they will construct a pie chart, using a protractor to measure the angles. A "standard" protractor has radius 5 cm, so if circles of this radius are drawn, it is easier to construct the angles.

Mathematical Talk

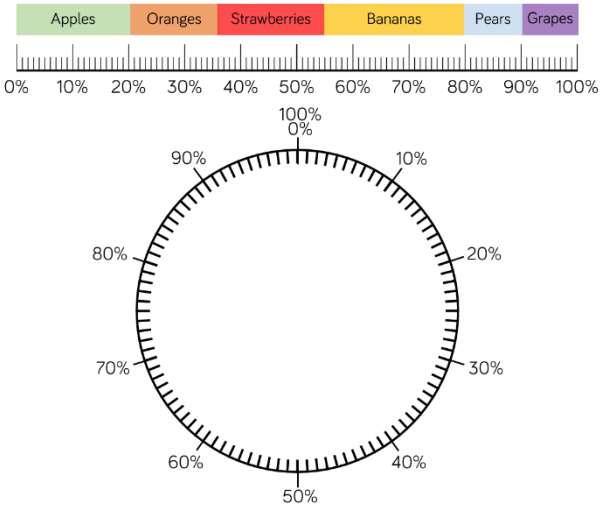
How many degrees are there around a point? How will this help us construct a pie chart?

If the total frequency is ____ , how will we work out the number of degrees representing each sector?

If 180° represents 15 pupils. How many people took part in the survey? Explain why.

Varied Fluency

Construct a pie chart using the data shown in this percentage bar model.



A survey was conducted to show how children in Class 6 travelled to school.

Draw a pie chart to represent the data.

Type of transport	Number of children	Convert to degrees
Car	12	12 × 10 = 120°
Bike	7	
Walk	8	
Bus	5	
Scooter	4	
Total	36	360°

Draw Pie Charts

Reasoning and Problem Solving

A survey was conducted to work out Year 6's favourite sport. Work out the missing information and then construct a pie chart.

Favourite sport	Number of children	Convert to degrees
Football	10	
Tennis	18	
Rugby		× 6 = 90°
Swimming	6	6 × 6 = 36°
Cricket		× 6 = 42°
Golf	4	4 × 6 = 24°
Total	60	360°



Children will then use this to draw a pie chart.

Favourite sport	Number of children	Convert to degrees
Football	10	10 × 6 = 60°
Tennis	18	18 × 6 = 108°
Rugby	15	15 × 6 = 90°
Swimming	6	6 × 6 = 36°
Cricket	7	7 × 6 = 42°
Golf	4	4 × 6 = 24°
Total	60	360°

A restaurant was working out which Sunday dinner was the most popular. Use the data to construct a pie chart.

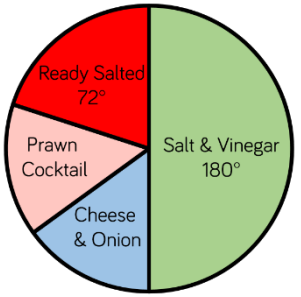
Dinner choice	Frequency	Convert to degrees
Chicken	11	
Pork	8	
Lamb	6	
Beef	9	
Vegetarian	6	
Total	40	

Children will then use this table to draw a pie chart.

Dinner choice	Frequency	Convert to degrees
Chicken	11	11 × 9 = 99°
Pork	8	8 × 9 = 72°
Lamb	6	6 × 9 = 54°
Beef	9	9 × 9 = 81°
Vegetarian	6	6 × 9 = 54°
Total	40	360°

Miss Jones is carrying out a survey in class about favourite crisp flavours. 15 pupils chose salt and vinegar.

How many fewer people chose ready salted?



15 pupils = 180°
180 ÷ 15 = 12
12° = 1 pupil
72 ÷ 12 = 6 pupils
15 – 6 = 9
9 fewer students chose ready salted over salt and vinegar.

The Mean

Notes and Guidance

Children will apply their addition and division skills to calculate the mean average in a variety of contexts. They could find the mean by sharing equally or using the formula:
Mean = Total ÷ number of items.
Once children understand how to calculate the mean of a simple set of data, allow children time to investigate missing data when given the mean.

Mathematical Talk

What would the total be? If we know the total, how can we calculate the mean?

Do you think calculating the mean age of the family is a good indicator of their actual age? Why? *(Explore why this isn't helpful).*

When will the mean be useful in real life?

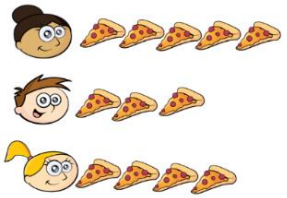
Varied Fluency

Here is a method to find the mean.

No. of glasses of juice drunk by 3 friends	Total glasses of juice drank	If each friend drank the same no. of glasses
		

The mean number of glasses of juice drunk is 3

Use this method to calculate the mean average for the number of slices of pizza eaten by each child.



Calculate the mean number of crayons:

Crayon colour	Amount
Blue	14
Green	11
Red	10
Yellow	9

Hassan is the top batsman for the cricket team. His scores over the year are: 134, 60, 17, 63, 38, 84, 11
Calculate the mean number of runs Hassan scored.

The Mean

Reasoning and Problem Solving

The mean number of goals scored in 6 football matches was 4.

Use this information to calculate how many goals were scored in the 6th match:

Match number	Number of goals
1	8
2	4
3	6
4	2
5	1
6	

As the mean is 4, the total must be $6 \times 4 = 24$.

The missing number of goals is 3

Three football teams each play 10 matches over a season. The mean number of goals scored by each team was 2.

How many goals might the teams have scored in each match?

How many solutions can you find?

Any sets of 10 numbers that total 20 e.g.

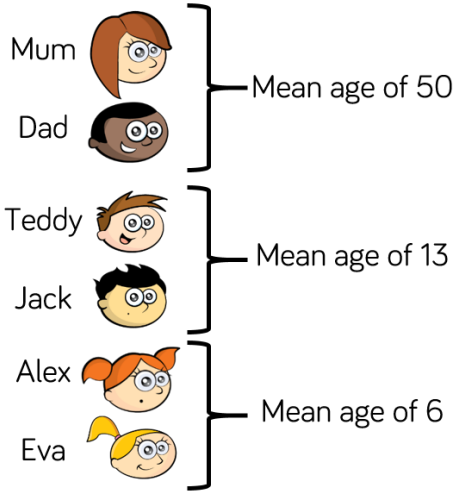
2, 2, 2, 2, 2, 2, 2, 2, 2 and 2

3, 1, 4, 5, 3, 1, 3, 0, 0 and 0 etc.

Work out the age of each member of the family if:

Mum is 48 years old.

Teddy is 4 years older than Jack and 7 years older than Alex.



Calculate the mean age of the whole family.

23

White Rose Maths

Summer - Block 2

Properties of Shape

Overview

Small Steps

Measure with a protractor	
Draw lines and angles accurately	R
Introduce angles	
Angles on a straight line	R
Angles around a point	R
Calculate angles	
Vertically opposite angles	
Angles in a triangle	
Angles in a triangle – special cases	
Angles in a triangle – missing angles	
Angles in special quadrilaterals	
Angles in regular polygons	
Draw shapes accurately	
Draw nets of 3-D shapes	

Notes for 2020/21

In this block children will build on learning from year 5 to look at properties of shape in detail, specifically angles.

There is time available after this block so it can span a longer period of time if needed.

Consider recapping the drawing of pie charts from the previous block when working with protractors.

Measure with a Protractor

Notes and Guidance

This step revisits measuring angles using a protractor from Year 5

Children recap how to line up the protractor accurately, and identify which side of the scale to read. They link this to their understanding of angle sizes.

Children read the measurement and practise measuring angles given in different orientations.

Angles are also related to compass points.

Mathematical Talk

Can we name and describe the 4 different types of angles? (right angle, obtuse, acute, reflex)

What unit do we use to measure angles?

Does it matter which side of the protractor I use?

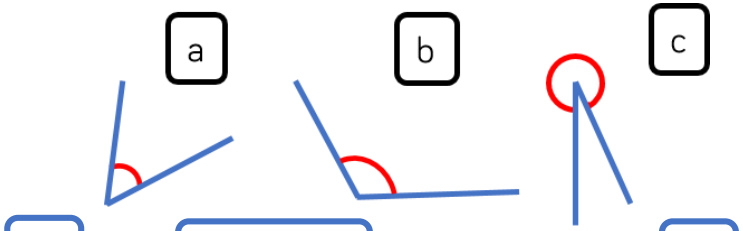
What mistakes could we make when measuring with a protractor?

How would I measure a reflex angle?

Look at a compass, what angles can we identify using the compass?

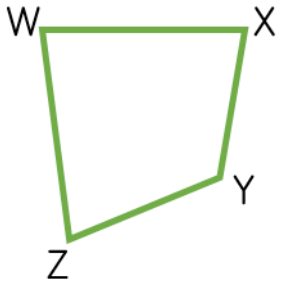
Varied Fluency

Identify the type of angle, and measure the angle using a protractor.



Angle ☐ is an ☐ angle. It measures ☐

Estimate, then measure each of the angles at the vertices of the quadrilateral.

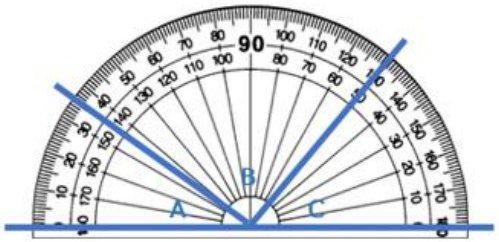


W: ☐ X: ☐

Y: ☐ Z: ☐

Work out the size of each angle.

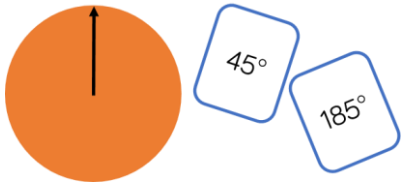
Explain how you found your answers.



Measure with a Protractor

Reasoning and Problem Solving

Cut out a circle and draw a line from the centre to the edge. Add a spinner in the centre.



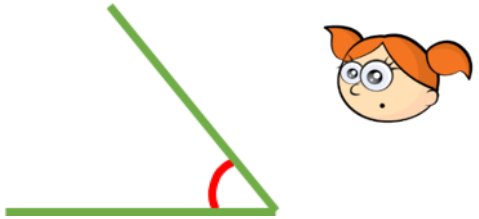
Put the arrow in the starting position as shown above. Turn over a flash card with an angle on.

Estimate the given angle by moving the spinner.

Check how close you are using a protractor.

Children could work in pairs and get a partner to check the accuracy of the angles made.

Alex measures this angle:



She says it is 130°

Explain what she has done wrong.

Alex is wrong because 130° is an obtuse angle and the angle indicated is acute.
She has used the wrong scale on the protractor. She should have measured the angle to be 50°

Drawing Accurately

Notes and Guidance

Children need to draw lines correct to the nearest millimetre. They use a protractor to draw angles of a given size, and will need to be shown this new skill.

Children continue to develop their estimation skills whilst drawing and measuring lines and angles. They also continue to use precise language to describe the types of angles they are drawing.

Mathematical Talk

How many millimetres are in a centimetre?

How do we draw a line that measures ___?

Explain how to draw an angle.

What's the same and what's different about drawing angles of 80° and 100° ?

How can I make this angle measure ___ but one of the lines have a length of ___?

Varied Fluency

R

Draw lines that measure:

4 cm and 5 mm	45 mm	4.5 cm

What's the same? What's different?

Draw:

- angles of 45° and 135°
- angles of 80° and 100°
- angles of 20° and 160°

What do you notice about your pairs of angles?

Draw:

- an acute angle that measures 60° with the arms of the angle 6 cm long
- an obtuse angle that measures 130° but less than 140° with the arms of the angle 6.5 cm long

Compare your angles with your partner's.

Drawing Accurately

Reasoning and Problem Solving

R

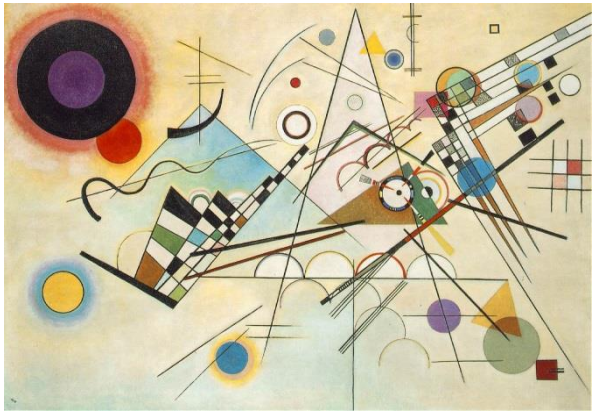
Draw a range of angles for a friend.
Estimate the sizes of the angles to order them from smallest to largest.
Measure the angles to see how close you were.

Always, sometimes or never true?

- Two acute angles next to each other make an obtuse angle.
- Half an obtuse angle is an acute angle.
- 180° is an obtuse angle

- Sometimes
- Always
- Never

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



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

For example, "My line is horizontal and has an obtuse angle of 110° on it."

Introduce Angles

Notes and Guidance

Children build on their understanding of degrees in a right angle and make the connection that there are two right angles on a straight line and four right angles around a point.

Children should make links to whole, quarter, half and three-quarter turns and apply this in different contexts such as time and on a compass.

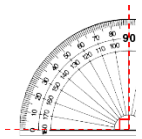
Mathematical Talk

If there are 90 degrees in one right angle, how many are there in two? What about three?

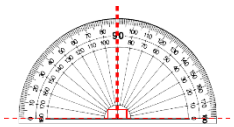
How many degrees are there in a quarter/half turn?

Between which two compass points can you see a right angle/half turn/three quarter turn?

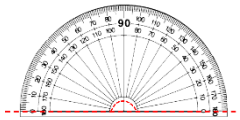
Varied Fluency



There are ☐ degrees in a right angle.



There are ☐ right angles on a straight line.



There are ☐ degrees on a straight line.

Complete the table.

Angle	Fraction of a full turn	Degrees
Right angle	$\frac{1}{4}$	90°
Straight line		
Three right angles		
Full turn		

Use a compass to identify how many degrees there are between:

- North & South (turning clockwise)
- South & East (turning anti-clockwise)
- North-East and South-West (turning clockwise)

Introduce Angles

Reasoning and Problem Solving

Dora and Eva are asked how many degrees there are between North-West and South-West.

Dora says,

There are 90 degrees between NW and SW.

Eva says,

There are 270° between NW and SW

Who do you agree with?
Explain why.

They are both correct. Dora measured anti-clockwise whereas Eva measured clockwise.

If it takes 60 minutes for the minute hand to travel all the way around the clock, how many degrees does the minute hand travel in:

- 7 minutes
- 12 minutes

How many minutes have passed if the minute hand has moved 162°?

360 ÷ 60 = 6
so the minute hand travels 6° per minute.
7 minutes : 42°
12 minutes : 72°

162° : 27 minutes

Always, sometimes, never.

W to S = 90 degrees
NE to SW = 180 degrees
E to SE in a clockwise direction > 90°

Sometimes
Always
Never

Angles on a Straight Line

Notes and Guidance

Children build on their knowledge of a right angle and recognise two right angles are equivalent to a straight line, or a straight line is a half of a turn.
Once children are aware that angles on a straight line add to 180 degrees, they use this to calculate missing angles on straight lines.
Part-whole and bar models may be used to represent missing angles.

Mathematical Talk

How many degrees are there in a right angle?

How many will there be in two right angles?

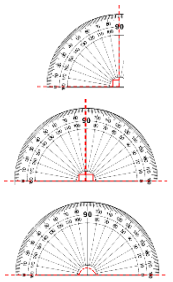
If we place two right angles together, what do we notice?

How can we calculate the missing angles?

How can we subtract a number from 180 mentally?

Varied Fluency

R

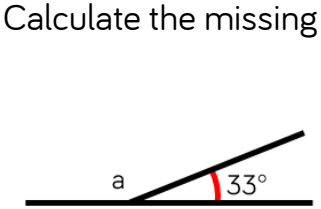


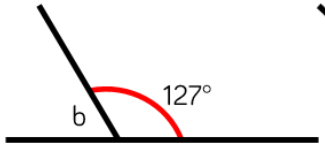
There are _____degrees in a right angle.

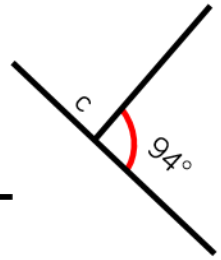
There are _____right angles on a straight line.

There are _____degrees on a straight line.

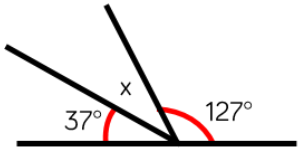
Calculate the missing angles.

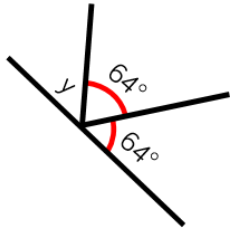


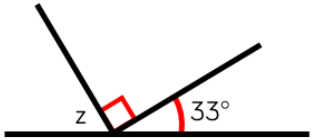




Calculate the missing angles.







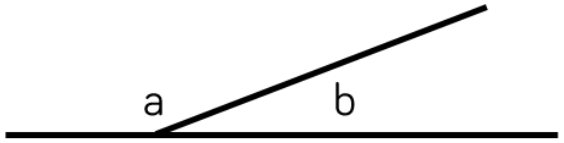
Is there more than one way to calculate the missing angles?

Angles on a Straight Line

Reasoning and Problem Solving

R

Here are two angles.



Angle b is a prime number between 40 and 50

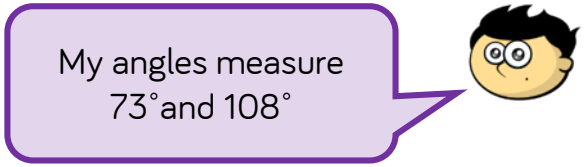
Use the clue to calculate what the missing angles could be.

b = 41°, a = 139°

b = 43°, a = 137°

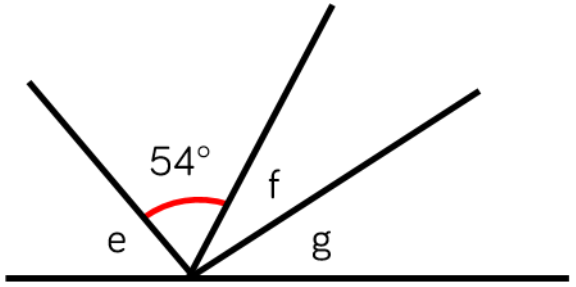
b = 47°, a = 133°

Jack is measuring two angles on a straight line.



Explain why at least one of Jack's angles must be wrong.

His angles total more than 180°.



- The total of angle f and g are the same as angle e
- Angle e is 9° more than the size of the given angle.
- Angle f is 11° more than angle g

Calculate the size of the angles.

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

e = 63°

f = 37°

g = 26 °

Angles around a Point

Notes and Guidance

Children need to know that there are 360 degrees in a full turn. This connects to their knowledge of right angles, full turns and compass points.

Children need to know when they should measure an angle and when they should calculate the size of angle from given facts.

Mathematical Talk

How many right angles are there in $\frac{1}{4}, \frac{1}{2}, \frac{3}{4}$ of a full turn?

If you know a half turn/full turn is 180/360 degrees, how can this help you calculate the missing angle?

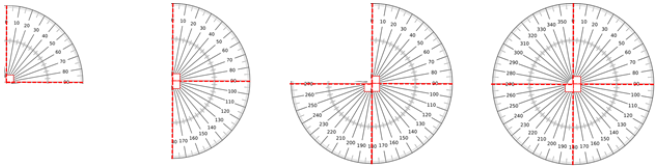
What is the most efficient way to calculate a missing angle? Would you use a mental or written method?

When you have several angles, is it better to add them first or to subtract them one by one?

Varied Fluency

R

Complete the sentences.



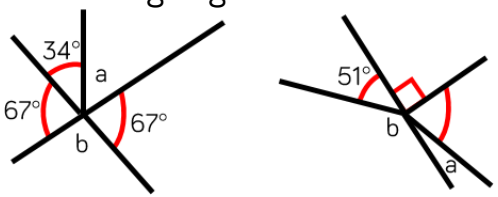
$\frac{1}{4}$ of a turn = 1 right angle = 90°

$\frac{1}{2}$ of a turn = __ right angles = ____°

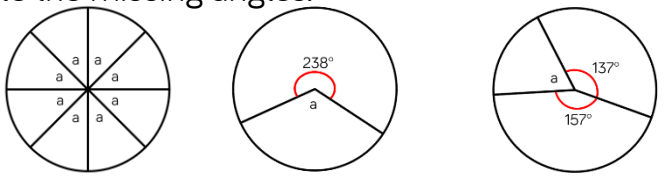
$\frac{\square}{\square}$ of a turn = 3 right angles = ____°

A full turn = __ right angles = ____°

Calculate the missing angles.

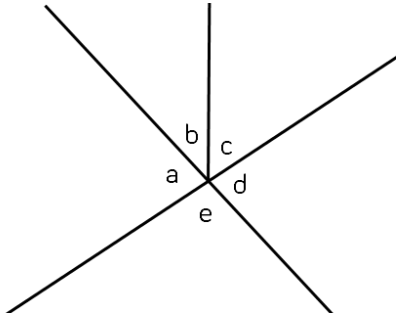


Calculate the missing angles.



Angles around a Point

Reasoning and Problem Solving



$a + b + c + d + e = 360^\circ$

$d + e = 180^\circ$

Write other sentences about this picture.

Various answers e.g.

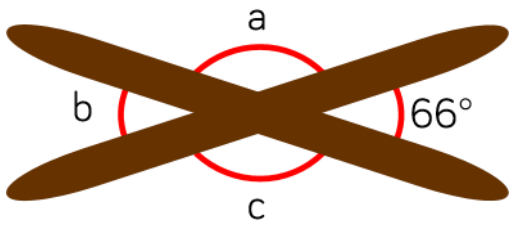
$a + b + c = e + d$

$360^\circ - e - d = 180^\circ$

Etc.

Two sticks are on a table.

Without measuring, find the three missing angles.



$a = 114^\circ$

$b = 66^\circ$

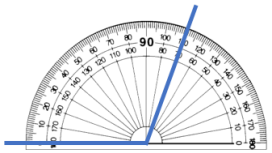
$c = 114^\circ$

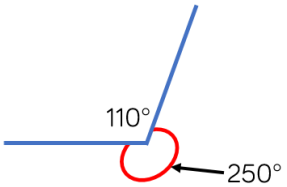
Eva says,

My protractor only goes to 180 degrees, so I can't draw reflex angles like 250 degrees.

Rosie says,

I know a full turn is 360 degrees so I can draw 110 degrees instead and have an angle of 250 degrees as well.





Use Rosie's method to draw angles of:

- 300°
- 200°
- 280°

Calculate Angles

Notes and Guidance

Children apply their understanding of angles in a right angle, angles on a straight line and angles around a point to calculate missing angles.

They should also recognise right angle notation and identify these on a diagram. Children then use this information to help them calculate unknown angles.

Mathematical Talk

What do we know about a and b? How do we know this?

Which angle fact might you need to use when answering this question?

Which angles are already given? How can we use this to calculate unknown angles?

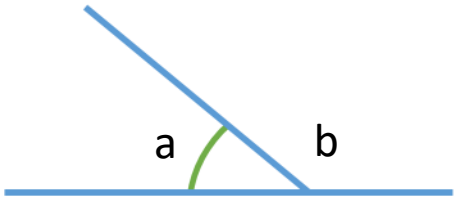
Varied Fluency

- $a + b = \square$

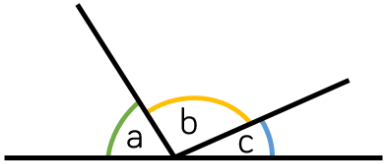
  $b + a = \square$

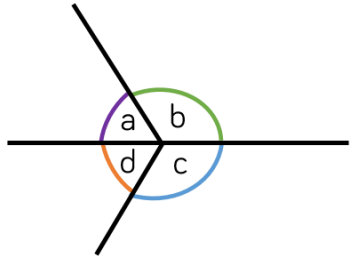
  $\square - a = b$

  $\square - b = a$

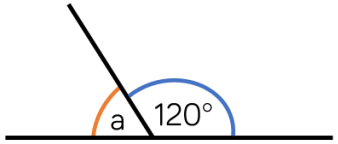


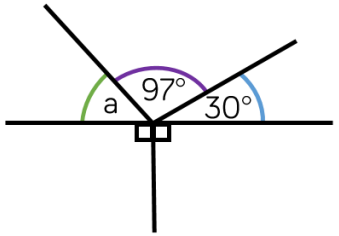
- How many number sentences can you write from the images?





- Calculate the missing angles.





Calculate Angles

Reasoning and Problem Solving

There are five equal angles around a point.

What is the size of each angle?

Explain how you know.

72° because
360 ÷ 5 = 72

Four angles meet at the same point on a straight line.

One angle is 81°

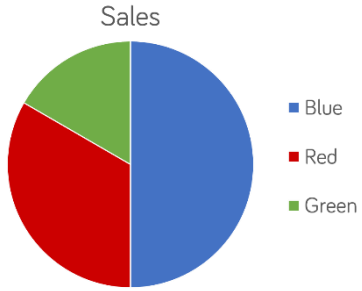
The other three angles are equal.

What size are the other three angles?

Draw a diagram to prove your answer.

180 − 81 = 99°
99 ÷ 3 = 33°

Here is a pie chart showing the colour of cars sold by a car dealer.



The number of blue cars sold is equal to the total number of red and green cars sold.

The number of red cars sold is twice the number of green cars sold.

Work out the size of the angle for each section of the pie chart.

Blue : 180°
Red : 120°
Green : 60°

Vertically Opposite Angles

Notes and Guidance

Children recognise that vertically opposite angles share a vertex. They realise that they are equal and use practical examples to show this.

They continue to apply their understanding of angles on a straight line and around a point to calculate missing angles.

Mathematical Talk

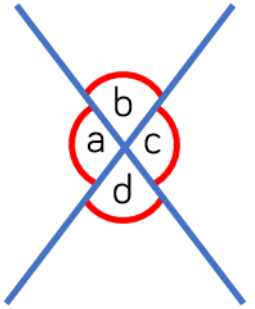
What sentences can we write about vertically opposite angles in relation to other angles?

How can we find the missing angle?

Is there more than one way to find this angle?

Varied Fluency

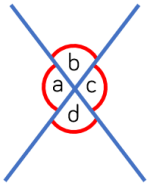
- Take a piece of paper and draw a large 'X'.
  Mark the angles on as shown.
  Measure the angles you have drawn.
  What do you notice about angles b and d?
  What do you notice about angles a and c?
  Is this always the case?
  Investigate with other examples.



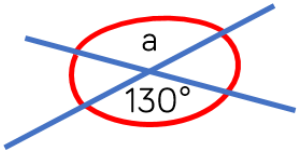
- Use the letters from the diagram to fill in the boxes.

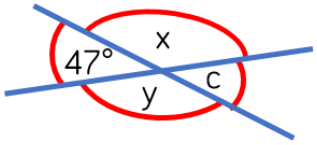
$\square = \square$ $\square = \square$

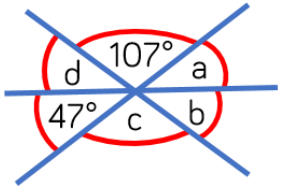
$\square + \square = 180°$ $\square + \square = 180°$



- Find the size of the missing angles.





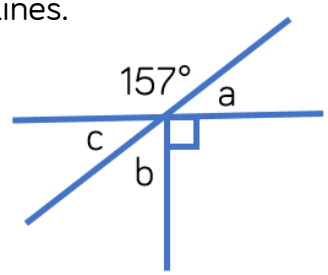


Is there more than one way to find them?

Vertically Opposite Angles

Reasoning and Problem Solving

The diagram below is drawn using three straight lines.



Whitney says that it's not possible to calculate all of the missing angles.

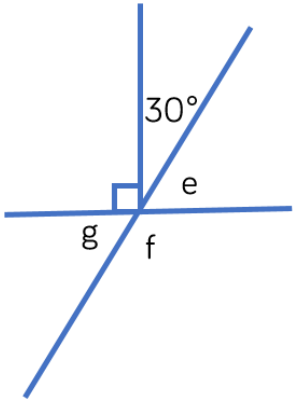
Do you agree? Explain why.

I disagree because:
180 – 157 = 23
so a = 23°
because angles on a straight line add up to 180°

Angles a and c are equal because they are vertically opposite so
c = 23°

Angles around a point add up to 360° so
b = 67°

The diagram below is drawn using three straight lines.



Amir says that angle g is equal to 30° because vertically opposite angles are equal.

Do you agree? Explain your answer.

Find the size of all missing angles.
Is there more than one way to find the size of each angle?

Amir is wrong because g is vertically opposite to e, not to 30° so g would actually be 60°

e = 60°
g = 60°
f = 120°
There are multiple ways to find the size of each angle.

Angles in a Triangle (1)

Notes and Guidance

Children practically explore interior angles of a triangle and understand that the angles will add up to 180 degrees.

Children should apply their understanding that angles at a point on a straight line add up to 180 degrees.

Mathematical Talk

What's the same and what's different about the four types of triangle?

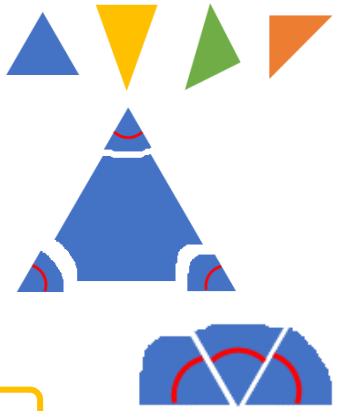
What do the three interior angles add up to? Would this work for all triangles?

Does the type of triangle change anything?

Does the size of the triangle matter?

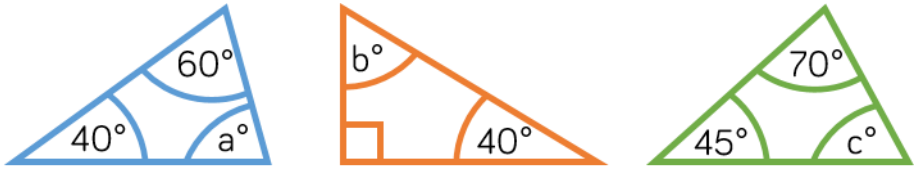
Varied Fluency

- Use different coloured pieces of card to make an equilateral, isosceles, scalene and right-angled triangle.
Use a protractor to measure each interior angle, then add them up. What do you notice?
Now take any of the triangles and tear the corners off. Arrange the corners to make a straight line.
The interior angles of a triangle add up to ☐



- Calculate the missing angles and state the type of triangle that these corners have been torn from.

- Calculate the missing angles.



Angles in a Triangle (1)

Reasoning and Problem Solving

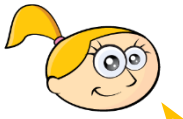
Amir says,

My triangle has two 90° angles.

Can Amir be correct? Can you demonstrate this?

Amir can't be correct because these two angles would add up to 180 degrees, and the third angle can't be 0 degrees.

Eva says,



My triangle is a scalene triangle. One angle is obtuse. One of the angles measures 56°
The obtuse angle is three times the smallest angle.

Work out the size of each of the angles in the triangle.

The interior angles of Eva's triangle are 56°, 93° and 31°

True or False?

A triangle can never have 3 acute angles.

False
Children could use multiple examples to show this.

Angles in a Triangle (2)

Notes and Guidance

Children are introduced to hatch marks for equal lengths. They concentrate on angles in right-angled triangles and isosceles triangles.

Children use their understanding of the properties of triangles to reason about angles.

Mathematical Talk

How can we identify sides which are the same length on a triangle?

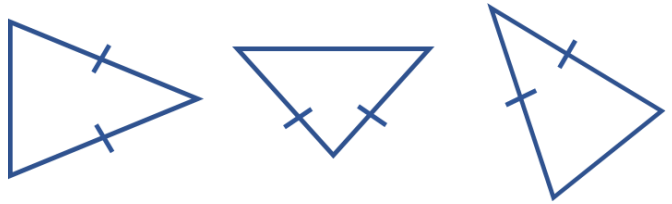
How can we use the use the hatch marks to identify the equal angles?

If you know one angle in an isosceles triangle, what else do you know?

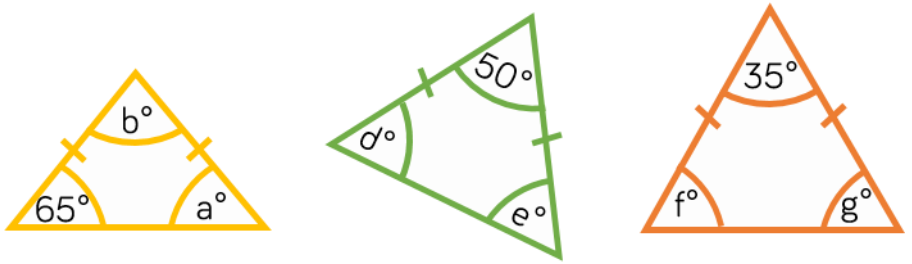
Can you have an isosceles right-angled triangle?

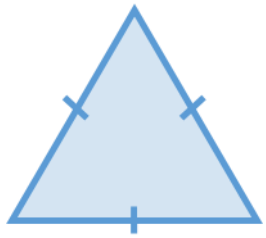
Varied Fluency

- Identify which angles will be identical in the isosceles triangles.



- Calculate the missing angles in the isosceles triangles.



- 

What type of triangle is this?
What will the size of each angle be?
How do you know?
Will this always be the same for this type of triangle?
Explain your answer.

Angles in a Triangle (2)

Reasoning and Problem Solving

I have an isosceles triangle.
One angle measures 42 degrees.

What could the other angles measure?

The angles could be:
42°, 42°, 96°
or
42°, 69°, 69°

Alex

My angles are 70°, 70° and 40°

Mo

My angles are 45°, 45° and 90°

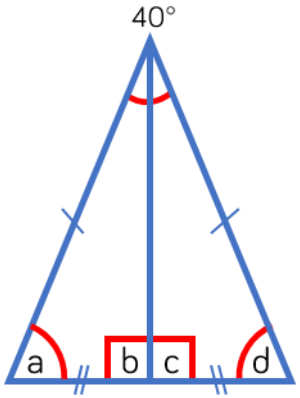
Eva

My angles are 60°, 60° and 60°

What type of triangle is each person describing?
Explain how you know.

Alex is describing an isosceles triangle.
Mo is describing an isosceles right-angled triangle.
Eva is describing an equilateral triangle.

How many sentences can you write to express the relationships between the angles in the triangles?
One has been done for you.



40° + a + d = 180°

Possible responses:
20° + a + b = 180°
20° + c + d = 180°
b = 90 °
c = 90 °
b = c
a = d
etc.

Children could also work out the value of each angle.

Angles in a Triangle (3)

Notes and Guidance

Children build on prior learning to make links and recognise key features of specific types of triangle. They think about using this information to solve missing angle problems.

They should also use their knowledge of angles on a straight line, angles around a point and vertically opposite angles.

Mathematical Talk

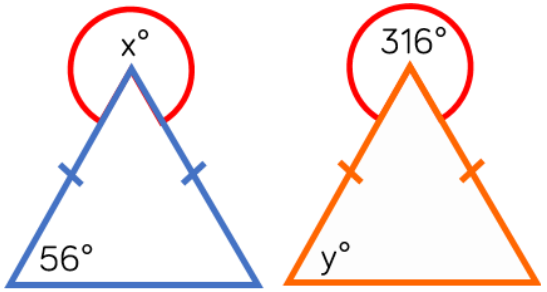
Is it sensible to estimate the angles before calculating them? Are the triangles drawn accurately?

Can you identify the type of triangle? How will this help you calculate the missing angle?

Which angle can you work out first? Why? What else can you work out?

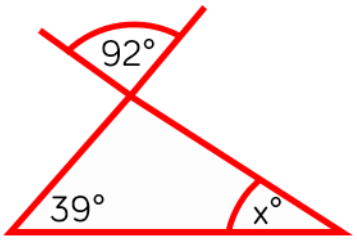
Varied Fluency

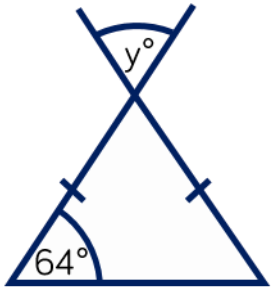
- Work out the value of x and y.
  Explain each step of your working.



- Work out the value of f and g.
  Explain each step of your working.

- Work out the value of x and y.
  Explain each step of your working.

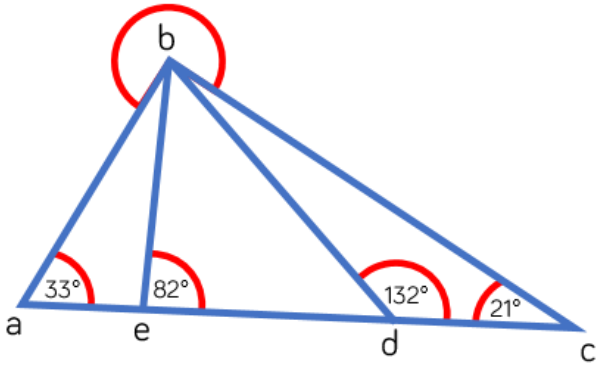




Angles in a Triangle (3)

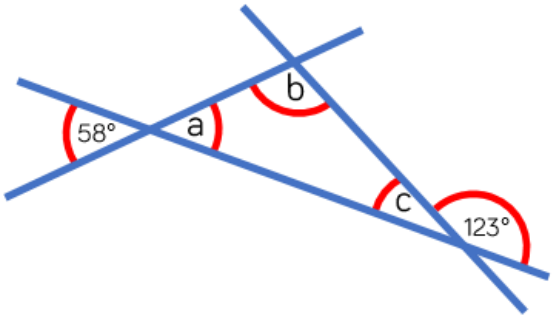
Reasoning and Problem Solving

Calculate the size of the reflex angle b.



234°

Calculate the size of angles a, b and c.



Give reasons for all of your answers.

a is 58 degrees because vertically opposite angles are equal.

c is 57 degrees because angles on a straight line add up to 180 degrees.

b is 65 degrees because angles in a triangle add up to 180 degrees.

Angles in Quadrilaterals

Notes and Guidance

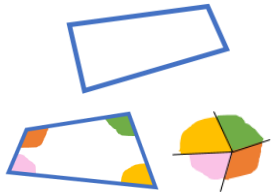
Children use their knowledge of properties of shape to explore interior angles in a parallelogram, rhombus, trapezium etc. They need to learn that angles in any quadrilateral add up to 360°. If they are investigating by measuring, there may be accuracy errors which will be a good discussion point.
Children need to have a secure understanding of the relationship between a rectangle, a parallelogram, a square and a rhombus.

Mathematical Talk

Is a rectangle a parallelogram? Is a parallelogram a rectangle?
What do you notice about the opposite angles in a parallelogram?
Is a square a rhombus? Is a rhombus a square?
What do you notice about the opposite angles in a rhombus?
What is the difference between a trapezium and an isosceles trapezium?
If you know 3 of the interior angles, how could you work out the fourth angle?

Varied Fluency

- Take two quadrilaterals.



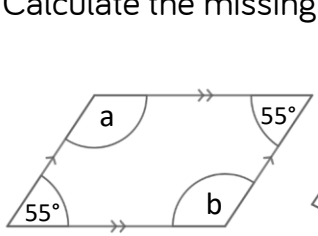
For the first quadrilateral, measure the interior angles using a protractor.
For the second, tear the corners off and place the interior angles at a point as shown.

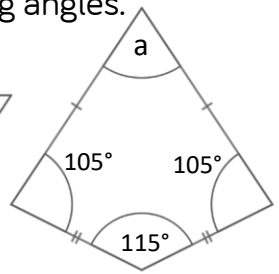
What's the same? What's different? Is this the case for other quadrilaterals?

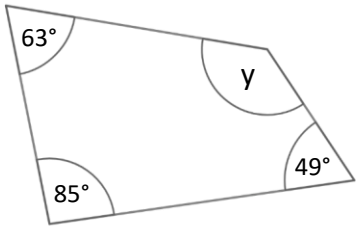
- Here are two trapeziums. What's the same? What's different?

Can you draw a different trapezium?
Measure the interior angles of each one and find the total.

- Calculate the missing angles.



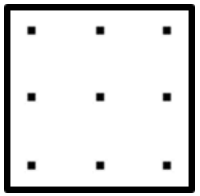




Angles in Quadrilaterals

Reasoning and Problem Solving

How many quadrilaterals can you make on the geoboard?



Identify the names of the different quadrilaterals.

What do you notice about the angles in certain quadrilaterals?

If your geoboard was 4 × 4, would you be able to make any different quadrilaterals?

There are lots of different quadrilaterals children could make.
They should notice that opposite angles in a parallelogram and rhombus are equal.
They should also identify that a kite has a pair of equal angles, and some kites have a right angle.
On a larger grid, they could draw a trapezium without a right angle.

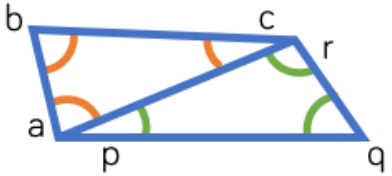
Jack says,

All quadrilaterals have at least one right angle.

Draw two different shapes to prove Jack wrong. Measure and mark on the angles.

Examples:
Trapezium (without a right angle)
Rhombus
Parallelogram

This quadrilateral is split into two triangles.



Use your knowledge of angles in a triangle to find the sum of angles in a quadrilateral.

Split other quadrilaterals into triangles too. What do you notice?

Children should find that angles in all quadrilaterals will always sum to 360 degrees.

Angles in Polygons

Notes and Guidance

Children use their knowledge of properties of shape to explore interior angles in polygons.

Children explore how they can partition shapes into triangles from a single vertex to work out the sum of the angles in polygons.

They use their knowledge of angles on a straight line summing to 180° to calculate exterior angles.

Mathematical Talk

What is a regular polygon? What is an irregular polygon?

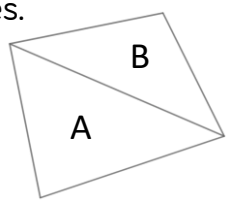
What is the sum of interior angles of a triangle?

How can we use this to work out the interior angles of polygons?

Can we spot a pattern in the table? What predictions can we make?

Varied Fluency

- Draw any quadrilateral and partition it into 2 triangles.
  What do the interior angles of triangle A add up to?
  What do the interior angles of triangle B add up to?
  What is the sum of angles in a quadrilateral?



- Use the same method to complete the table.

Shape	No. of sides	No. of triangles	180 × no. of triangles	Sum of internal angles
Quadrilateral	4	2	180 × 2	360°
Pentagon	5	3		
Hexagon				
Heptagon				

What do you notice?
Can you predict the angle sum of any other polygons?

Angles in Polygons

Reasoning and Problem Solving

Use the clues to work out what shape each person has.

Dora

My polygon is made up of 5 triangles.

Tommy

The sum of my angles is more than 540° but less than 900°

Alex

The sum of my angles is equivalent to the sum of angles in 3 triangles.

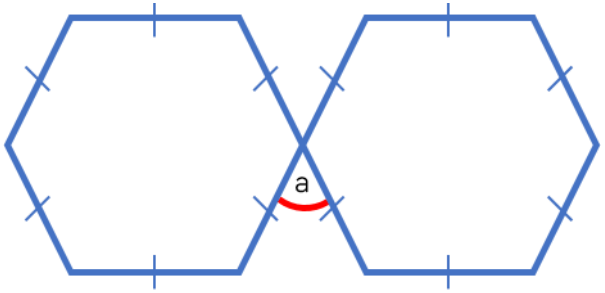
What is the sum of the interior angles of each shape?

Dora:
Heptagon – 900°

Tommy:
Hexagon – 720°

Alex:
Pentagon – 540°

Here are two regular hexagons.



The interior angles of a hexagon sum to 720°
Use this fact to work out angle a in the diagram.

60°

Drawing Shapes Accurately

Notes and Guidance

Children begin by drawing shapes accurately on different grids such as squared and dotted paper. They then move on to using a protractor on plain paper.

Children use their knowledge of properties of shapes and angles, as well as converting between different units of measure.

Mathematical Talk

What do you know about the shapes which will help you draw them?

How can we ensure our measurements are accurate?

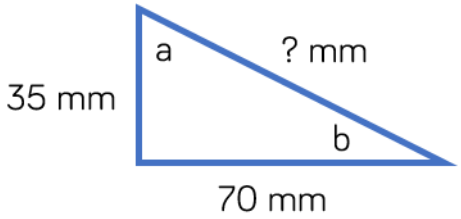
How would you draw a triangle on a plain piece of paper using a protractor?

Varied Fluency

On a piece of squared paper, accurately draw the shapes.

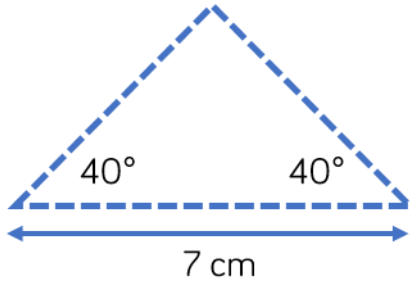
- A square with perimeter 16 cm.
- A rectangle with an area of 20 cm^2.
- A right-angled triangle with a height of 8 cm and a base of 6 cm.
- A parallelogram with sides 3 cm and 5 cm.

Draw the triangle accurately on squared paper to work out the missing length. Measure the size of angles A and B.



Rosie has been asked to draw this triangle on plain paper using a protractor.

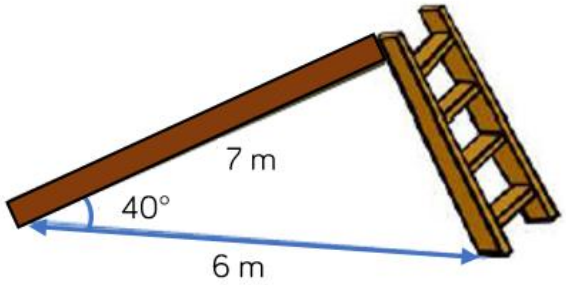
Create a step-by-step plan to show how she would do this.



Drawing Shapes Accurately

Reasoning and Problem Solving

Mr Harrison is designing a slide for the playground.



Use a scale of 1 cm to represent 1 m.

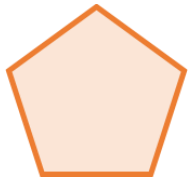
Draw a scale diagram.

Use the diagram to find out how long Mr Harrison needs the ladder to be.

Children will have to use the scale to give their answer in m once they have measured it in cm.

The ladder should be approximately 4.5 m

What is the size of each interior angle of the regular shape below.



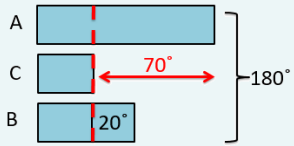
Accurately draw a regular pentagon with side length 5 cm.

108°

Eva has drawn a scalene triangle.
Angle A is the biggest angle.
Angle B is 20° larger than angle C.
Angle C is the smallest angle, and it is 70° smaller than angle A.

Use a bar model to help you calculate the size of each angle, then construct Eva's triangle.

Is there more than one way to construct the triangle?



Angle A: 100°
Angle B: 50°
Angle C: 30°
These angles would work with different side lengths.

Nets of 3-D Shapes

Notes and Guidance

Children use their knowledge of 2-D and 3-D shapes to identify three-dimensional shapes from their nets.

Children need to recognise that a net is a two-dimensional figure that can be folded to create a three-dimensional shape.

They use measuring tools and conventional markings to draw nets of shapes accurately.

Mathematical Talk

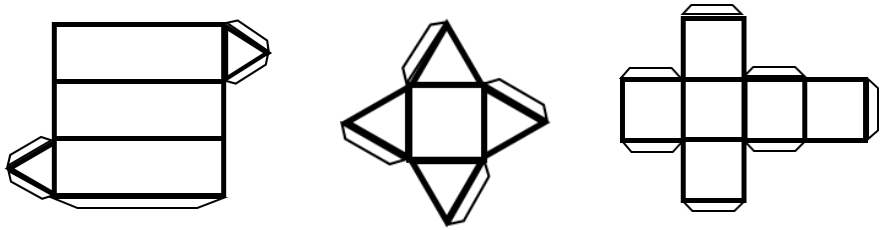
Looking at the faces of a three-dimensional shape, what two-dimensional shapes can you see?

What is a net? What shape will this net make? How do you know? What shape won't it make?

If you make this net, what would happen if you were not accurate with your measuring?

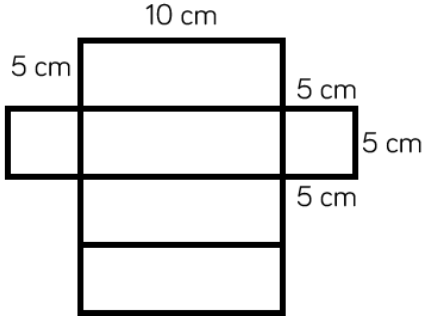
Varied Fluency

- What three-dimensional shape can be made from these nets?

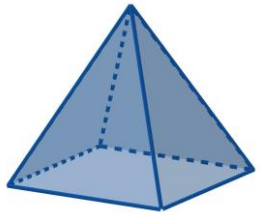


Identify and describe the faces of each shape.

- Accurately draw this net. Cut, fold and stick to create a cuboid.



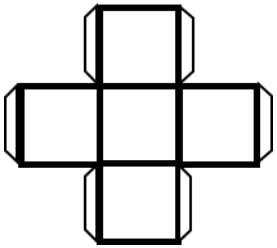
- Draw possible nets of these three-dimensional shapes.



Nets of 3-D Shapes

Reasoning and Problem Solving

Dora thinks that this net will fold to create a cube.



Do you agree with Dora?
Explain your answer.

Dora is incorrect because a cube has 6 faces, this net would only have 5

Use Polydron to investigate how many different nets can be made for a cube.

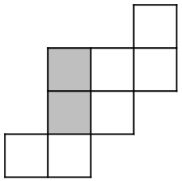
Is there a rule you need to follow?
Can you spot an arrangement that won't work before you build it?
How do you know why it will or won't work?
Can you record your investigation systematically?

There are 11 possible nets.

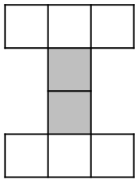
Here is an open box.

Which of the nets will fold together to make the box?
The grey squares show the base.

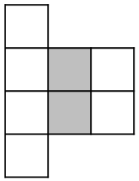
A



B



C



B and C