White Rose Maths

Summer - Block 3

Statistics

Year 6

Overview

Small Steps

1. Read and interpret line graphs
2. Draw line graphs
3. Use line graphs to solve problems
4. Circles
5. Read and interpret pie charts
6. Pie charts with percentages
7. Draw pie charts
8. The mean

NC Objectives

Illustrate and name parts of circles, including radius, diameter and circumference and know that the diameter is twice the radius.

Interpret and construct pie charts and line graphs and use these to solve problems.

Calculate the mean as an average.

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

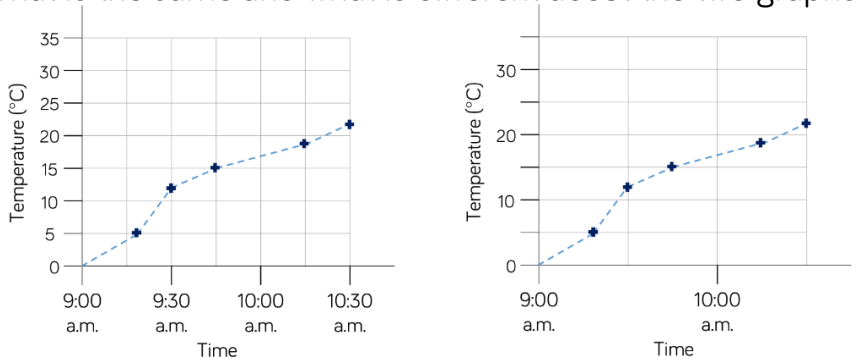
Where might you see a line graph used in real life?

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

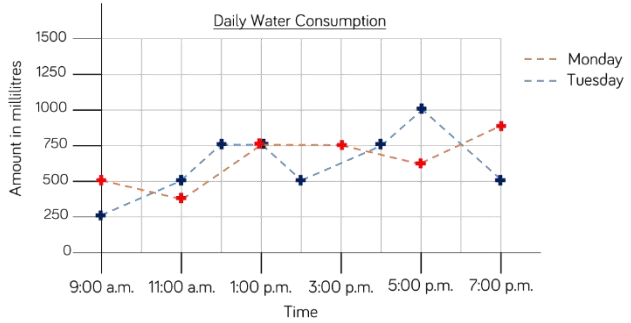
How can you make sure that you read the information accurately?

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.



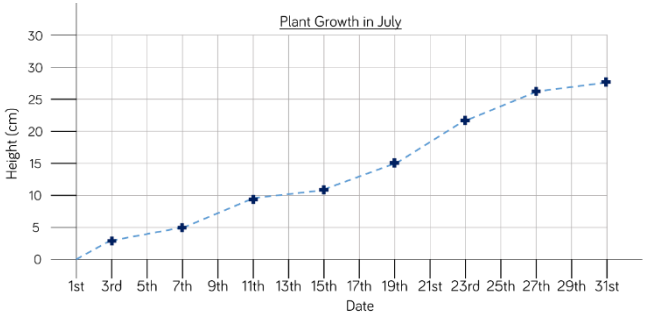
At what times of the day was the same amount of water consumed on Monday and Tuesday?

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?

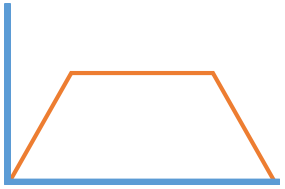
a) On the 9th July a more accurate measurement would be 7.5 cm.

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



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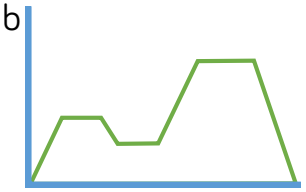
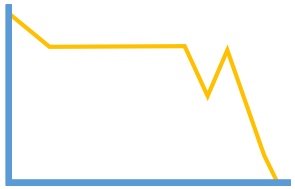


c



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.

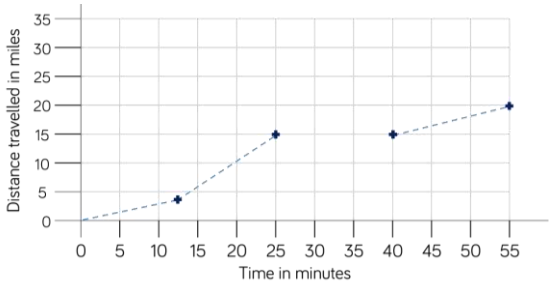
	1990	1995	2000
UK	57,200,000	58,000,000	58,900,000
Australia	17,000,000	18,000,000	19,000,000
	2005	2010	2015
UK	60,300,000	63,300,000	65,400,000
Australia	20,200,000	22,100,000	23,800,000

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

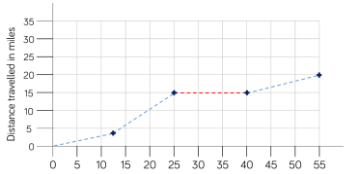
Reasoning and Problem Solving

This graph shows the distance a car travelled.

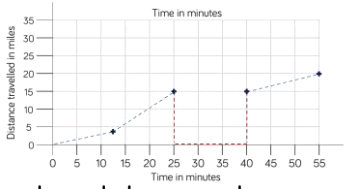


Rosie and Jack were asked to complete the graph to show the car had stopped.
Here are their completed graphs.

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

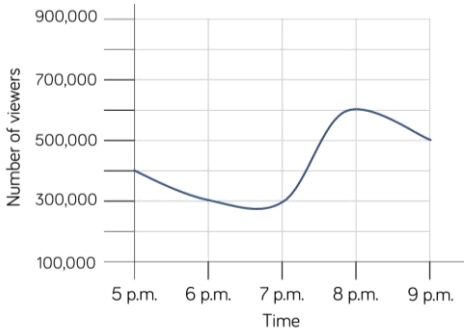
What do you notice about the scale on the vertical axis? Why might it be misleading?
What other scale could you use?

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

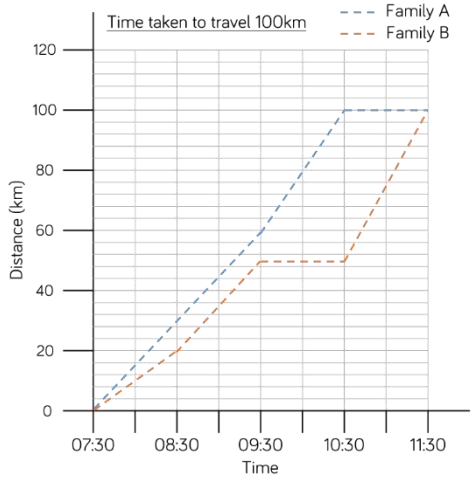
How can you calculate _____?
Why would this information be placed on a line graph and not a different type of graph?

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.?

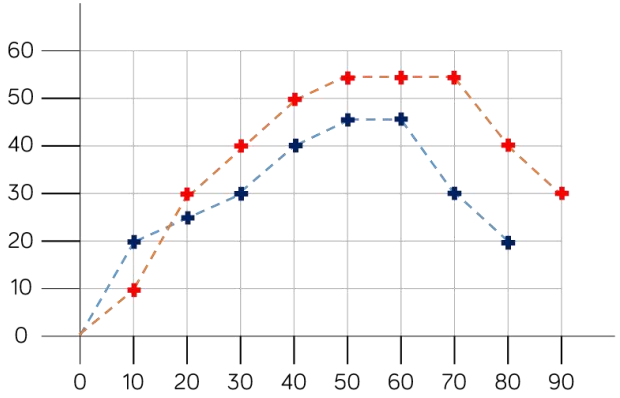


Two families were travelling to Bridlington for their holidays. They set off at the same time but arrived at different times.
What time did family A arrive?
How many km had each family travelled at 08:45?
Which family stopped midway through their journey?
How much further had they left to travel?

Line Graphs Problems

Reasoning and Problem Solving

What could this graph be showing?



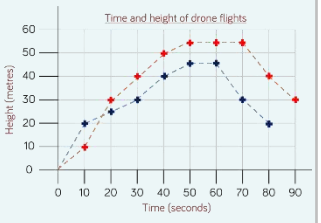
Label the horizontal and vertical axes to show this.

Is there more than one way to label the axes?

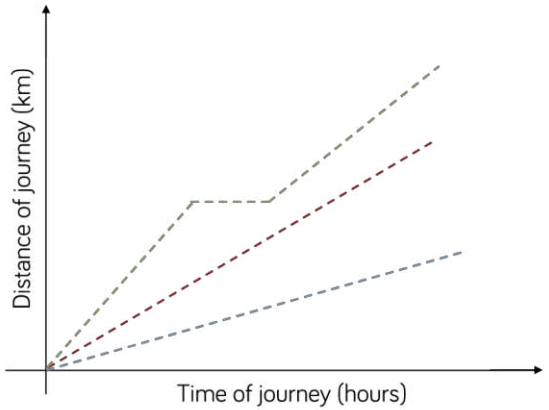
Possible response:

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

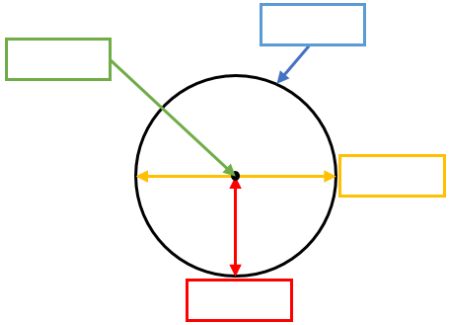
Why is the centre important?

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:



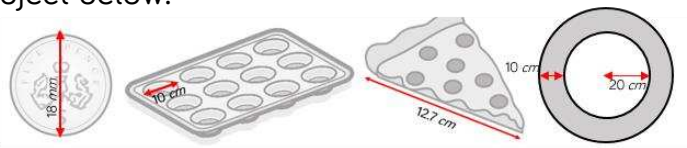
Radius

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

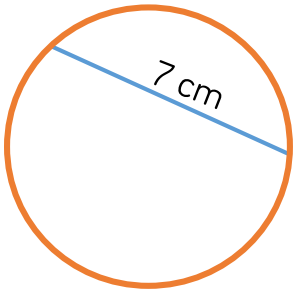
Alex says:

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.

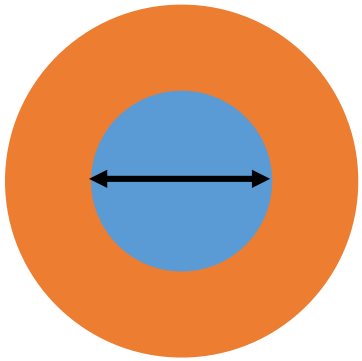
Spot the mistake!
Tommy has measured and labelled the diameter of the circle below.
He thinks that the radius of this circle will be 3.5 cm.



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.

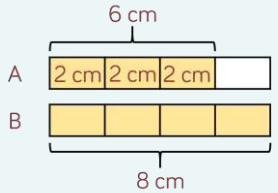
Here are 2 circles. Circle A is blue; Circle B is orange. The diameter of Circle A is $\frac{3}{4}$ the diameter of Circle B.



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?

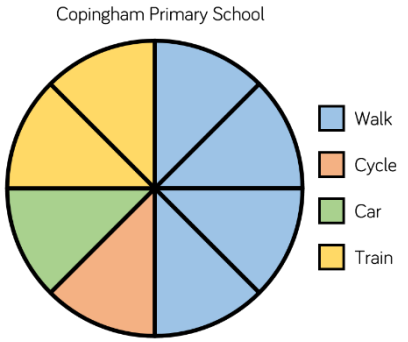
What's the same and what's different about the favourite drinks pie charts?

What other questions could you ask about the pie chart?

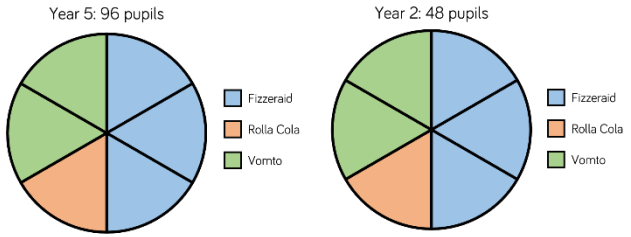
Varied Fluency

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:



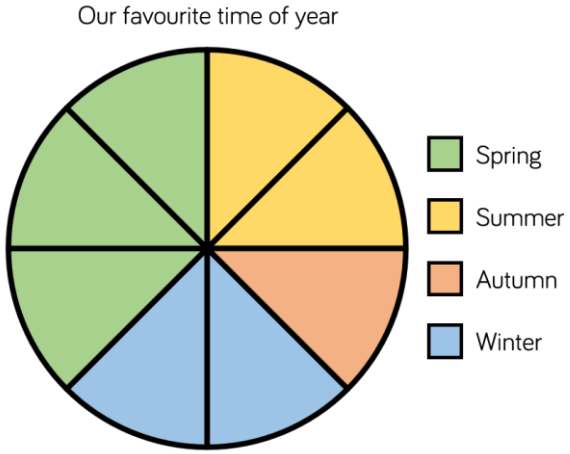
What fraction of pupils in Year 5 chose Fizzeraid?
How many children in Year 2 chose Rolla Cola?
How many more children chose Vomto than Rolla Cola in Year 2?
What other questions could you ask?

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.

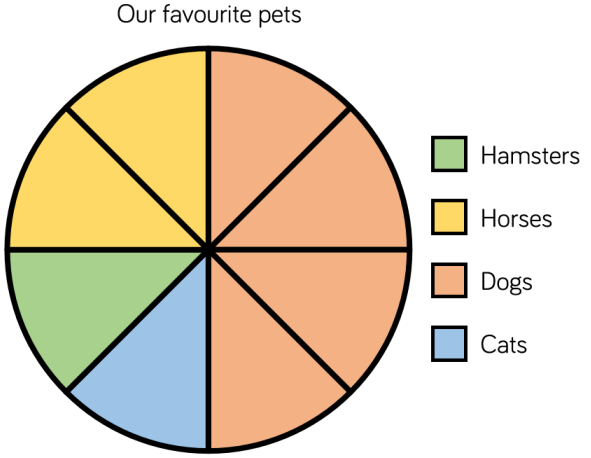
If 48 people voted summer, how many people took part in the survey?



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 $96 = 12$

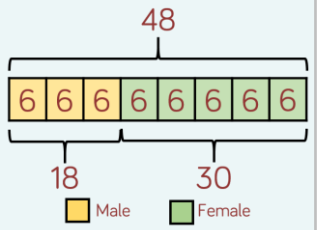
12 people voted cats.

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?

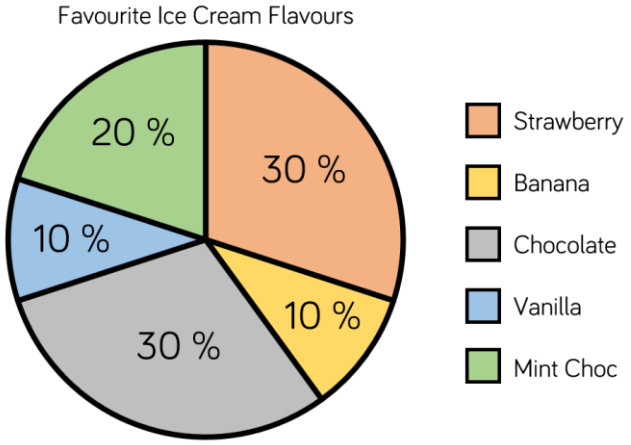
How else could you find the difference between Chocolate and Mint Chocolate?

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:



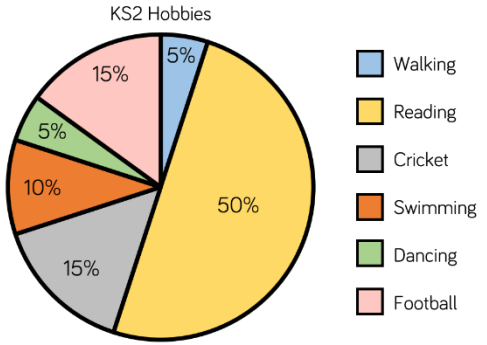
How many people voted for Vanilla?

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.

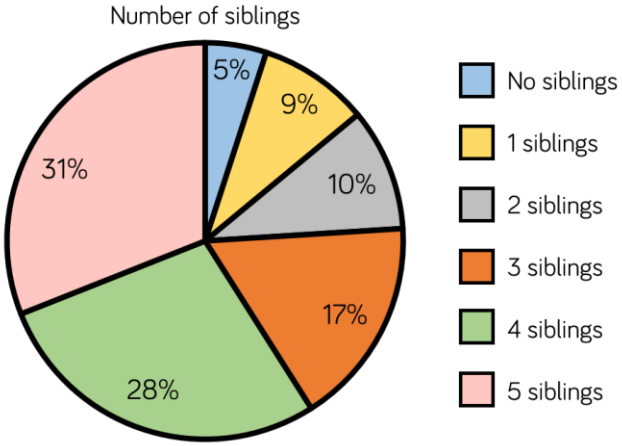
How many pupils chose each hobby?



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.

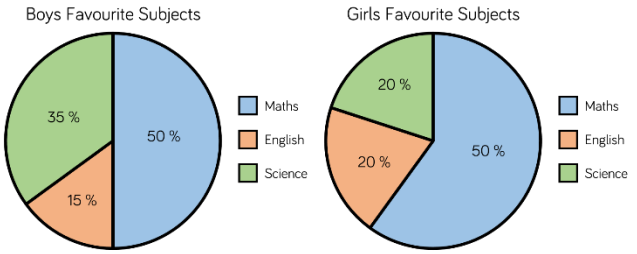


No siblings	15
1 sibling	27
2 siblings	30
3 siblings	51
4 siblings	84
5 siblings	93
Total	**300**

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

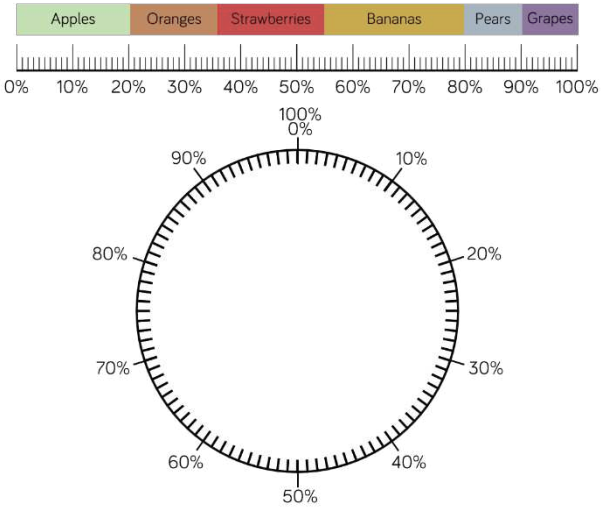
How many degrees are there around a point? How will this help us construct a pie chart?

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.

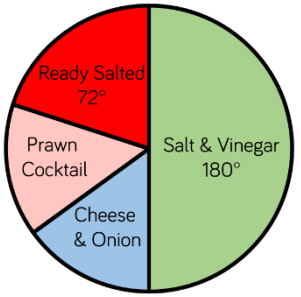
Dinner choice	Frequency	Convert to degrees
Chicken	11	
Pork	8	
Lamb	6	
Beef	9	
Vegetarian	6	
Total	40	

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

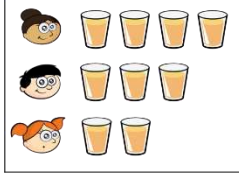
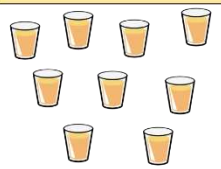
What would the total be? If we know the total, how can we calculate the mean?

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?

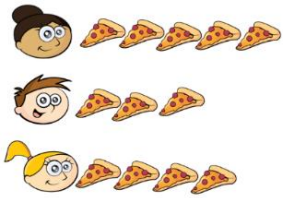
Varied Fluency

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:

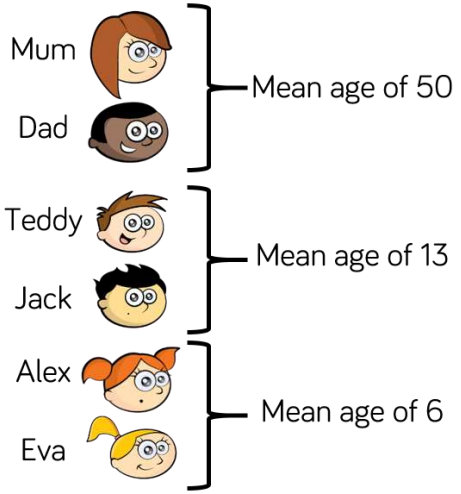
Match number	Number of goals
1	8
2	4
3	6
4	2
5	1
6	

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.

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