

Handling data 2

contents

There are three lessons in the first part of this unit, **Handling data 2A**.

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objectives

The objectives covered in **Handling data 2A** are:

- Find simple fractions of whole-number quantities.
- Plan how to collect and organise small sets of data.
- Construct charts and graphs, on paper and using a computer, to represent data.
- Construct frequency tables for discrete data.
- Solve a problem by extracting and interpreting data in tables, graphs and charts.

The objectives covered in **Handling data 2B** are:

- Find simple fractions of whole-number quantities.
- Recognise the equivalence of simple fractions and percentages.
- Solve a problem by extracting and interpreting data in tables, graphs and charts.
- Understand and use the probability scale from 0 to 1.

Using the lesson plans in this unit

These lesson plans supplement the *Springboard 7* materials for Key Stage 3 pupils working toward level 4 in mathematics. All the lessons are examples only. There is no requirement to use them. If you decide to use the lessons, you will need to prepare overhead projector transparencies (OHTs) and occasional resource sheets for pupils to use.

The lessons consolidate work at level 3 and extend into level 4. They are suitable for a group of pupils or a whole class. Whatever the size of the group, the pupils are referred to as 'the class'.

Each lesson will support about 30 to 40 minutes of direct teaching. To help match the time to your timetable, each plan refers to 'other tasks' for pupils, based on *Springboard 7* resources. Select from these, textbook exercises or your own materials, to provide practice and consolidation in the main part of a lesson and to set homework. Aim to choose tasks that vary in their level of demand, to suit pupils' knowledge, confidence and rate of progress.

Although the 'other tasks' are listed for convenience at the end of the main part of the lesson, they can be offered at any point, especially between the 'episodes' that form the main activity.

The lesson starters are of two kinds: practice starters and teaching starters. The former are opportunities to rehearse skills that will be needed later in the lesson. Teaching starters introduce an idea that is then developed in the main activity.

You will need to tell pupils what they will learn in the lesson, either in the starter or at the beginning of the main activity. Use the plenary to check pupils' learning against the lesson's objectives and to draw attention to the key points that pupils should remember.

Interactive teaching programs (ITPs)

Interactive teaching programs are interactive animated visual aids that can be used with a laptop and data projector or with an interactive whiteboard. As extra support for this unit, you may find it useful to download and use these ITPs from the website www.standards.dfes.gov.uk/numeracy:

for lesson D2.1: *Handling data*

for lesson D2.2: *Line graph*

D2.1

Pie charts and fractions

objectives

- Plan how to collect and organise small sets of data.
- Construct pie charts, on paper and using a computer, to represent data.
- Solve a problem by extracting and interpreting data in pie charts and bar charts.
- Find simple fractions of whole-number quantities.

starter

Vocabulary

survey
sample
pie chart
sector
category

Say that you are going to carry out a *survey* of a small *sample* of pupils by asking them how they like their tea. Write a list on the board, saying that you will use four *categories* of people:

no sugar
1 lump
2 lumps
more than 2 lumps

Resources

ITP *Handling data*
(optional)

Choose four pupils who drink tea. Explain that a lump of sugar is equivalent to one teaspoon, and ask them:

Q How do you like your tea?

Get the pupils to choose from the list and record the results, for example:

no sugar	1
1 lump	2
2 lumps	1
more that 2 lumps	0

Say that you are going to show the results of your survey in a special chart called a *pie chart*, which you will divide into slices. The slices are called *sectors*. Write *pie chart* on the board and draw a large circle with four equally spaced marks on its circumference.

Q How many prefer no sugar in their tea? (e.g. 1 out of 4, or one quarter)

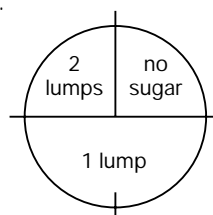
Say that you are going to show this by slicing one quarter of the pie. Draw a quarter of the circle and write 'no sugar' inside it.

Q How many like one lump of sugar? (e.g. 2 out of 4, or one half)

Draw a half slice of the pie, and write '1 lump' inside it.

Q How many like two lumps of sugar? (e.g. 1 out of 4, or one quarter)

Write '2 lumps' in the remaining quarter. Discuss how the slices of the pie match the number of votes, and that there is no slice or sector for 'more than 2 lumps' because nobody voted for it.



Now ask eight different pupils how they like their tea, and record their votes separately. Draw a large circle on the board and mark the circumference with eight equally spaced marks. Choose pupils to draw sectors to match each category. Discuss the resulting chart.

Say that you are now going to carry out a survey of a sample of 16 pupils to find out which of five colours they like the best. List five colours on the board: for example, red, white, blue, yellow, green. Choose 16 pupils to vote for their one preferred colour from the list, and record their votes. Represent the votes by drawing a large circle with 16 equally spaced marks, choosing pupils to draw the five sectors. Quickly colour the sectors in the matching colour, then discuss the results.

You could, if you wish, support the activities above with the ITP *Handling data*, downloaded from www.standards.dfes.gov.uk/numeracy. Use it to present the pie charts after pupils have constructed them.

main activity

Vocabulary

fraction

Resources

OHT D2.1a

mini-whiteboards

Show **OHT D2.1a**. Work through the questions with the class, asking them to estimate the fractional values and to respond using their whiteboards.

Ask questions to supplement those on the OHT such as:

Q What was the most popular item that the pupils chose? How many pupils chose this? What fraction of the pupils do you think that was?

For each answer, ask pupils to explain how they decided. Invite a pupil to the board to show how to write one of the explanations and discuss how to improve it. In another example, ask all pupils to write an explanation on their whiteboards. Ask several pupils to read out their explanations and ask the class to decide which of the explanations they think is the best.

other tasks

Springboard 7

Unit 12

Unit 12 section 2: Pie charts and bar graphs

2 Reading simple pie charts

page 399

You may wish to provide further consolidation on constructing and interpreting simple pie charts.

plenary

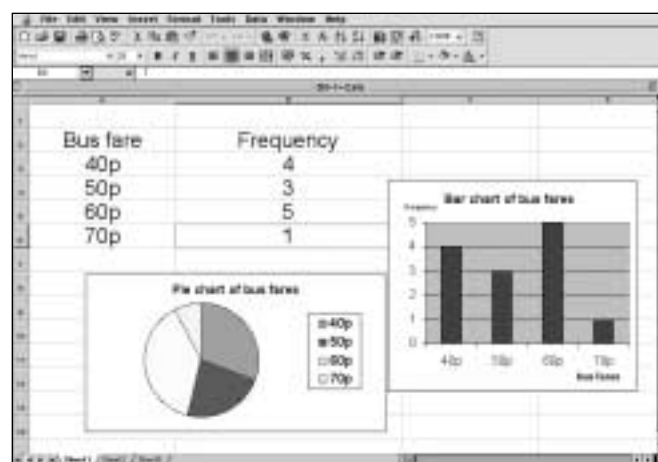
Resources

OHT D2.1b

computer with data projector and spreadsheet

Explain that a bar chart and a pie chart can show the same information.

Before the lesson, prepare a simple spreadsheet. Using the chart wizard, show pupils how to present the information in a table in a pie chart and a bar chart.



- Q Which chart is more useful for showing the most common bus fare?
- Q Which is more useful for showing the fraction of the pupils whose bus fare is 50p?
- Q Can you tell how many pupils took part in the survey from the pie chart?
(no)

Show pupils how the graphs change when changes to the data are made. For example, change the number of 60p bus fares to 1, and observe what happens.

Show **OHT D2.1b**.

- Q What is missing from the bar chart?

Establish that the bar chart needs a title, labels on the axes, and a scale. Each of the bars needs a label.

Label one of the bars 'BBC 1'.

- Q What could the bar chart be representing now?

Discuss and agree possible labels for the axes, the scale, and the title of the graph. Agree on the names of the other bars, for example ITV 1, BBC 2, Sky Sports and so on.

Refer to the pie chart. Say that it represents the same information. Use the information you have agreed to discuss the sectors of the pie chart.

- Q What will the largest sector of the pie chart represent?
- Q What will the smallest sector of the pie chart represent?
- Q What title shall we give the pie chart? What else do we need to add?
(labels for the sectors and/or a key)

Remember

- The bars of a bar chart show how many of each item there are.
- The sectors of a pie chart show how the total is divided up into different parts, and what fraction of the whole each part is.
- Each sector of the pie chart should be labelled with the category it represents, or there should be a key.
- A pie chart should have a title to explain what it is showing.
- A pie chart can represent the same data as a bar chart.

D2.2

Line graphs

objectives

- Construct charts and graphs, on paper and using a computer, to represent data.
- Solve a problem by extracting and interpreting data in bar charts and line graphs.

starter

Show the bar chart on **OHT D2.2a**.

Vocabulary

bar chart
title
horizontal axis
vertical axis
label
scale
gridlines

Resources

OHT D2.2a
mini-whiteboards

Q What is this type of graph called?

Confirm that it is a bar chart.

Q What is missing from the bar chart?

Establish that a title and labels on the axes are needed to identify what the graph is showing.

Q Suppose the horizontal axis shows the days of the week. What could the vertical axis show?

Establish that it might be how many of something or how much of something related to each day of the week. Label the horizontal axis 'days of week' and the individual bars 'Sun', 'Mon', 'Tue', 'Wed', 'Thu', 'Fri', 'Sat'.

Say that the bar chart in fact shows the number of pets treated at a vet's surgery on each day of the week. Invite a pupil to write a title for the chart. Say that the greatest number of pets treated in a day was just over 70.

Q What numbers should we put on the vertical scale?

Identify the tallest bar and use it to establish that that the axis would be marked in intervals of 10. Invite a pupil to label the vertical axis and mark the gridlines in steps of 10.

Now ask pupils to estimate the number of pets treated on each day of the week, and to answer using their whiteboards.

Erase the labels on the vertical axis and the title of the chart. Say that this time the bar chart shows the number of hours someone spent each day watching TV. Say that the greatest amount of time was just less than 4 hours.

Q What numbers should we put on the vertical scale?

Identify the tallest bar. Establish that the axis would be marked in intervals of half an hour or 30 minutes. Label the vertical axis 'hours watching TV' and mark every other gridline 0, 1, 2, 3, 4.

Ask pupils to estimate the number of hours and minutes the person spent each day watching TV.

main activity

Vocabulary

line graph

Resources

Resources D2.2b,

D2.2c

OHT D2.2d

ITP *Line graph*

(optional)

Give out copies of **Resource D2.2b**. Say that some pupils are going on a sponsored walk for charity. They will get £3 for every mile that they walk. This graph shows how much money the pupils will raise, depending on how far they walk. Point out that the graph has two different scales: one horizontal (for the miles walked) and one vertical (for the money raised). It is called a *line graph*.

Say that one pupil walked 6 miles. Show pupils how to find 6 miles on the horizontal scale, to follow the gridline upwards to the graph, and then to read off the money that she raised by following a gridline sideways to the vertical scale.

Say that another pupil raised £21. Show pupils how to find out how many miles he walked by finding £21 on the vertical scale, following it sideways to the graph, and then reading off the miles by following a gridline downwards to the horizontal scale.

Repeat by finding out the amount raised for a walk of 9 miles, and the distance walked if the amount raised was £15.

Show the class how to read the graph when the amounts fall in between the gridlines, if necessary by using their rulers to guide them.

Q Robert walked 7.5 miles. How much money did he raise?

Q Suzy raised £10.50. How far did she walk?

Invite a few pupils in turn to make up a question for other pupils to answer by reading the information from the graph.

You could if you wish support this activity with the ITP *Line graph*, downloaded from www.standards.dfes.gov.uk/numeracy. Use it to present the 'sponsored walk' data or your own example.

Give out copies of **Resource D2.2c**.

Q What is this graph about? What does the horizontal axis show? What does the vertical axis show?

Explain that on some graphs not all the gridlines are labelled. Get pupils to label the intermediate gridlines on the vertical axis.

Q What was the temperature on 13 June? 17 June? 14 June?

Explain that where a reading falls between two gridlines an estimate has to be made.

Q Estimate the temperature on 16 June. (20.2 °C or 20.25 °C)

Ask pupils to complete the rest of the questions working in pairs. Collect and go through responses, then ask:

Q Estimate the change in temperature between 14 and 15 June.
(2.75 degrees)

Show the line graph on **OHT D2.2d**.

Q What do we call this type of graph?

Say that it represents the cost of making a telephone call in the evening for a period of up to 20 minutes. Write on the board:

The cost for 10 minutes is 16p.

Q What labels should we put on the axes?

Establish that the horizontal axis represents the time in minutes and the vertical axis the cost in pence. Invite a pupil to label the axes.

Q How much time will each interval on the horizontal axis represent if the phone call lasts for 20 minutes?

Using the pupils' suggested step sizes, count along the horizontal axis with the class. Establish that each interval is worth 2 minutes. Invite a pupil to label each gridline along the horizontal axis.

Remind the class that the cost for a 10 minute phone call is 16p. Identify the point on the graph that represents 10 minutes costing 16p.

Q What would be the cost for a 20 minute phone call? (32p)

Q Which point on the graph represents 20 minutes costing 32p? (the highest point at the top right)

Q How much will each interval on the vertical axis represent?

Establish that there are eight intervals for the 32p, so that each interval represents 4p. With the class, count up the vertical axis to check, and label the gridlines.

Use the graph to ask questions about the cost of phone calls, for example:

Q How much does a 12 minute phone call cost? A 7 minute phone call?

Remind pupils how to read the information, working from the horizontal axis, to the graph, to the vertical axis.

Q How long were you talking on the telephone if your call cost 20p? If it cost 15p?

This time make sure that pupils can read the information by transferring from the vertical axis to the horizontal axis via the graph.

other tasks

Unit 12 section 1: Line graphs

Springboard 7
Unit 12

- | | |
|---------------------------------|----------|
| 1 The temperature graph | page 393 |
| 2 The sales graph | page 394 |
| 3 The currency conversion graph | page 395 |
| Star challenge 1: Car sales | page 396 |

plenary

Resources
Resource D2.2e

Give out copies of **Resource D2.2e**. Ask pupils to work through the questions in pairs.

Go through the questions, inviting individual pupils to describe how they worked out the answer.

Remember

- There are two scales on a line graph. The line shows the relationship between the values on one scale and the values on the other.
- Make sure that you understand the values that the scales represent before you answer questions about line graphs.

D2.3

Two-way tables

objectives

- Find simple fractions of whole-number quantities.
- Construct frequency tables for discrete data.
- Solve a problem by extracting and interpreting data in tables, graphs and charts.

starter

Say that the tables that the class has looked at so far have gone just one way – down the page.

Vocabulary

two-way table

Resources

OHTs D2.3a, D2.3b
mini-whiteboards

Show **OHT D2.3a**. Say that this is a *two-way table* – it goes across the page as well as down the page. Show pupils how to scan down each column, looking at the information in each row to find the information that they need.

Show **OHT D2.3b**. Ask the class to discuss each question in pairs before answering using their whiteboards. Invite pupils to the projector to identify which rows and columns they used to find the information and to explain to the class how they worked out the answer.

main activity

Vocabulary

bar chart

Resources

OHT D2.3c
mini-whiteboards
computer with data
projector and
spreadsheet

Show **OHT D2.3c**, another two-way table, but this time a frequency table. Say that all the children in a primary school class have answered the question: 'Do you own a bicycle?' The replies are shown in the table.

Ask pupils to use their whiteboards to answer some questions about the information in the table. After the first two questions, invite pupils to explain how they worked out the answer, and to fill in the relevant blanks on the table.

- Q How many boys own a bicycle? (8)
- Q How many girls don't own a bicycle? (4)
- Q How many bicycles does the whole class own? (14)
- Q How many girls are in the class? (10)
- Q How many pupils are in the class? (30)
- Q What fraction of the boys own bicycles? ($\frac{8}{20}$ or $\frac{4}{10}$)
- Q What fraction of the girls own bicycles? ($\frac{6}{10}$ or $\frac{3}{5}$)
- Q Who are better off for bicycles, boys or girls? (girls)

Point out that the sum of the totals of the rows equals the sum of the totals of the columns, because each represents the total number of pupils in the class.

- Q What fraction of the class are girls? ($\frac{10}{30}$ or $\frac{1}{3}$)
- Q What fraction of those who don't own bicycles are girls? ($\frac{4}{16}$ or $\frac{1}{4}$)

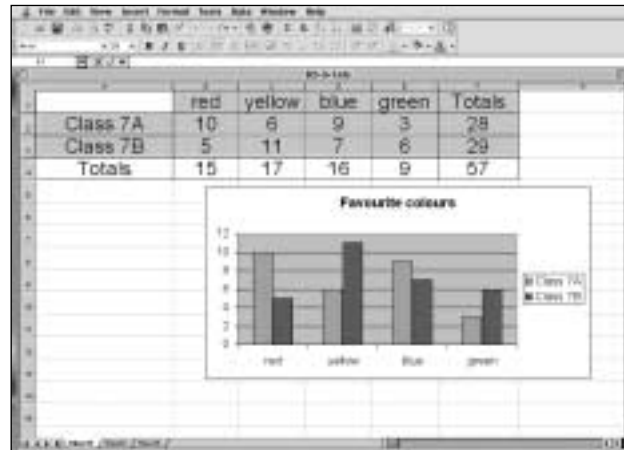
Now complete the table in the lower part of the grid by collecting data from your own class. For example, ask all the boys who own a bicycle to put their hand up, and so on. Show again that the sum of the totals of the rows equals the sum of the totals of the columns.

(In single-sex classes, choose another criterion to subdivide the class, such as pupils aged 11 and pupils aged 12, or the oldest child in the family and not the oldest child in the family, with only children counting as the 'oldest child'.)

Tell the class that information in two-way frequency tables can be represented in bar charts. Before the lesson, prepare a simple two-way table using a spreadsheet, for example on the favourite colours of two classes of pupils.

Using the chart wizard, remind pupils how to present the information from a single class in a bar chart. Stress that the bars may be horizontal or vertical but that each form represents the same data and gives the same information.

Then show how to present the information from both classes in a clustered bar chart with two bars for each colour, representing class 7A and class 7B respectively.

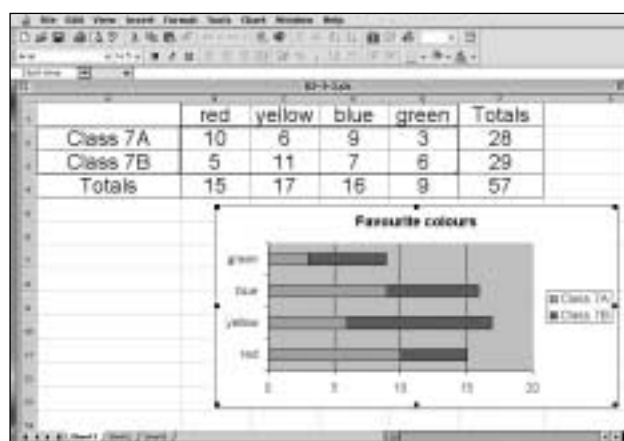


Explain that this form of bar chart is useful for making comparisons between the two classes. Ask:

Q What questions could this bar chart help to answer?

(e.g. Which is the most/least popular colour in each class? Is the same colour the most popular colour in each class? Which class has more pupils who prefer yellow? How many more pupils prefer yellow in class 7A than in class 7B?)

Now show the class how the same data can be represented in a stacked bar chart. Explain that this form of bar chart is useful for seeing the contribution that each class makes to the total and for making comparisons between the totals.



Q What questions could this bar chart help to answer?

(e.g. What is the most/least popular colour in the two classes combined? Which class has more pupils who prefer green? What fraction of the total who prefer red are from class 7A? What fraction are from class 7B?)

other tasks

Springboard 7 Units 4 and 12

Unit 4 section 2: Charts and tables

1 May days	page 148
Star challenge 2: Second-hand cars	page 149
Star challenge 3: How many miles?	page 150

Unit 12 section 3: Information from tables and lists

1 Household goods	page 401
2 Fly to the USA	page 401
Star challenge 4: Yesterday's weather from around the world	page 402
Star challenge 5: The castle visit	page 403

plenary

mini-whiteboards

Show **OHT D2.3d**. Say that this table, which is slightly different from the tables shown so far, shows the distances between five cities.

Q Why are some of the squares blanked out? (each blanked-out square is the distance between a city and itself – it has no meaning)

Explain that the table can be read either from the top to the point of intersection with the relevant row, or from the left-hand side to the point of intersection with the relevant column. Point out that the distance between Cardiff and Manchester is the same as the distance between Manchester and Cardiff.

Ask the class some questions about the distance between one city and another to answer using their whiteboards, for example:

Q What is the distance between London and Newcastle?

Stress that pupils should name the units in their answers.

Refer to the question on the OHT. Ask the class to discuss it in pairs and to use one of their whiteboards for any working out that they need to do. Then ask for answers to the question on the other whiteboards. Invite a pair to the projector to identify which rows and columns they used to find the information and to explain to the class how they worked out the answer.

Show the class how to fill in the space marked 'show your method'.

Remember

- Two-way tables are read both across and down the page.
- In a two-way frequency table the sum of the totals of the rows equals the sum of the totals of the columns.
- Information in two-way frequency tables can be represented in bar charts.

D2.4

More pie charts

objectives

- Find simple fractions of whole-number quantities.
- Recognise the equivalence of simple fractions and percentages.
- Solve a problem by extracting and interpreting data in pie charts.

starter

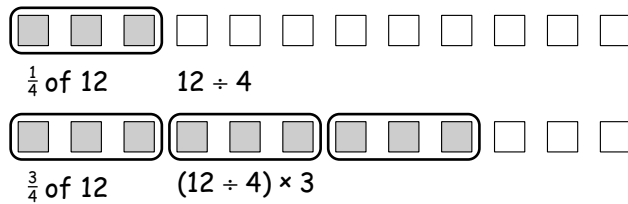
Vocabulary

fraction

Resources

mini-whiteboards

Remind the class that to find three quarters of a number, you first divide the number by 4 to find one quarter, then multiply by 3. Use a diagram to model the calculation.



Write the calculation on the board, step by step.

$$\frac{1}{4} \text{ of } 12 = 12 \div 4 = 3$$

$$\frac{3}{4} \text{ of } 12 = (\frac{1}{4} \text{ of } 12) \times 3 = 3 \times 3 = 9$$

Stress that to find two thirds, you first find one third, then multiply by 2. Work through a similar problem, for example to find three fifths of 30, again drawing a diagram.

Ask pupils to use their whiteboards to answer as you ask:

Q What is three tenths of 70? Four fifths of 30? Five ninths of 18?

main activity

Vocabulary

pie chart
sector
category
percentage
survey

Resources

OHTs D2.4a, D2.4b,
D2.4c
shapes made from
copy of OHT D2.4a
Resource D2.4d
OHT D2.4e
mini-whiteboards

Copy **OHT D2.4a**, preferably on coloured acetate but failing that on stiff paper, and cut out the seven slices of pie.

Show **OHT D2.4a** saying that it shows seven slices of pie.

Q Which piece is the biggest? (G) The smallest? (B)

Tell pupils that the seven pieces can be used to make two complete pies. One of these pies has three slices and the other has four.

Q Which pieces go in each pie?

Ask pupils to discuss the problem in pairs and to sketch diagrams if they wish. Allow a couple of minutes, then ask which slices go in the pie with three slices. Establish by placing the acetate paper shapes first on **OHT D2.4a** and then on **OHT D2.4b** that A, F and G will fit together, and B, C, D and E.

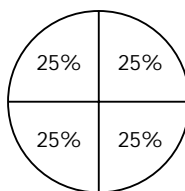
Q Some people share a pie equally. They each have a piece like slice A. How many people share the pie? (4)

Q What if they each have a piece like slice C? (3)

Q What if they each have a piece like slice B? (6)

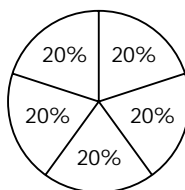
Q Four people share a pie equally. What fraction of the pie does each of them get? (one quarter) What percentage of the pie is this? (25%)

Draw on the board:



Q Five people share a pie equally. What fraction of the pie does each of them get? (one fifth) What percentage of the pie is this? (20%)

Draw on the board:



Illustrate one third in the same way.

Say that it is often useful to be able to estimate fractions and percentages of a circle, for example when considering pie charts.

Show **OHT D2.4c**. Point at the shaded sector of the first circle and ask:

Q What fraction of the circle is this shaded sector? (one quarter) What is this as a percentage? (25%)

Q What fraction of the circle is the unshaded sector? (three quarters) What is this as a percentage? (75%)

Stress that the two fractional parts must have a total of 1, and that the two percentages must have a total of 100%.

Repeat with the other circles. (Shaded parts are one quarter, one half, one third, three quarters, two thirds, one tenth, one fifth and one sixth of the whole circle.)

Give out copies of **Resource D2.4d**.

Say that Sam and Kate carried out some surveys. Kate asked 120 young people what their main hobby is. She made a pie chart to show the information she collected. Sam asked 80 young people what their main hobby is and he too made a pie chart showing his information.

Remind pupils that the 'slices' of a pie chart are called *sectors*, and that in each of these pie charts the sectors represent the *categories*: swimming, reading, football and drama. Ask:

Q In which survey did more people say that their main hobby is football – Sam's survey or Kate's survey?

It is likely that pupils will say that it was Sam's survey. Tell pupils that it is easy to be deceived and you will show them why.

Point in turn to each sector of the pie charts. Get pupils to estimate the fractional values represented by the sector and to show the answer on their whiteboards. Note any pupils whose estimates are wide of the mark so that you can give them support at a later point of the lesson. Agree as a class what each estimate might be (reading

clockwise: one half, one tenth, three tenths and one tenth in Kate's chart; one eighth, one quarter, three eighths and one quarter in Sam's chart).

Ask pupils to work in pairs. They should use their estimates to work out the number of people in each category and to record their answers in the tables. Take the opportunity to give some support to the pupils you identified earlier.

Q What must the numbers add up to in Kate's table? (120)

Q What must the numbers add up to in Sam's table? (80)

Say that you will now ask again:

Q In which survey did more people say that their main hobby is football – Sam's survey or Kate's survey?

Ask pupils to compare the numbers they have worked out. Explain that in Sam's survey, three eighths of 80 people is 30 people, whereas in Kate's survey three tenths of 120 people is 36 people. More people said that football is their main hobby in Kate's survey. Emphasise that even though the sector in Sam's pie chart is bigger, Kate asked more people.

other tasks

Unit 12 section 2: Pie charts and bar graphs

Star challenge 3: Pie charts

page 400

Springboard 7

Unit 12

You may wish to provide further examples of interpreting pie charts.

plenary

Show **OHT D2.4e**.

Resources

mini-whiteboards

Ask pupils to estimate the fraction or percentage of snails, slugs and beetles that each child found. Then focus on the worms. Say that sometimes it may be difficult to decide exactly on the fraction: for example, in Gemma's case, between one eighth and one quarter of her 'finds' were worms.

Q How many worms do you think that Tony found?

Ask pupils to discuss the problem in pairs, then take responses. Answers in the range 21 to 26 inclusive are acceptable.

Q Explain why you think this.

Look for explanations that more than one quarter but fewer than one third of Tony's 80 'finds' were worms.

Q Who found more snails – Tony or Gemma? (Tony)

Q Explain how you know.

Look for explanations that recognise that Tony's snails are one quarter of 80, and Gemma's snails are one half of 36, so that Tony found more – for example: 'Tony found 20 and Gemma found only 18' or 'Quarter of 80 is more than half of 36'.

Remember

- The size of the sectors of pie charts can be deceiving. You need to work out the actual numbers involved before comparing.
- To find three fifths of a number, first find one fifth by dividing by 5, then find three fifths by multiplying by 3.

D2.5

Working out probabilities

objectives

- Understand and use the probability scale from 0 to 1.
- Find simple fractions of whole-number quantities.

starter

Ask pupils to answer your questions using their whiteboards.

Vocabulary

probability
random

Resources

mini-whiteboards

Tell them that you have a pencil case with 12 pens in it, and you are going to take out one of the pens at random. Explain that this means that every pen has an equal chance of being chosen. Write on the board:

12 pens: 6 black, 3 red, 2 blue, 1 green

Q What is the probability that the pen I take out:

- is black? ($\frac{1}{2}$)
- is red? ($\frac{1}{4}$)
- is blue? ($\frac{1}{6}$)
- is green? ($\frac{1}{12}$)

Say that you also have a packet of 15 fruit gums and are going to take one of them at random. Write on the board:

15 fruit gums: 5 orange, 3 lemon, 6 lime, 1 raspberry

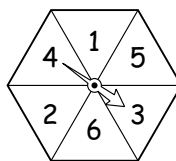
Q What is the probability that the fruit gum I choose:

- is orange? ($\frac{1}{3}$)
- is lemon? ($\frac{1}{5}$)
- is lime? ($\frac{2}{5}$)
- is raspberry? ($\frac{1}{15}$)

After each answer to the questions above ask pupils to explain their reasons.

main activity

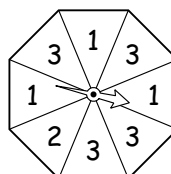
Tell the class that games are sometimes played using a spinner instead of a dice. Draw this diagram on the board.



Explain that this spinner is similar to a dice. When it is spun, the pointer is equally likely to stop on each of the six sections 1 to 6.

Q What is the probability of getting 4? ($\frac{1}{6}$)

Now draw this diagram on the board.



Vocabulary

spinner

Resources

OHTs D2.5a, D2.5b
Resources D2.5c,
D2.5d

Point out that on this spinner some of the numbers are repeated. There is an equal chance that the pointer will stop on each of the eight sections of the spinner. The probability of the spinner stopping on 1 is $\frac{3}{8}$, since there are 3 chances out of 8.

Q What is the probability of the spinner:

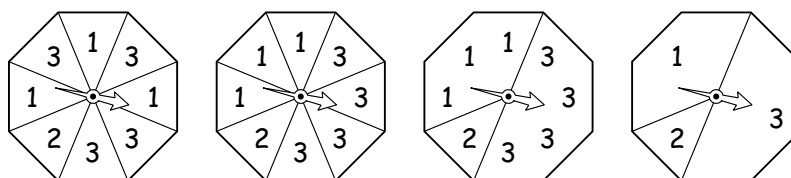
- stopping on 2? ($\frac{1}{8}$)
- stopping on 3? ($\frac{4}{8}$ or $\frac{1}{2}$)

Show **OHT D2.5a**. Work through the probability of getting a 4 on spinner A ($\frac{1}{8}$), then discuss on which spinner Lee is more likely to get 1. Make sure that pupils understand that the chance of getting a 1 on spinner A is $\frac{3}{8}$, and the chance of getting a 1 on spinner B is $\frac{2}{4}$ or $\frac{1}{2}$. There is a better chance on spinner B since $\frac{1}{2}$ is greater than $\frac{3}{8}$.

Show pupils what to write in the section for giving a reason – for example: ‘The chance of 1 on A is $\frac{3}{8}$. The chance of 1 on B is $\frac{1}{2}$. It is more likely on B because $\frac{1}{2}$ is greater than $\frac{3}{8}$.’

Discuss the likelihood of getting a 2 on each of the spinners. Show pupils how to explain why Lee’s statement is correct – for example: ‘The chance of 2 on A is $\frac{2}{8}$ or $\frac{1}{4}$. The chance of 2 on B is $\frac{1}{4}$. These are equally likely.’

Refer back to the second diagram on the board. Draw more diagrams next to it.



Explain that these diagrams all represent the same spinner. All that has happened is that the numbers have been rearranged to group the same numbers together. The probability of getting 1 is still $\frac{3}{8}$, and of getting 3 is still $\frac{1}{2}$.

Show **OHT D2.5b**.

Count the number of small sections for 1, 2, 3 and so on. Ask pupils to discuss in pairs which number the pointer is most likely to stop on and how they would write the reason. Invite a pupil to the projector to write an explanation – for example: ‘3 is most likely because the chance of getting 3 is $\frac{4}{12}$, of getting 1 is $\frac{3}{12}$, of getting 2 is $\frac{2}{12}$, of getting 4 is $\frac{2}{12}$ and of getting 5 is $\frac{1}{12}$.’

Give copies of **Resources D2.5c** and **D2.5d** to each pupil. Ask the class to complete the questions. Encourage them to produce clear written explanations.

Bring the class together and invite different pupils to read out their explanations. Discuss how to improve them. Emphasise that marks in tests are awarded for good written explanations.

other tasks

Springboard 7 Unit 7

Unit 7 section 3: Working out probabilities

Star challenge 4: Random letters	page 260
Star challenge 5: Probabilities with one dice	page 260
Star challenge 6: Probabilities with two dice	page 261

plenary

Resources

ten cubes (three yellow,
two green, one blue,
four red)
an open box
mini-whiteboards

Show the class the box and three yellow cubes, two green and one blue. Tell pupils that you did an experiment. You took a cube from the box, recorded its colour, then replaced it, and you did this 30 times.

Explain that an estimate of the probability of your taking out a yellow cube is 3 in every 6, or $\frac{1}{2}$. This is equivalent to 15 out of 30, since one half of 30 is 15. Write on the board:

$$\frac{3}{6} = \frac{1}{2} = \frac{15}{30}$$

Q Estimate how many times out of 30 I took out a blue cube.

Invite a pupil to explain that the probability is 1 in every 6, or $\frac{1}{6}$, which is 5 out of every 30. Write on the board:

$$\frac{1}{6} = \frac{5}{30}$$

Q Estimate how many times out of 30 I took out a green cube.

Invite another pupil to explain that the probability is 2 in every 6, or $\frac{1}{3}$, which is 10 out of 30. Write on the board:

$$\frac{2}{6} = \frac{1}{3} = \frac{10}{30}$$

Add four red cubes to the three yellow, two green and one blue. Say that you did another experiment, this time repeating it 40 times. Ask pupils to answer your questions using their whiteboards.

Q Estimate how many times out of 40:

- **I took out a yellow cube.**
(3 in every 10, which is equivalent to 12 out of 40)
- **I took out a green cube.**
(2 in every 10, or 8 out of 40)
- **I took out a blue cube.**
(1 in every 10, or 4 out of 40)
- **I took out a red cube.**
(4 in every 10, or 16 out of 40)

Remember

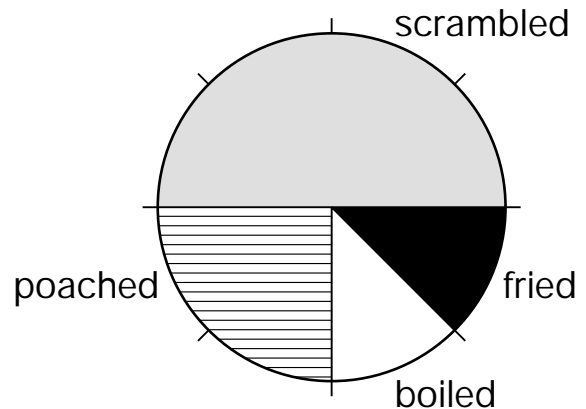
- A probability scale has 0 at one end (impossible) and 1 at the other end (certain).
- Probabilities are usually written as fractions, as decimals, and sometimes as percentages. A one in five chance is written as a probability of $\frac{1}{5}$, 0.2 or 20%.
- If an object is chosen at random from a group of objects, it means that every object in the group has an equal chance of being chosen.

OHT D2.1a

16 pupils said how they liked their eggs cooked.

How many preferred poached eggs?

What fraction preferred boiled eggs?

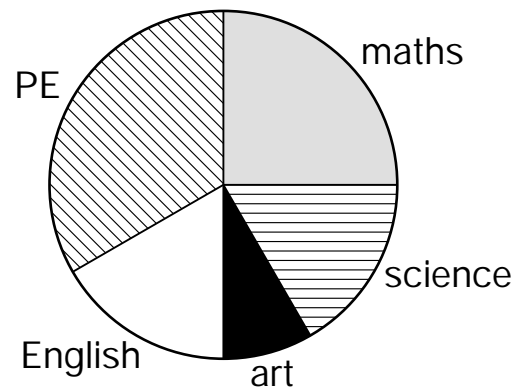


48 pupils chose to attend a Saturday class.

What fraction of them chose PE?

How many of them chose maths?

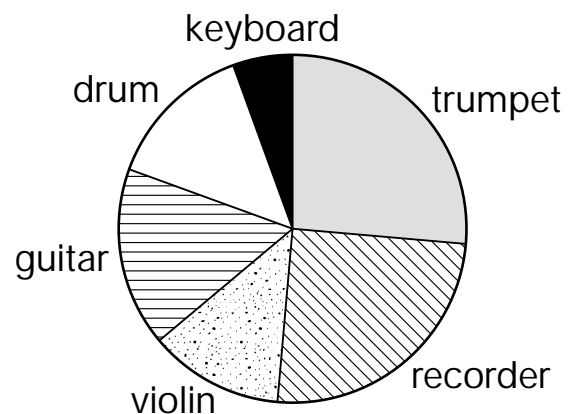
What fraction of them did not choose art or English?



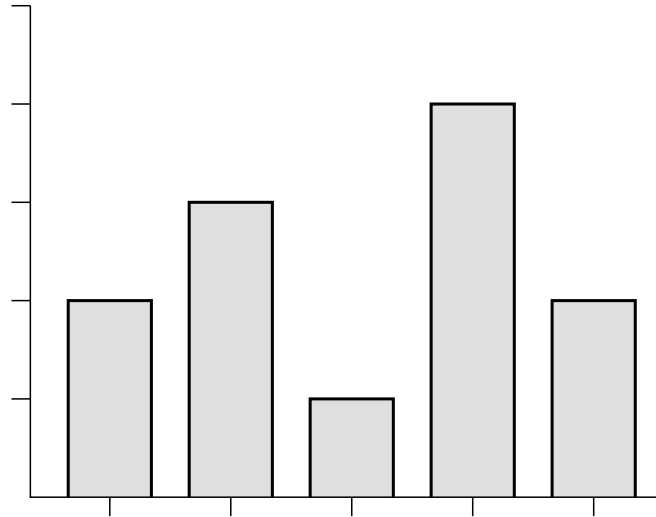
80 pupils chose a musical instrument.

Estimate what fraction of them chose a drum.

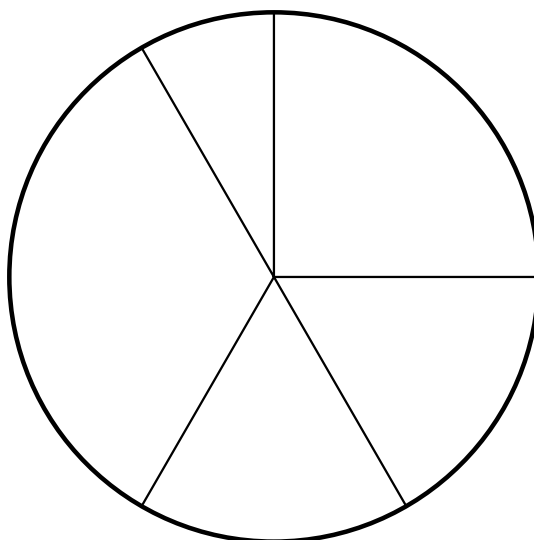
Estimate the number of them who chose a violin.

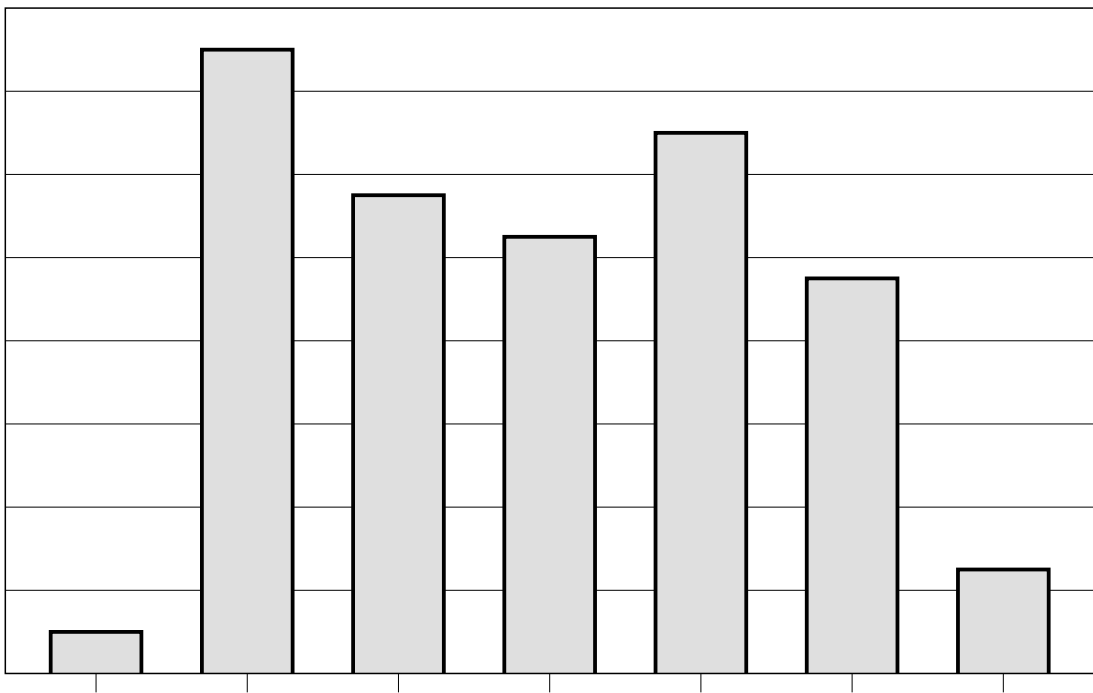


Bar chart

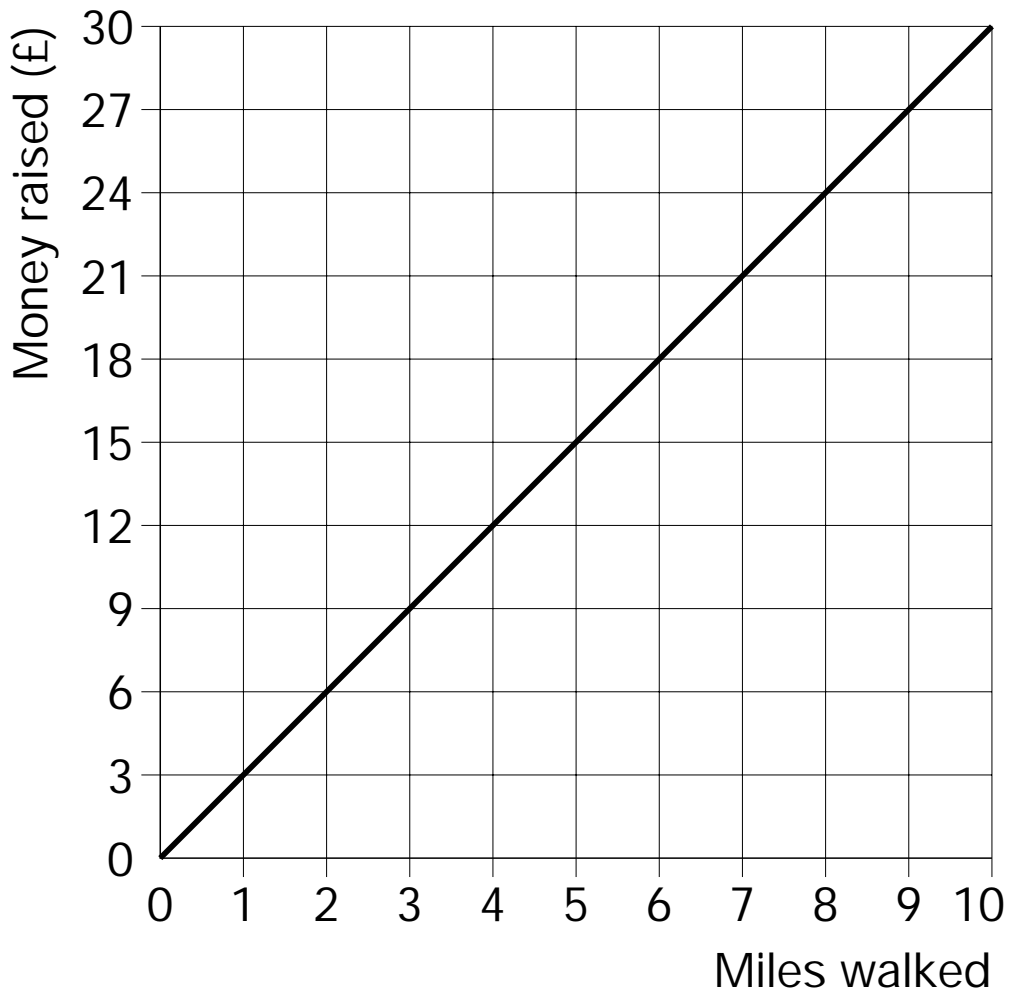


Pie chart



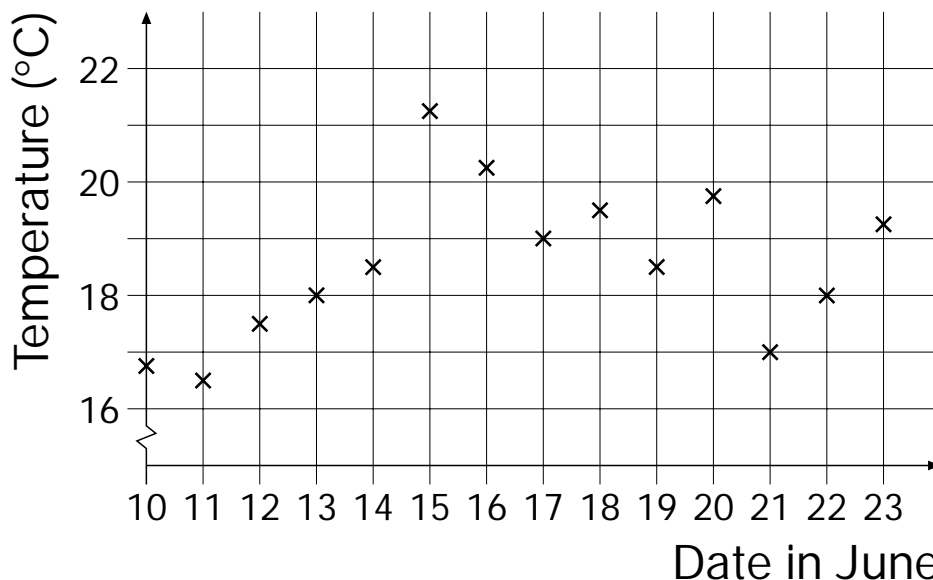


Money raised on a sponsored walk



This chart shows the air temperature at noon for two weeks in June.

Temperature at noon in June



For how many days was the temperature:

more than 19 °C? days

less than 18 °C? days

For the period 10–23 June, estimate:

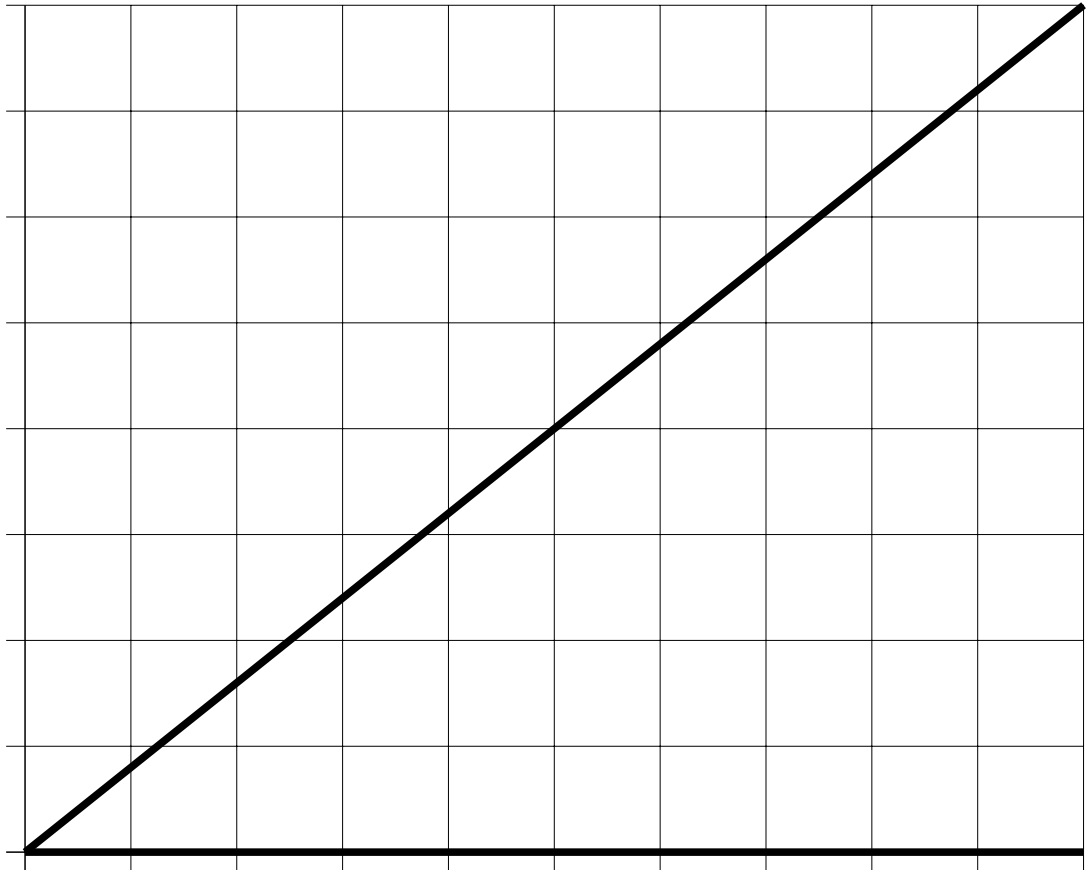
the highest temperature; °C

the lowest temperature. °C

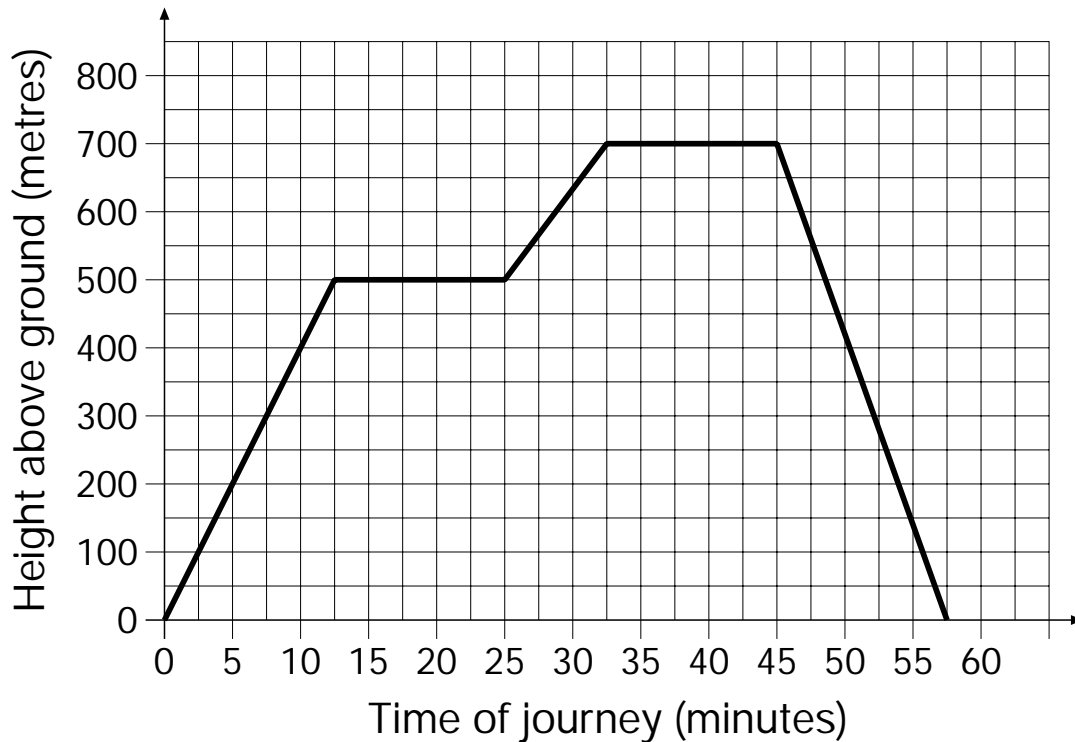
Which date showed:

the largest rise in temperature from the day before? June

the largest fall in temperature from the day before? June



The graph shows the journey of a hot-air balloon.



At what height above the ground was the balloon after 10 minutes? metres

After how many minutes of the journey did the balloon begin to go down? minutes

What was the maximum height that the balloon reached? metres

For how many minutes was it at this height? minutes

This chart shows the musical instruments that some pupils play.

	Lena	John	Rashid	Nicola	Yin
drums	✓	✓		✓	
keyboard			✓		
trumpet	✓				✓
recorder			✓	✓	✓
piano	✓	✓	✓		

Who plays both recorder and drums?

How many pupils play more than two musical instruments?

Which instrument is played by the least number of pupils?

OHT D2.3b

These are the opening times at a swimming pool.

	Opening time a.m.	Closing time p.m.
Wednesday	10:30	5:30
Thursday	10:30	8:30
Friday	10:30	9:00
Saturday	8:00	6:00
Sunday	7:00	4:00

How many hours is the pool open on a Sunday?

..... hours

Which day has the latest closing time?

.....

On which day is the pool open for the longest time?

.....

Habib arrives at the pool at 5:20 p.m. on Saturday.

How many minutes is it before the pool closes?

..... minutes

OHT D2.3c

	Own a bicycle	Don't own a bicycle	Totals
Boys	8	12	
Girls	6	4	
Totals			


	Own a bicycle	Don't own a bicycle	Totals
Boys			
Girls			
Totals			

OHT D2.3d

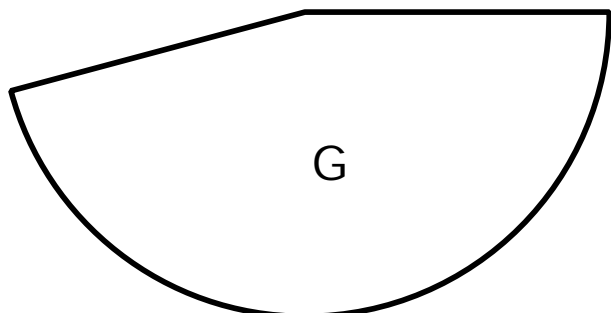
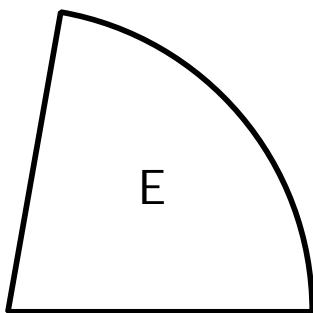
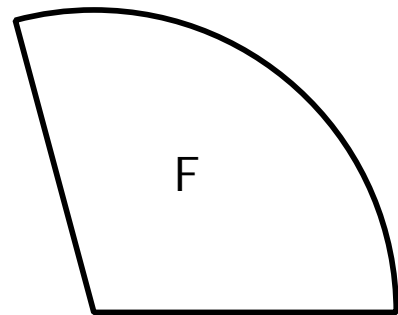
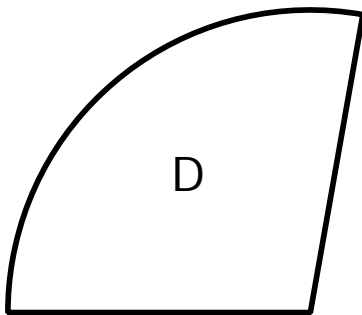
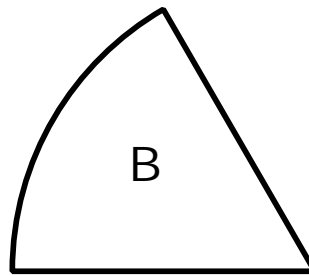
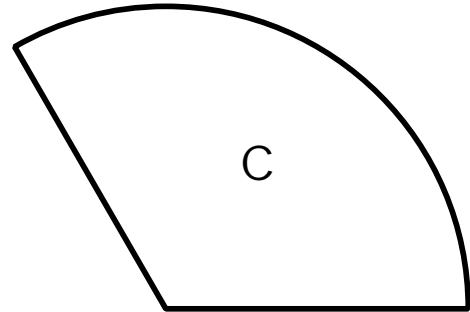
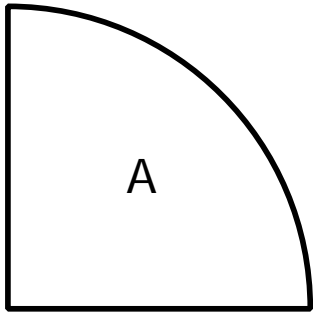
This table shows distances in kilometres between five cities.

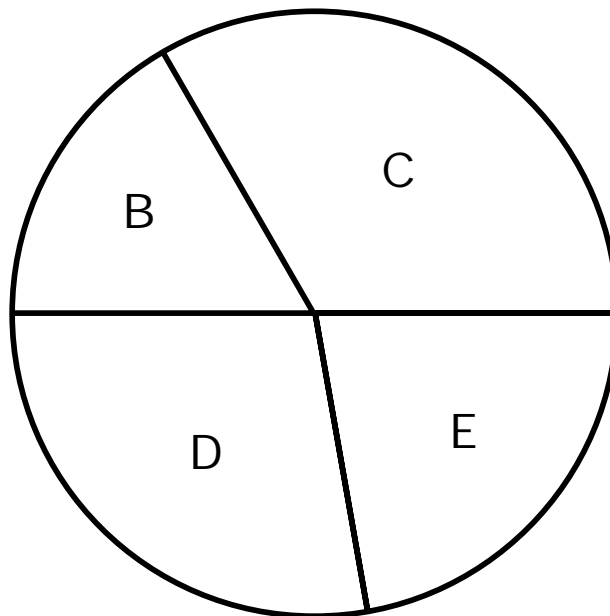
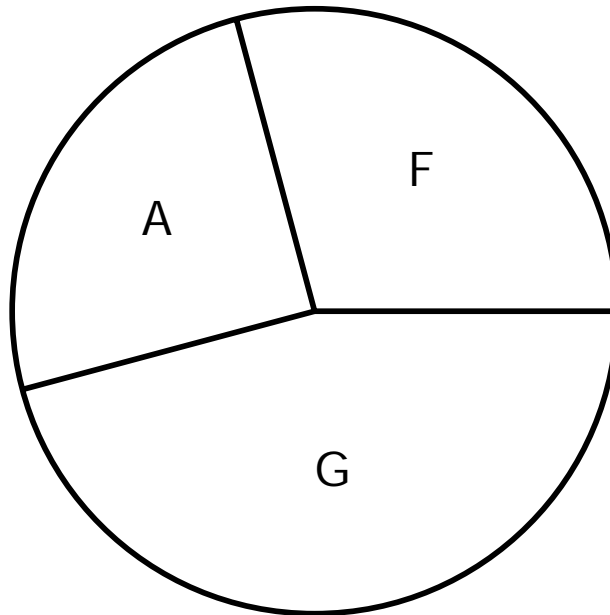
	Birmingham	Cardiff	London	Manchester	Newcastle
Birmingham		179	188	127	334
Cardiff	179		269	278	489
London	188	269		298	441
Manchester	127	278	298		212
Newcastle	334	489	441	212	

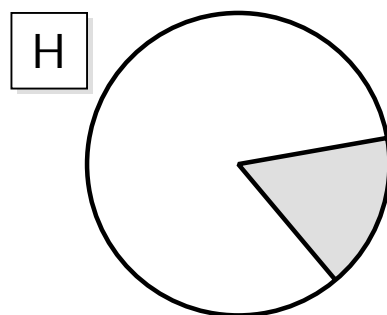
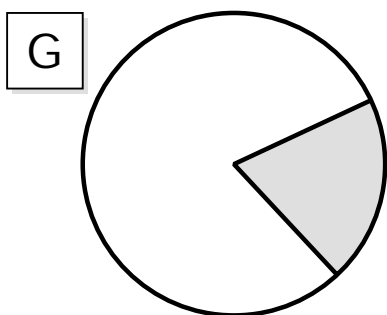
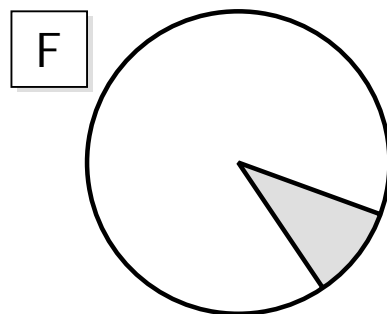
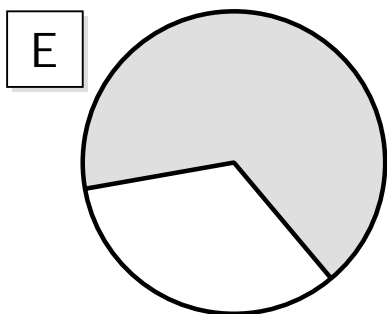
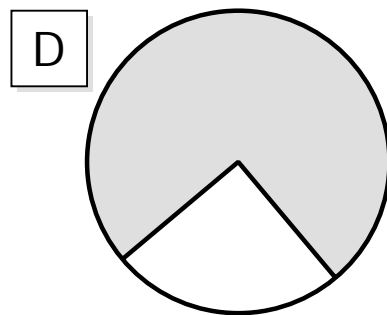
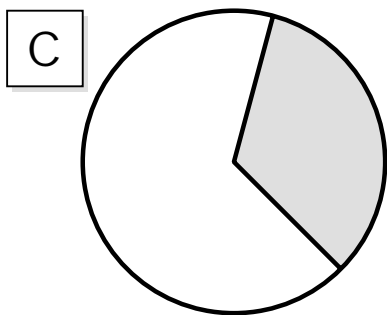
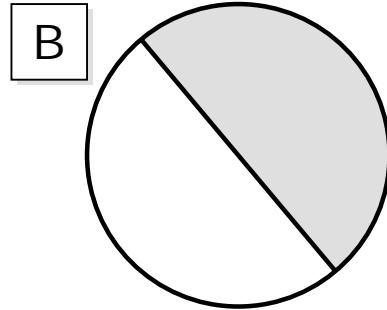
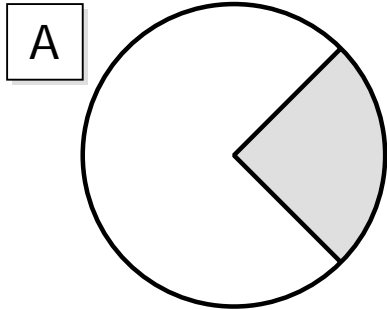
James goes from Newcastle to Birmingham, and then on to Cardiff. How many kilometres does he travel?

 Show your method. You may get a mark.

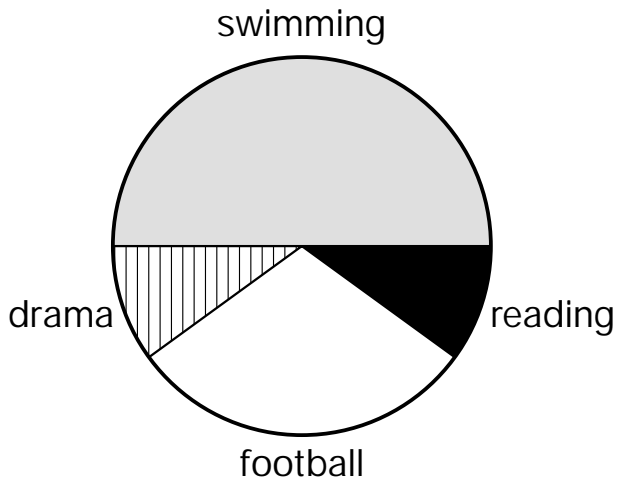
km







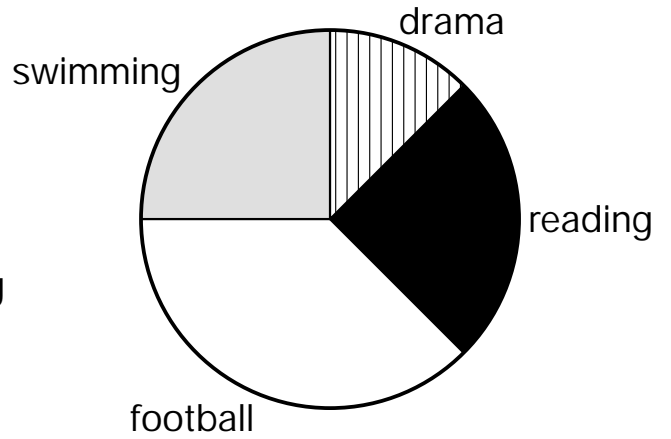
Kate's pie chart



People asked:
120

Hobby	Number of people
swimming	
reading	
football	
drama	
TOTAL	

Sam's pie chart



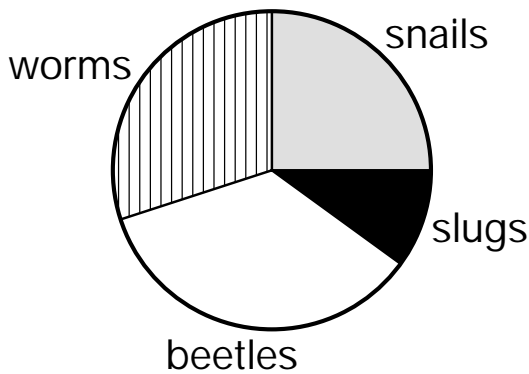
People asked:
80

Hobby	Number of people
swimming	
reading	
football	
drama	
TOTAL	

Tony and Gemma looked for snails, worms, slugs and beetles in their gardens.

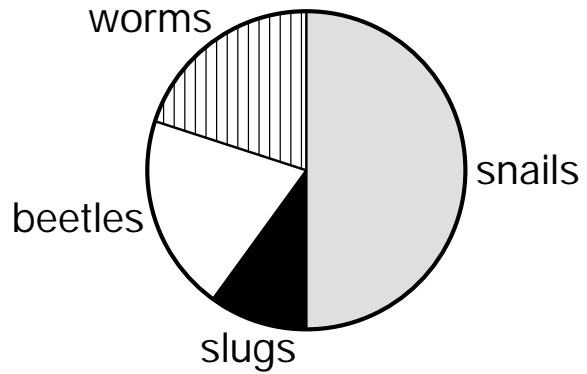
They each made a pie chart of what they found.

Tony's pie chart



Total 80

Gemma's pie chart



Total 36

Estimate the number of worms that Tony found.

..... worms

Who found more snails? Circle: Tony / Gemma

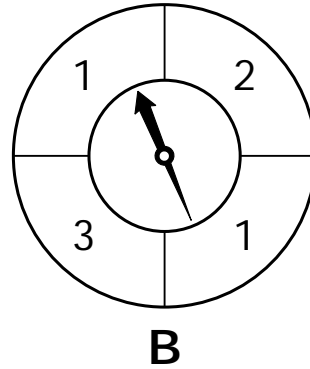
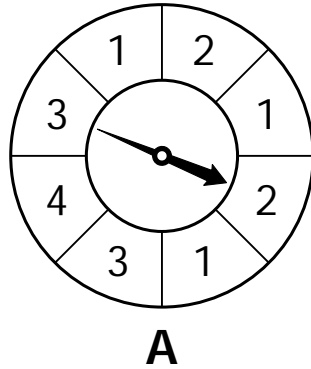
Explain how you know.

.....

.....

.....

Lee has two spinners.



What is the probability of spinning a 4 on spinner A?

Write your answer as a fraction.

On which spinner is he more likely to get a 1?

Give a reason.

.....

.....

.....

Lee says: 'I am equally likely to get a 2 on spinner A as on spinner B.'

Explain why he is correct.

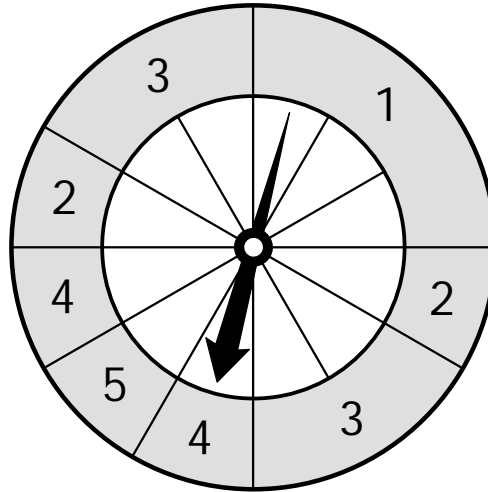
.....

.....

.....

The outer ring of this spinner has 8 sections labelled with the numbers 1 to 5.

The inner ring has 12 equal sections on it.



Which number is the pointer most likely to stop on?

.....

Give a reason.

.....

.....

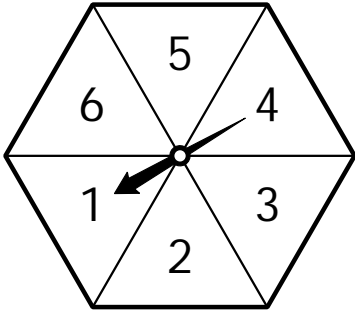
.....

What is the probability of getting an **even number** on this spinner?

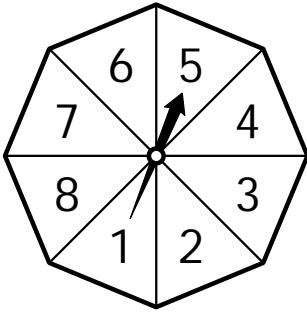
Give your answer as a fraction.

Here are two spinners.

Jill's spinner



Peter's spinner



Jill says: 'I am more likely than Peter to spin a 3.'

Give a reason why Jill is correct.

.....

.....

.....

Peter says: 'We are both equally likely to spin an even number.'

Give a reason why Peter is correct.

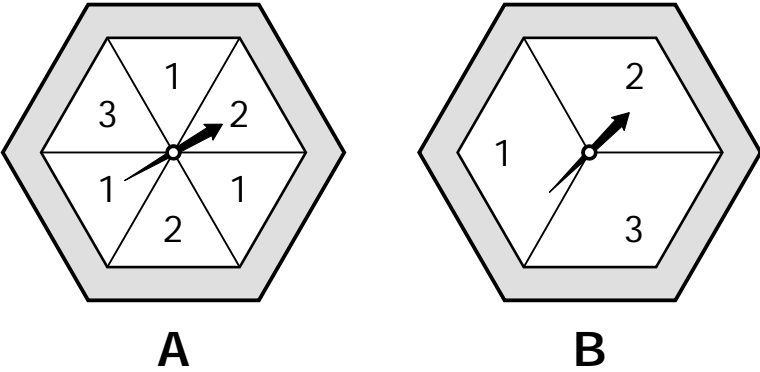
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Resource D2.5d

Here are two spinners, A and B.



For each statement, put a tick if it is true, or a cross if it is not true.

Scoring 1 is more likely on A than on B.

Scoring 2 is more likely on A than on B.

Scoring 3 is as equally likely on A as on B.

Zara spins both spinners.

The score on A is added to the score on B.

She says: 'The sum of the scores on the two spinners is certain to be less than 7.'

Is she correct? Circle: Yes / No

Explain how you know.

.....

.....

.....

