

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**.

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.

Vocabulary

bar chart

title

horizontal axis

vertical axis

label

scale

gridlines

Resources

OHT D2.2a

mini-whiteboards

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 $\frac{1}{4}$)

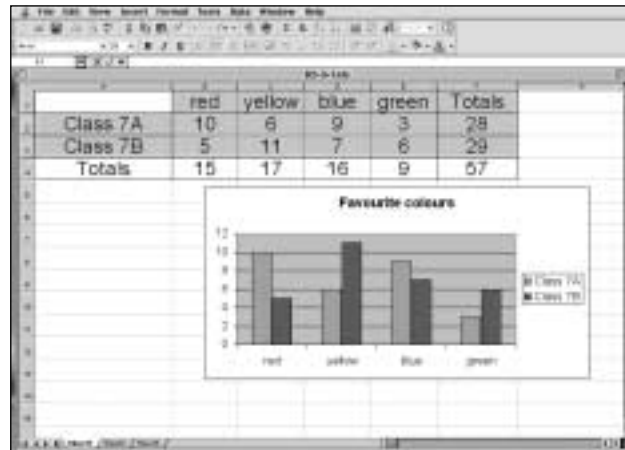
Now complete the table in the lower part of the grid by collecting data from your own class. For example, ask all the boys who own a bicycle to put their hand up, and so on. Show again that the sum of the totals of the rows equals the sum of the totals of the columns.

(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.

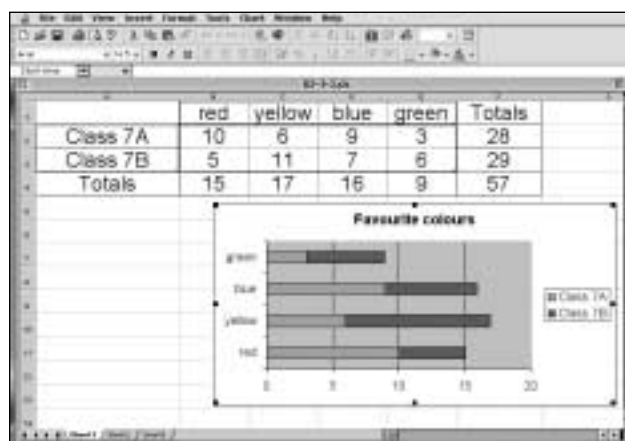


Explain that this form of bar chart is useful for making comparisons between the two classes. Ask:

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.