

Mathletics

Series



Student



Statistics

My name _____



Copyright © 2009 3P Learning. All rights reserved.

First edition printed 2009 in Australia.

A catalogue record for this book is available from 3P Learning Ltd.

ISBN 978-1-921861-11-6

Ownership of content The materials in this resource, including without limitation all information, text, graphics, advertisements, names, logos and trade marks (Content) are protected by copyright, trade mark and other intellectual property laws unless expressly indicated otherwise.

You must not modify, copy, reproduce, republish or distribute this Content in any way except as expressly provided for in these General Conditions or with our express prior written consent.

Copyright Copyright in this resource is owned or licensed by us. Other than for the purposes of, and subject to the conditions prescribed under, the Copyright Act 1968 (Cth) and similar legislation which applies in your location, and except as expressly authorised by these General Conditions, you may not in any form or by any means: adapt, reproduce, store, distribute, print, display, perform, publish or create derivative works from any part of this resource; or commercialise any information, products or services obtained from any part of this resource.

Where copyright legislation in a location includes a remunerated scheme to permit educational institutions to copy or print any part of the resource, we will claim for remuneration under that scheme where worksheets are printed or photocopied by teachers for use by students, and where teachers direct students to print or photocopy worksheets for use by students at school. A worksheet is a page of learning, designed for a student to write on using an ink pen or pencil. This may lead to an increase in the fees for educational institutions to participate in the relevant scheme.

Published 3P Learning Ltd

For more copies of this book, contact us at: www.3plearning.com/contact

Designed 3P Learning Ltd

Although every precaution has been taken in the preparation of this book, the publisher and authors assume no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of this information contained herein.

Series G – Statistics

Contents

Topic 1 – Types of graphs (pp. 1–24)

Date completed

- pictograms _____
- double bar charts _____
- pie charts _____
- divided bar charts _____
- reading line graphs _____
- constructing line graphs _____
- double line graphs _____
- travel graphs _____

Topic 2 – Collecting and analysing data (pp. 25–40)

- grouped data _____
- range _____
- mean _____
- median _____
- mode _____
- range, mean, median and mode _____
- surveys _____
- misleading graphs _____

Topic 3 – Data investigations (pp. 41–45)

- critically endangered – *create* _____
- a few very average questions ... – *investigate* _____
- get up and go – *create* _____
- ice cream dreams – *create* _____
- line it up – *create* _____

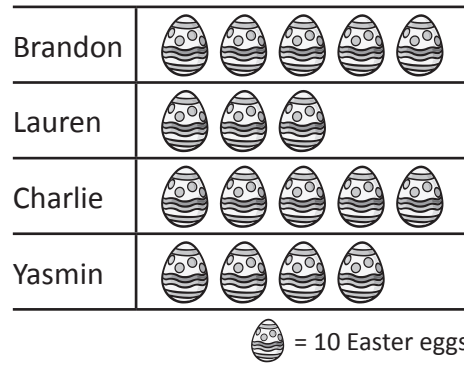
Series Authors:

Rachel Flenley
Nicola Herringer

Types of graphs – pictograms

Pictograms use symbols to represent information in the graph. Pictograms must include a key to show the value of each symbol.

Easter Eggs found at the Egg Hunt



1 Mr Gain, the headteacher of Mathletics Primary School – the school for Mathletes – likes to show off to other headteachers at meetings by showing a picture graph of his school’s Live Mathletics ranking.

a How many pupils are at the school?

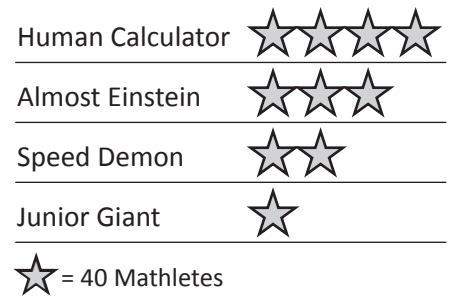
b How many Human Calculators are there?

c How many Speed Demons are there?

d How many more Human Calculators are there than Junior Giants?

e If all the Almost Einsteins moved up a rank, how many Human Calculators would there be?

Mathletics Ranking



2 Last term, Years 5 and 6 raised money for World Aid, a charity that sponsors underprivileged children around the world. They were asked to present how much money they’d raised to the school assembly.

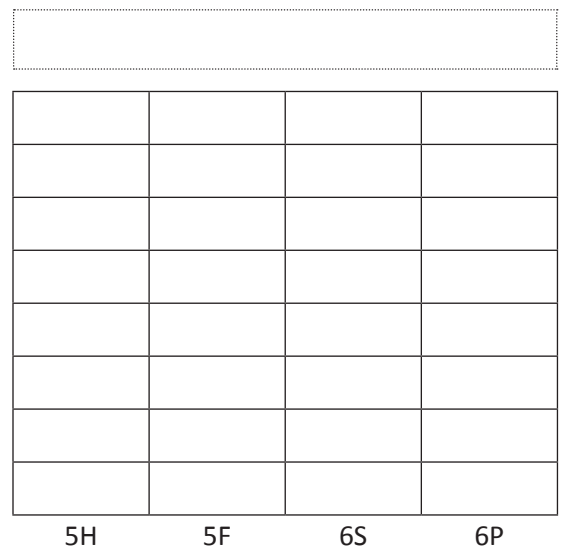
a Complete a pictograph for them to present as a poster in assembly. To make it clear to see from a distance, you should only put one or part of a symbol in each part of the grid. This clue should help you decide on the key.

Give your pictograph a title.



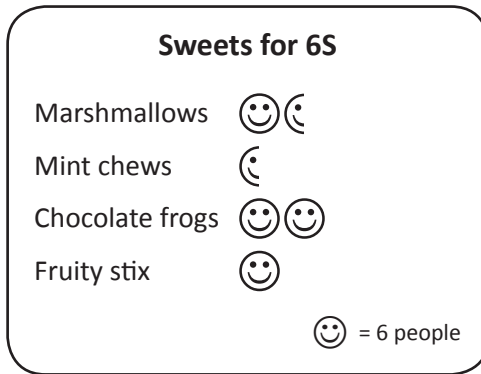
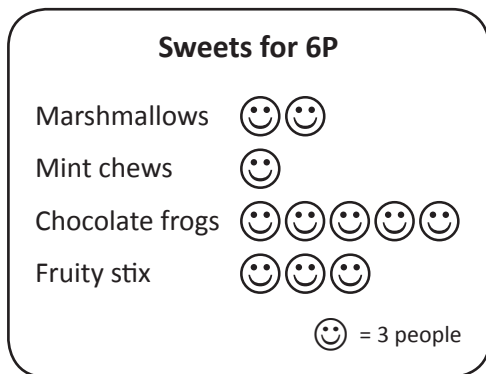
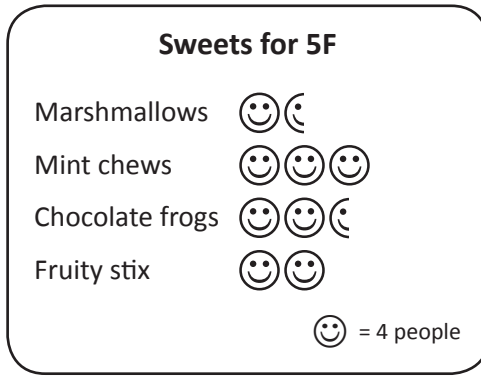
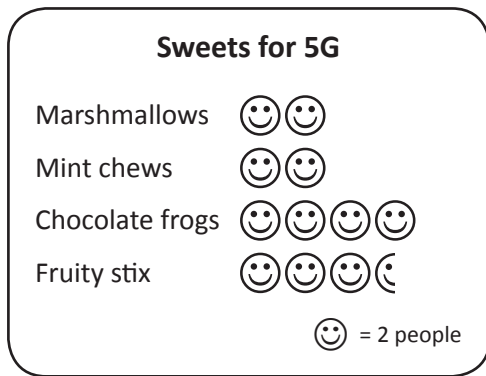
Class	Amount
5H	£1,200
5F	£1,600
6S	£900
6P	£1,100

Key: £ = _____



Types of graphs – pictograms

3 Mr Gain was preparing to take Years 5 and 6 away on camp. He asked each class to create a picture graph to show their sweet preference. He wanted to make sure he bought lots of sweets that the kids liked so he could bribe them to sleep at 'lights out'.



a In which class did 15 pupils choose chocolate frogs?

b Which was a more popular choice in Year 6, mint chews or marshmallows?

c How many pupils are there in Year 5?

d What was the most popular sweet in Year 5?

e Complete the table to show how many voted for each type of sweet:

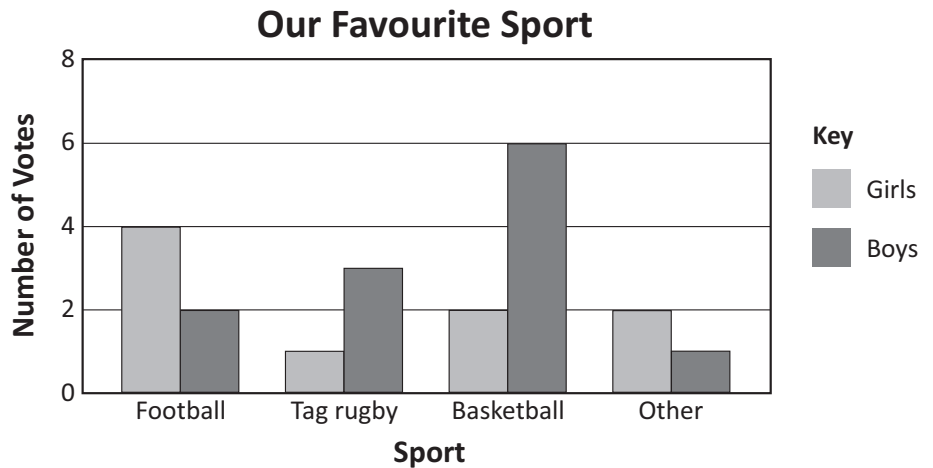
	5G	5F	6P	6S	Total
Marshmallows					
Mint chews					
Chocolate frogs					
Fruity stix					

f The sweet that Mr Gain should buy the most of, due to it being the most popular is:

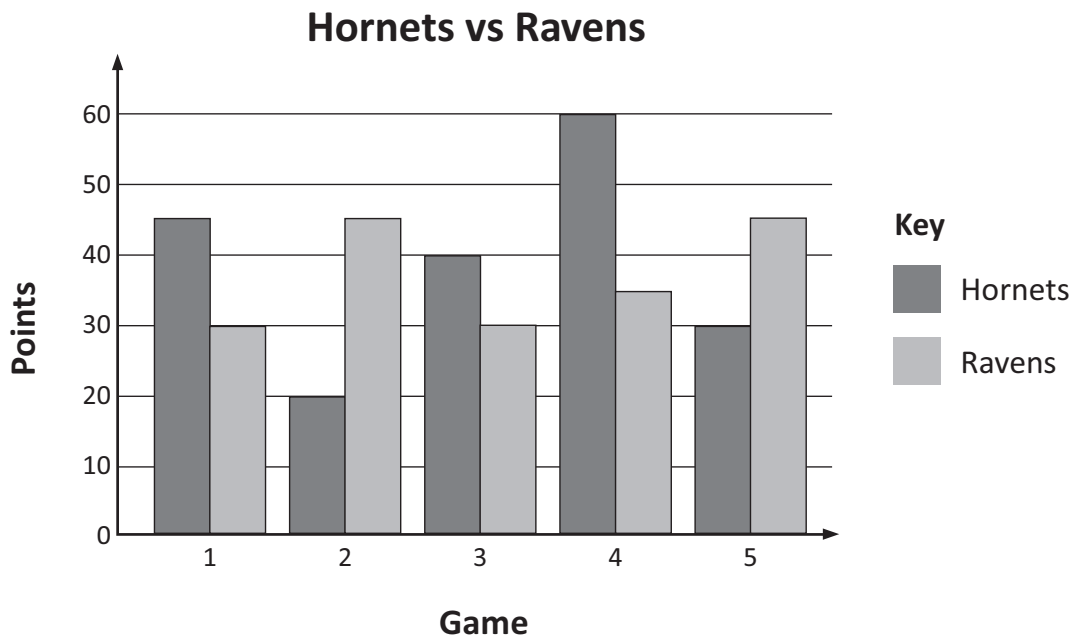
Types of graphs – double bar charts

Double bar charts make it easy to compare 2 sets of data against the same scale.

They must have a key so it's easy to see which column is which.



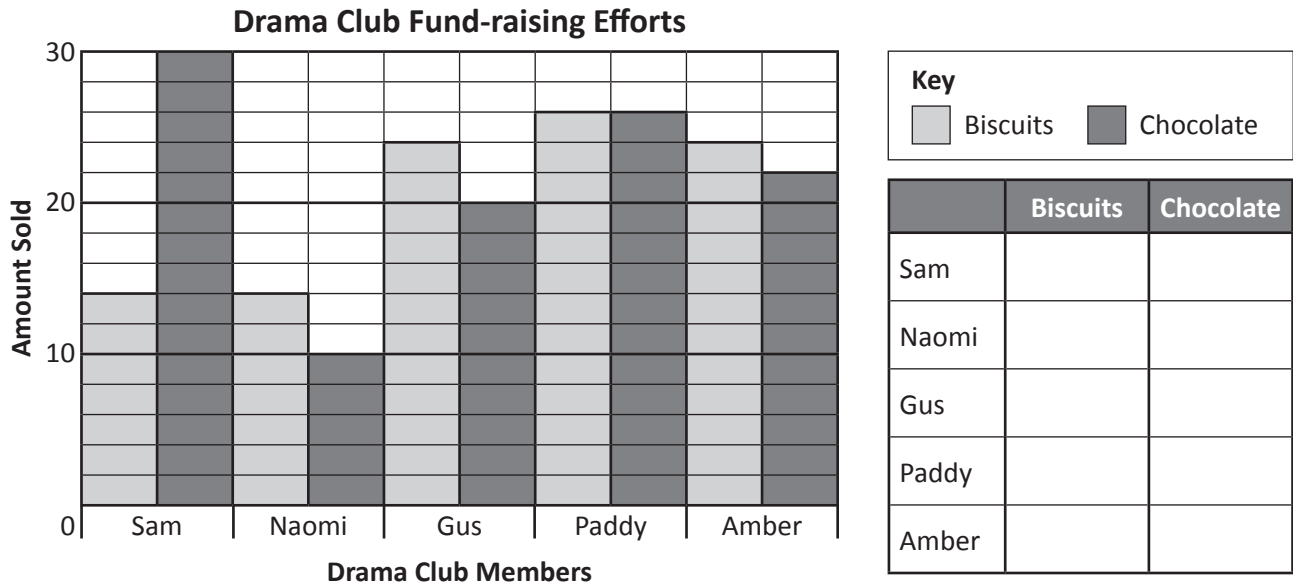
- 1 This double bar chart shows the total number of points scored by 2 rival netball teams over 5 games:



- a In which game did the Hornets beat the Ravens by 15 points?
- b In which game did the Hornets beat the Ravens by the most points?
- c Calculate the total points scored by the Ravens in 5 games.
- d How many more points did the Hornets score in 5 games?

Types of graphs – double bar charts

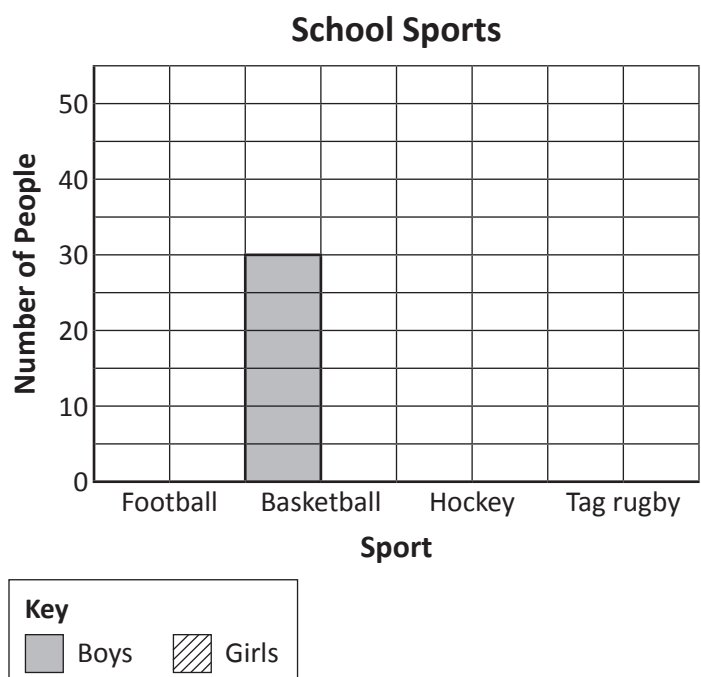
- 2 The Year 6 Drama Club at Hallowfield Primary hopes to raise enough money to fund their end of term concert. The pupils were each given 30 bars of chocolate and 30 boxes of gourmet biscuits to sell. Use the double bar chart to complete the data table.



- a Which sold better, the biscuits or the chocolate?
- b Who sold the most altogether?
- c If the biscuits were £2.50 a packet and the chocolate was £1.50 a bar, how much money did the top seller raise?

- 3 Read the clues to complete the double bar chart:

- Three times as many boys play basketball than girls.
- Ten fewer boys play football than basketball.
- Twice as many girls play football than boys.
- Five times the number of girls who play basketball play hockey.
- Half as many boys play hockey than girls.
- Double the number of boys who play hockey play tag rugby.
- 20 fewer girls than boys play tag rugby.

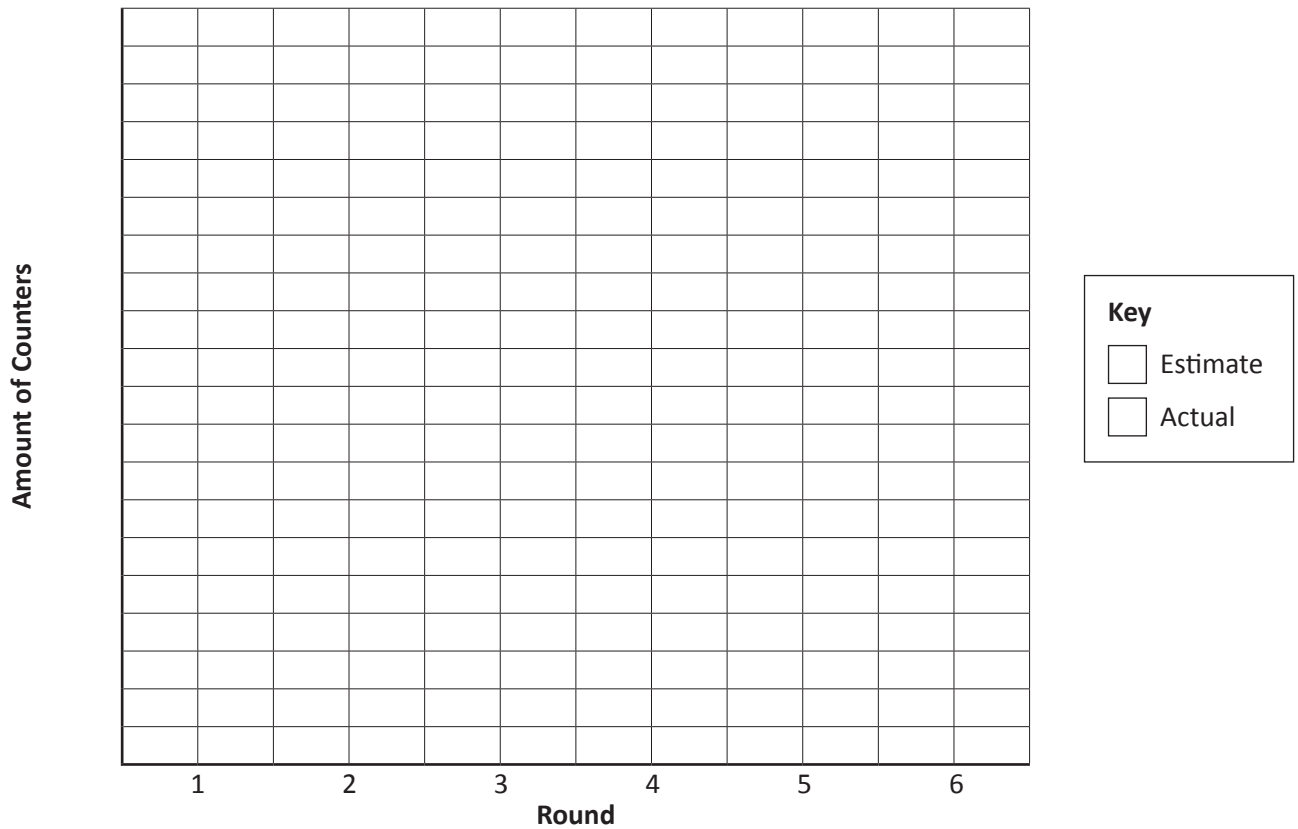


Types of graphs – double bar charts

- 4 Test your estimation skills! Grab a handful of counters and estimate how many are in your hand. Then count them. Repeat this for 6 rounds. Record both your estimates and the actual numbers in the table. Then show your results in a double bar chart. You'll need to come up with your own scale.

Round	Estimate	Actual
1		
2		
3		
4		
5		
6		

My Estimations



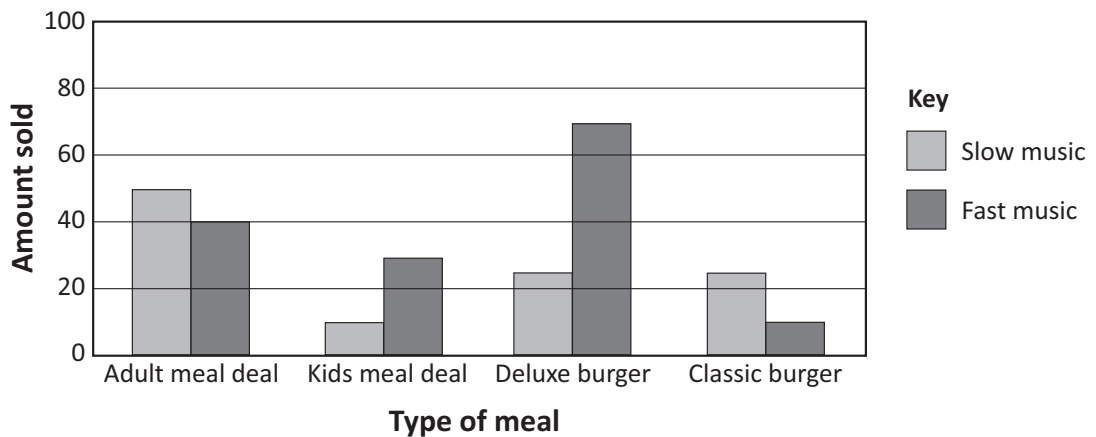
- a Which was your best round?
- b Write 2 questions about your graph for someone else to answer:

Types of graphs – double bar charts

- 5 A once popular fast food chain of hamburger restaurants called Juicy Burgers is looking at how they can boost sales. Things have not been the same since the trendy new burger joint Eataburger moved into the same street. They decide to experiment with music over 2 weeks. During the first week, they play slow music and record the sales of different types of meals. During the second week, they play fast music and record the sales of different types of meals. What they hope to find out is which type of music will lead to more sales.

Will it be that slow music will make people choose more expensive items that take longer to eat such as an adult meal deal that includes a burger, fries, drink and a dessert? Or will it be that fast music will encourage people to eat faster, spend less time at the tables and let more people through the restaurant?

Music Experiment at Juicy Burger



- a This graph above shows the results after the 2 week experiment. Look carefully at the graph and complete the table below. Start by entering in the amount of each meal that was sold for each music type. Then, calculate the sales of each type of meal (including the total of each column). You may use a calculator.

Meals	Slow music		Fast music	
	Amount sold	Sales	Amount sold	Sales
Adult meal deal (£7)	50	£350	40	£280
Kids meal deal (£5)				
Deluxe burgers (£6)	25			
Classic burgers (£3)				
Total				

Fifty adult meal deals were sold when the slow music was playing. This is £350 in sales. Forty adult meal deals were sold when the fast music was playing. This is £280 worth of sales. Hmm ... this looks like slow music is better ... or is it?

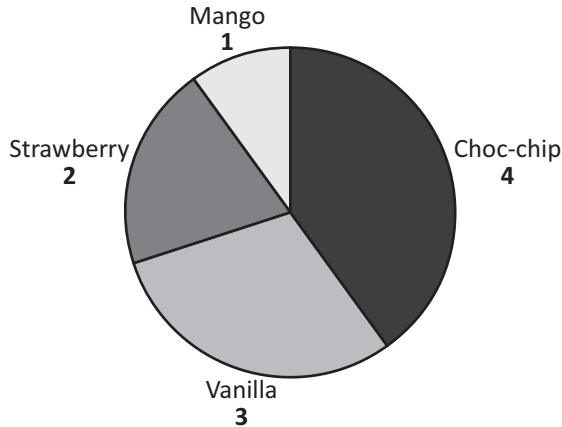
- b To sell more kids meal deals, which type of music is better?
- c Is playing slow music good for selling adult meal deals?
- d Looking at the totals in the table, which type of music generated the most sales overall?

Types of graphs – pie charts

A pie chart shows data as parts of a whole. The circle represents the total amount while the segments are the parts. When we compare the parts to the whole, we're looking at proportion. This is often written as a fraction.

This pie chart shows the favourite ice cream flavours of 10 people.

Favourite ice cream flavours of 10 people

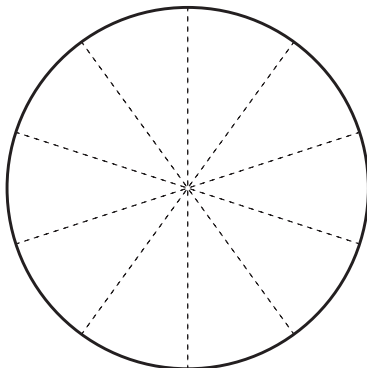


The table below summarises the information displayed on this graph.

Category	Amount	Fraction
Vanilla	3	$\frac{3}{10}$
Strawberry	2	$\frac{2}{10}$
Mango	1	$\frac{1}{10}$
Choc-chip	4	$\frac{4}{10}$
Total	10	$\frac{10}{10}$

- 1 Colour and label this pie chart according to the information in the table:

Favourite colours of 10 people

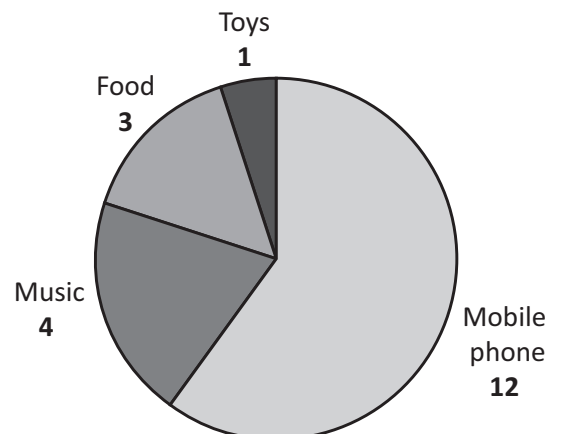


Category	Amount	Fraction
Red	3	
Blue	2	
Yellow	5	
Total		

- 2 A group of pupils was surveyed to find out what they spend their pocket money on. This pie chart shows the results. Circle True or False next to each statement.

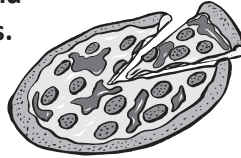
- More than half the pupils surveyed spent their money on a mobile phone.
True / False
- $\frac{4}{20}$ surveyed spent their money on food.
True / False
- 20 pupils were surveyed in total.
True / False

What do pupils spend their pocket money on?

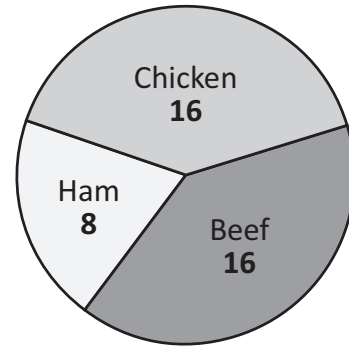


Types of graphs – pie charts

3 6F and 6H were planning a pizza party and conducted a survey of favourite toppings. This pie chart shows the results.



Pizza Topping Survey



a Complete the summary table if there are 40 pupils altogether.

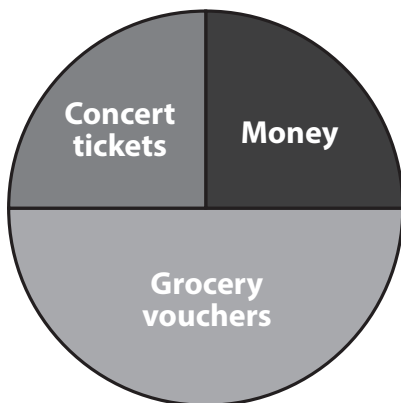
Category	Amount	Fraction
Chicken		
Ham		
Beef		
Total	40	$\frac{10}{10}$

b Their teacher said they could order 10 pizzas. How many of each flavour should they get?

Chicken Ham Beef

4 To boost ratings, Radio Non-Stop-Hits ran a promotion where they gave away prizes every hour. This pie chart shows the distribution of 60 prizes that they gave away.

Types of Prizes



a How many of each prize were given out?

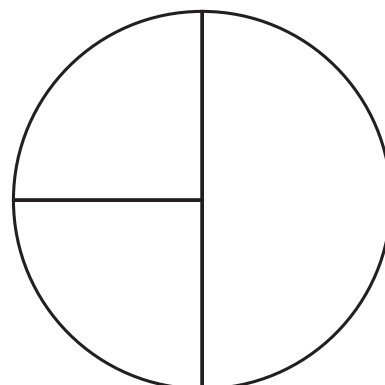
Concert tickets Grocery vouchers Money

b The radio station's accountant realised the pie chart was correctly divided but there'd been a miscalculation in the number of prizes given out. There'd actually been 25 money prizes given away. Calculate the actual amounts:

Concert tickets Grocery vouchers Money

5 The total amount that this graph is representing is 40. What could this be about? Give this pie chart a title and describe it by completing the table below:

Category	Amount	Fraction
Total		



Types of graphs – pie charts

A pie chart is a circle divided into sections called sectors. The circle represents the whole of the data and the sectors show how the total is divided. These can be shown as fractions or percentages.

This pie chart is divided into 10 equal parts. It shows what a group of children did on Saturday night.

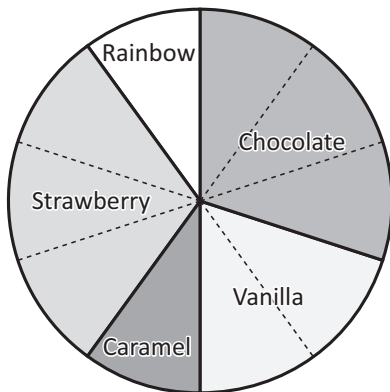
Saturday Night Activities



Category	Amount	Fraction	%
Went to the movies	3	$\frac{3}{10}$	30%
Party	2	$\frac{2}{10}$	20%
Stayed home	1	$\frac{1}{10}$	10%
Sleepover	4	$\frac{4}{10}$	40%
Total	10	$\frac{10}{10}$	100%

- 1 This pie chart shows the favourite smoothie flavours of 100 children. Use the information from the graph to complete the table:

Smoothie Flavours

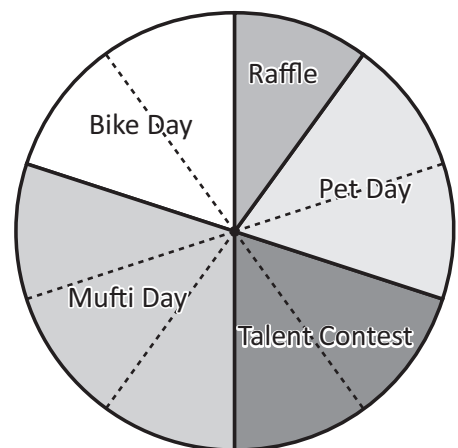


Category	Amount	Fraction	%
Chocolate	30		
Vanilla	20		
Caramel	10		
Strawberry	30		
Rainbow	10		
Total	100	$\frac{10}{10}$	100%

- 2 500 pupils voted on their next fund-raising activity. The pie chart shows the most popular responses. Complete the table:

Fund-raising Activities

Activity	Amount	Fraction	%
Raffle	50	$\frac{1}{10}$	10%
Pet Day			
Talent Contest			
Mufti Day			
Bike Day			
Total	500	$\frac{10}{10}$	100%

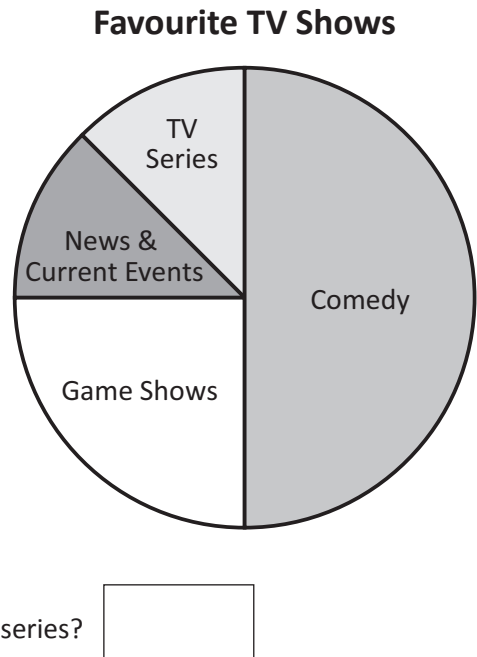


Types of graphs – pie charts

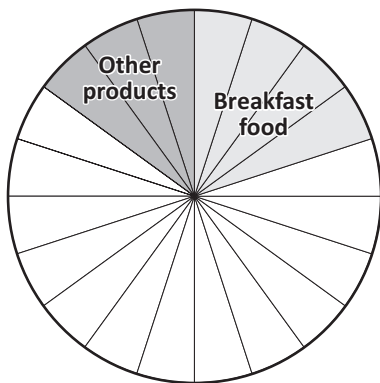
3 This pie chart shows the television shows children in Year 6 prefer to watch. Look carefully to see how the pie chart is divided and answer the following questions:

- a What percentage of children prefer to watch comedy?
- b What fraction like game shows best?
- c Which types of shows were chosen by the same number of children?

- What percentage was chosen by the same number of children?
- d There are 64 children in Year 6. How many prefer comedy?
- e How many like news and current events?
- f How many more children like watching game shows than a TV series?



4 Complete the pie chart and the table so that the information is the same on both. Label and colour the pie chart. Give the pie chart a title.



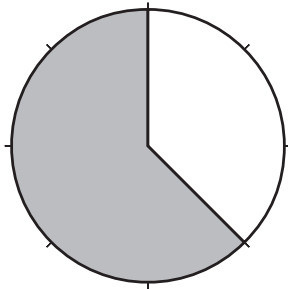
Types of Ads on Children's TV Shows	
Type of Product	Number of Ads
Fast food and drinks	60
Toys	70
Breakfast food	
Other products	30

- a What is the total number of ads represented on the pie chart?
- b How many ads does each sector on the graph represent?
- c What percentage of ads are about breakfast food?
What fraction is this?
- d Which two types of ads together make up half the number of ads on children's TV shows?

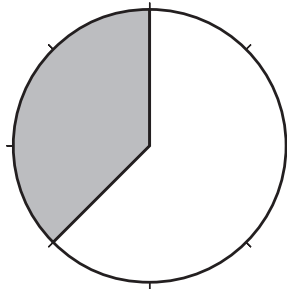
Types of graphs – pie charts

- 5 Three pupils surveyed people to see if they could taste the difference between blue smarties and yellow smarties. Sam surveyed 64 people, Kia surveyed 80 people and Kate surveyed 96 people.

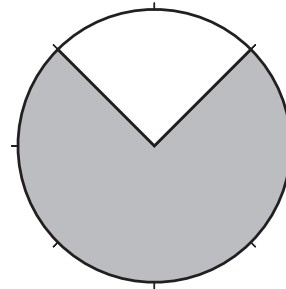
Sam's Pie Chart





Kia's Pie Chart



Kate's Pie Chart



Key

-  Can taste the difference
-  Can't taste the difference

- a Complete the table from the pie charts:

	Number who can taste the difference	Number who can't taste the difference
Sam		
Kia		
Kate		
Total		

- b Write one statement that you can tell from this data:

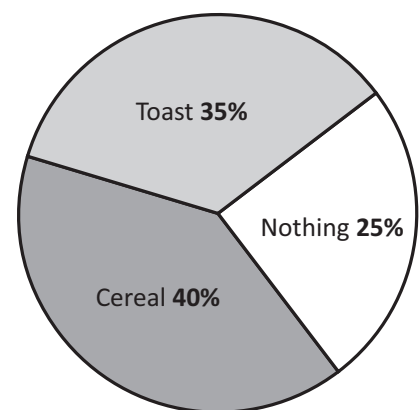
- 6 A study was conducted into the breakfast habits of Year 6 pupils at 3 different schools. Remarkably, the same pie chart was used to summarise the findings even though the numbers at each school were different. Answer the following:

- a How many pupils are in Year 6 at Hogwart's Academy if 35 children have nothing for breakfast?

- b At Summer Bay Primary, if 16 children have cereal, how many have nothing for breakfast?

Hint: Start by finding out what 10% is.

Year 6 Breakfast Habits



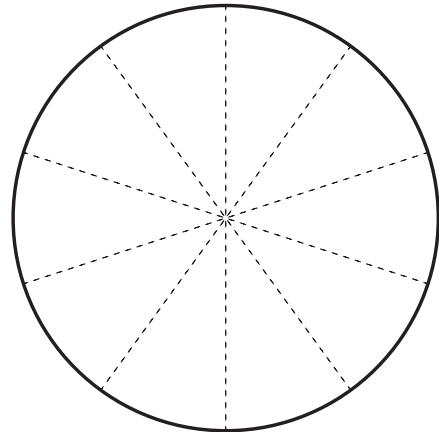
Types of graphs – pie charts

7 Create your own pie chart.

- Ask 10 pupils to choose which of these gaming consoles they like best.
- Use the table below to collect your data.
- Show the results on a clearly labelled pie chart.

Gaming Console	Tally	Amount
Wii		
Xbox 360		
Playstation 3		
Nintendo Game Cube		

- What fraction of the group surveyed chose Wii?

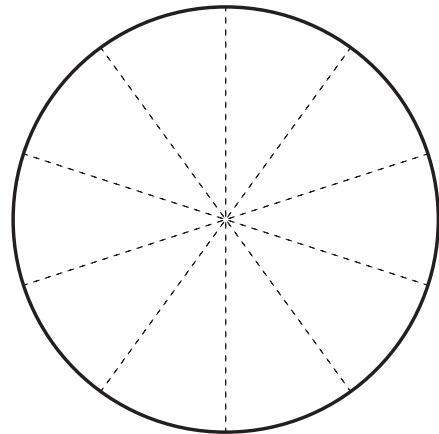


8 Survey 10 children on the topic of favourites. You can ask about favourite foods, TV shows, music or whatever you like.

- Write the topic at the top of the first column.
- Write 4 options to choose from underneath.
- Record your results in the frequency table below.
- Transfer the data from the frequency table to the pie chart.
- Label all sections correctly.

	Tally	Amount

- Write a statement about what your pie chart shows:



Types of graphs – divided bar charts

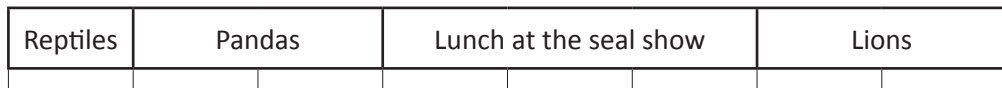
A divided bar chart is used to show how a total is divided.

It's similar to a pie chart except it's a rectangle divided into parts that represent the information.

This divided bar chart shows the results of a sweet hunt at a party. 20 sweets were hidden.



- 1** This divided bar chart shows how 6F spent the morning at the zoo. Answer the questions below about how much time each category represents:



- a If 15 minutes were spent at the reptiles section, how long was spent watching the pandas?
- b How long was lunch at the seal show?
- c How much time in total was spent at the zoo?

- 2** Marley is planning her 16th birthday party. Turning 16 is a special birthday, so she wants to spare no expense.

DJ Roxy	Makeup artist	Bubble machine	Magician	Food	Drinks
£250	£150	£150	£150	£200	£100

- a Show the information in this table as a divided bar chart. Each space represents £100.



- b How much is Marley planning to spend on her party?
- c What percentage is she planning to spend on DJ Roxy?

- d Marley's dad has decided she's being too extravagant and he's instructed her to reduce the budget to £500 or pay the extra money herself. Show the revised budget below. You must have some form of entertainment and both food and drinks. The cost of everything is fixed except for food and drinks. This time, each space will equal £50.



Types of graphs – divided bar charts

- 3 Callum, Lauren and Ali are on the verge of having their mobile phone plans cancelled by their parents. At £100 each, the monthly bills are just too expensive! Look at these divided bar charts of each person's bill. Each segment is £10.

Lauren's last bill



Plan A

Ali's last bill







Plan B

Callum's last bill



Plan C

Key

-  Text messages
-  Peak calls
-  Off peak calls
-  Internet

Help Callum, Lauren and Ali to keep their mobile phones by answering the questions and then working out a cheaper plan for each of them.

- a Whose bill had £50 worth of text messages?

- b Who made the most peak time calls?

- c Who spent the least amount of time on the internet?

- d What fraction of Ali's bill was spent on internet connection?

Part of Bill	Plan A (pence)	Plan B (pence)	Plan C (pence)
Text messages per unit	15	20	50
Peak call per minute	35	20	20
Off peak call per minute	30	15	20
Internet per minute	25	40	15

- e Circle the best plan for each person:

Callum Plan A / Plan B / Plan C Reason: _____

Lauren Plan A / Plan B / Plan C Reason: _____

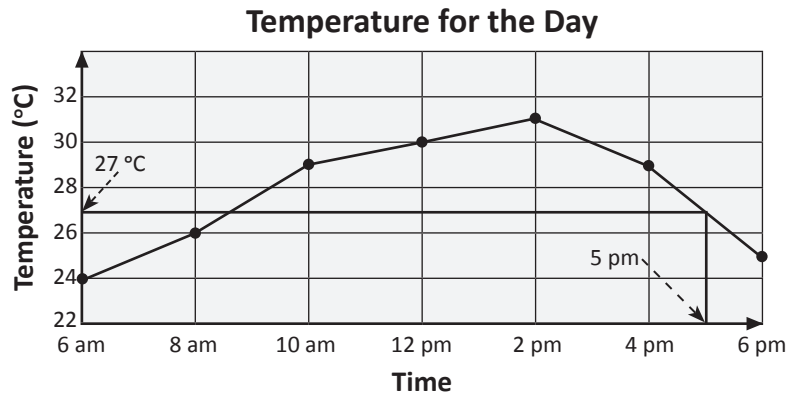
Ali Plan A / Plan B / Plan C Reason: _____

Types of graphs – reading line graphs

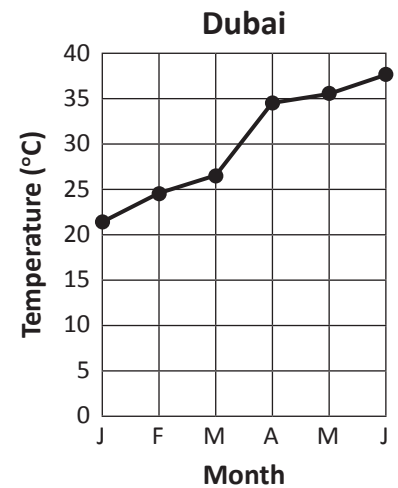
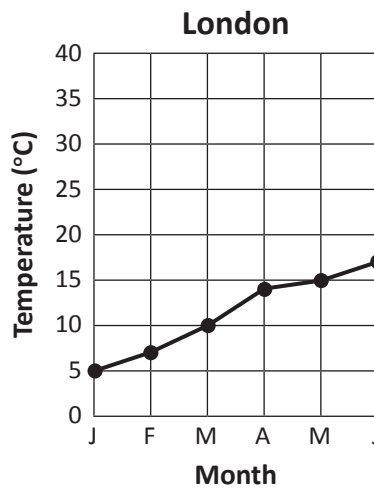
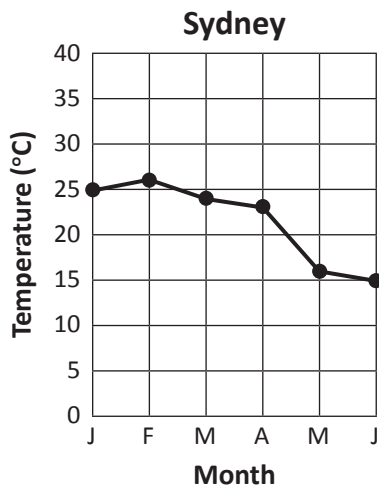
Line graphs can show how something changes over time in relation to something else.

In this topic we are going to look at many different examples of line graphs.

Here is an example of a temperature line graph.



- 1 The line graphs below show the average temperatures in degrees Celsius (°C) in Sydney, London and Dubai for the first 6 months of the year.



- a Study the graphs carefully and complete the table:

	January	February	March	April	May	June
Sydney				23		
London		7				
Dubai			27			

- b Are these statements true or false? Circle one:

In January, the difference between Dubai and Sydney is 4 °C. True / False

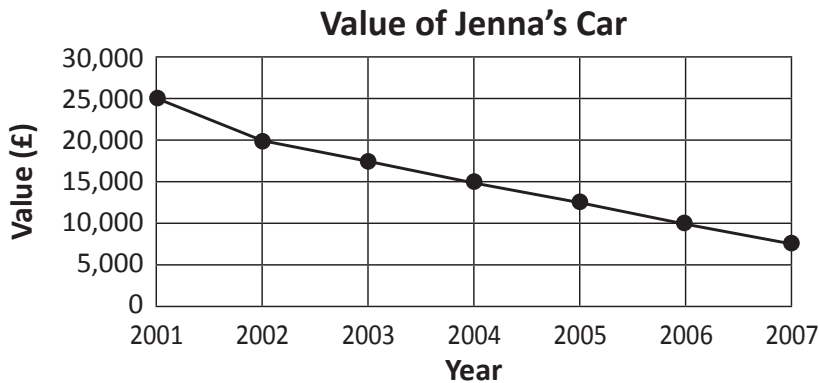
In February, the difference between Dubai and London is 18 °C. True / False

In May, Dubai is 21 °C warmer than London. True / False

Types of graphs – reading line graphs

2 Jenna bought a new car in 2001 for £25,000. The pound value of her car changed each year as shown in line graph below:

a Transfer the data from the graph into the table.



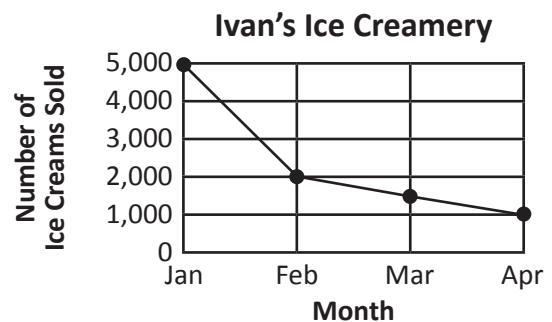
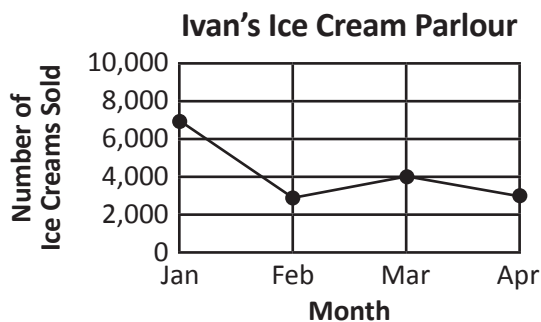
Value of Jenna's Car	
Year	Value
2001	
2002	
2003	
2004	
2005	
2006	
2007	

b What was the value of Jenna's car in 2003?

c By how much did the car's value drop between 2002 and 2005?

d Between which years was the greatest drop in value?

3 Ivan, a very inventive ice cream manufacturer, is analysing sales of his new range of ice cream flavours. He wants to find out if his latest creations such as Chocolate Garlic Ripple, Caramel Squid Ink or Crunchy Seaweed Swirl are taking off or not. Help him find out by comparing his 2 stores. One store sells the crazy new flavours and the other sells regular flavours.



a How many ice creams were sold over January at Ivan's Ice Cream Parlour?

b How many ice creams were sold over January at Ivan's Ice Creamery?

c What was the difference in the number of ice creams sold at each store in March?

d Which of Ivan's stores do you think sells his latest crazy creations and why?

Types of graphs – constructing line graphs

Let's see how to build a line graph from a data table.
This data shows the rate of filling a fish tank with water.

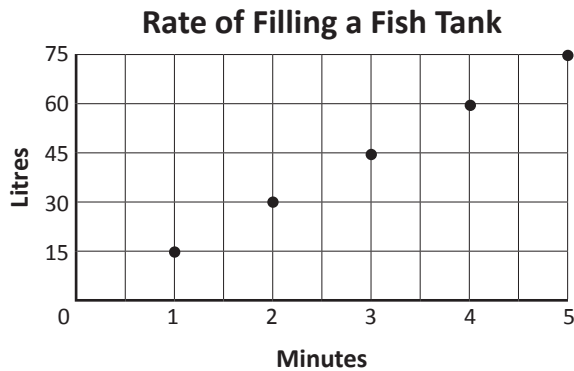
Minutes	1	2	3	4	5
Litres	15	30	45	60	75



Usually, we join the dots, but sometimes we don't.

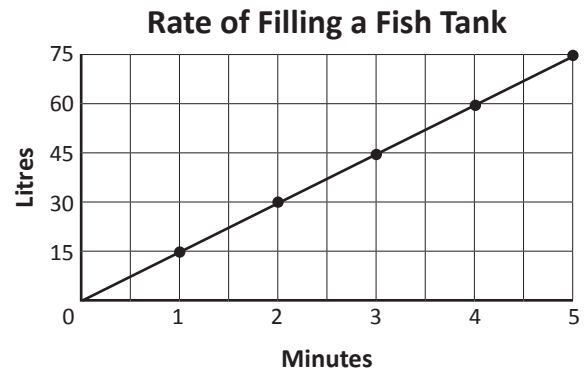
Step 1

Carefully plot the data from the table.



Step 2

Join the points with straight lines.

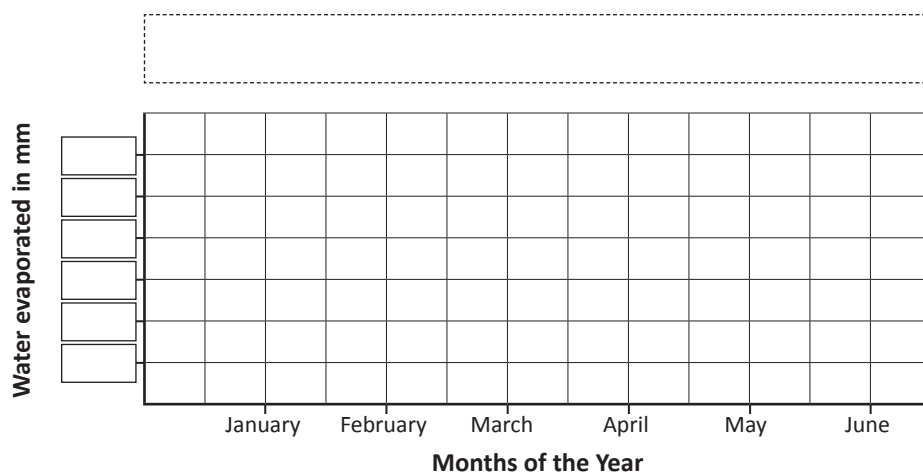


1 The average rate that water evaporates from an indoor swimming pool is 6 mm a month.

a Complete this table to show how much water will evaporate over 6 months:

Millimetres	6					
Month	January	February	March	April	May	June

b Label the vertical axis with an appropriate scale, then plot the points and join the points with a ruler. What else do you need to add to make this graph complete?



c Write 2 questions about this graph and write the answers.

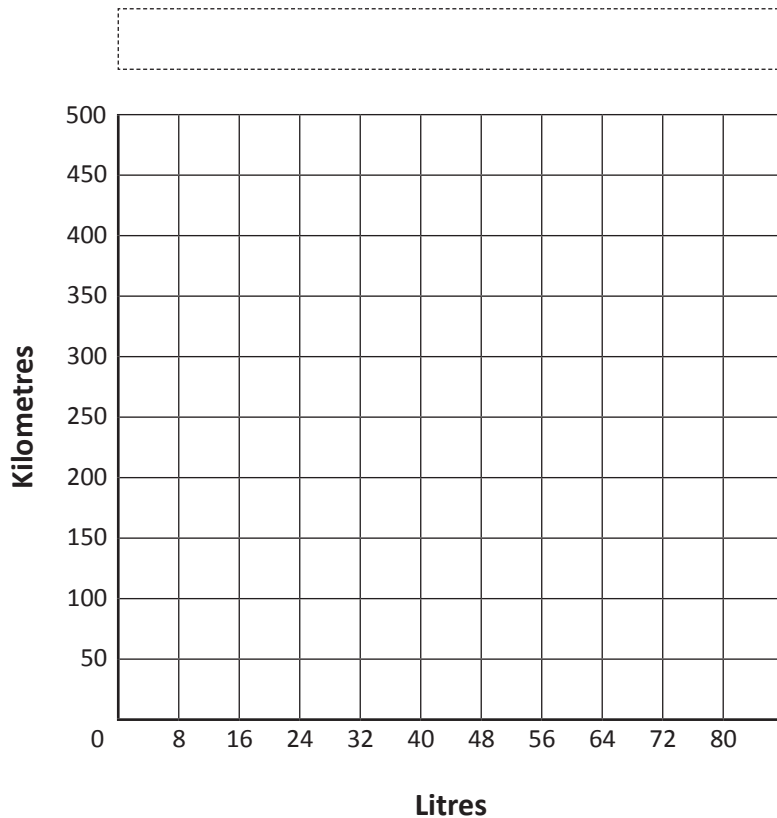
Types of graphs – constructing line graphs

2 A car uses 8 litres of petrol for every 50 km travelled.

a Complete this table to show how much petrol is needed for a journey:

Litres	8	16	24	32	40	48	56	64	72	80
Kilometres	50									

b Complete this line graph:



c How far can the car go on 32 litres of petrol?

d How many litres of petrol are needed to travel 450 km?

e How far would a car travel on 12 litres of petrol?

f How far would you have travelled if you used 96 litres of petrol?

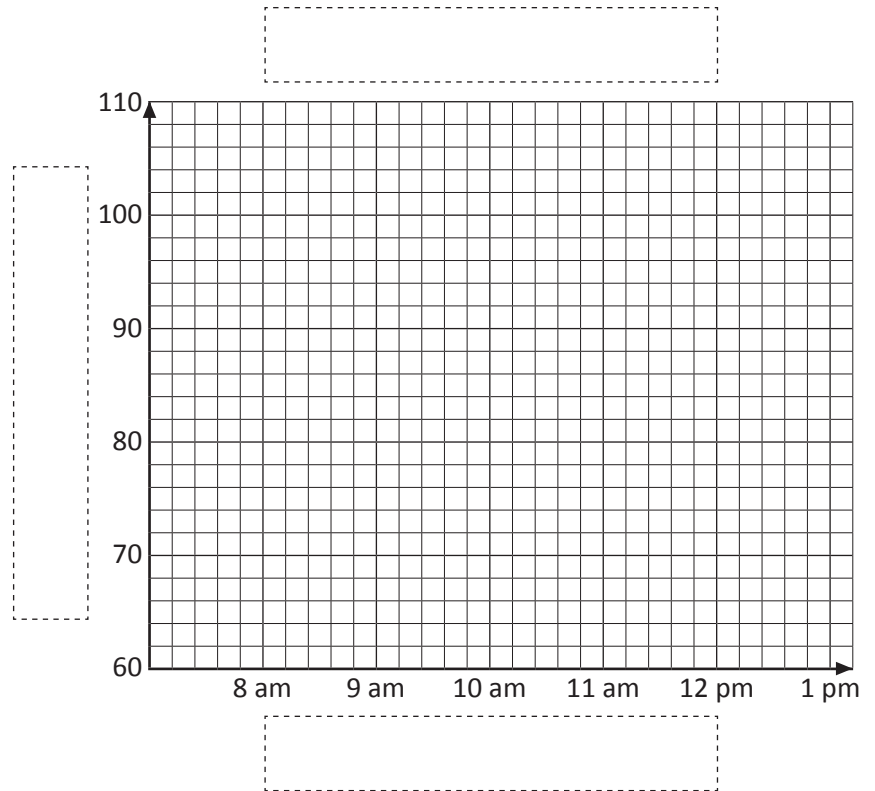
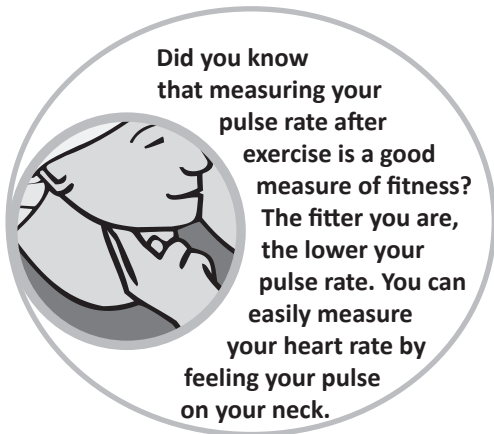
g If this car's fuel tank had a capacity of 40 litres, how many times would you need to fill it if you wanted to travel 500 km?

Types of graphs – constructing line graphs

To construct a line graph, we carefully plot the data from the table and then join the dots with straight lines.

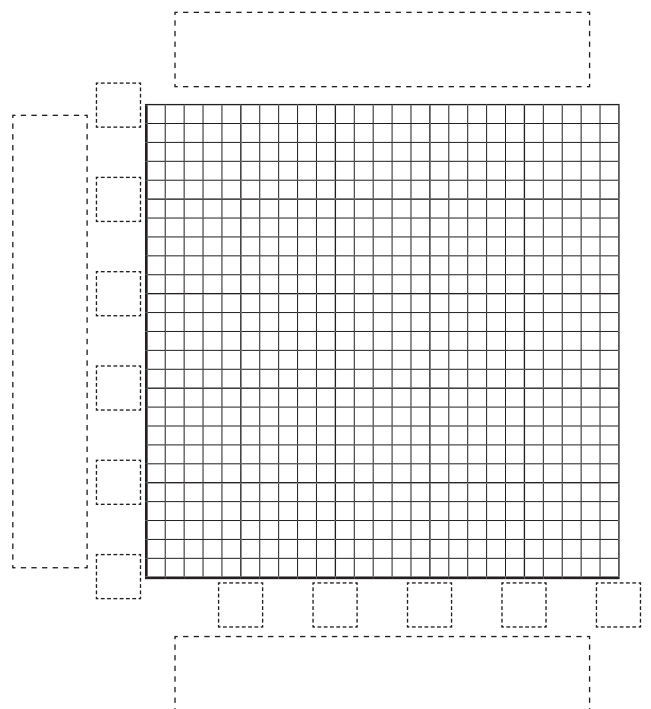
- 3 Jamie wrote down his pulse rate each hour from 8 am to 1 pm. Complete the line graph from the data. Plot the points carefully and then join the dots with a ruler. Label each axis and give the graph a heading.

Time	Pulse Rate (beats per minute)
8 am	62
9 am	66
10 am	60
11 am	76
12 pm	104
1 pm	70



- 4 In pairs, test your pulse rate for 5 minutes after exercise and construct a line graph to show the results. Find a partner and stopwatch. Your partner counts as you do 100 star jumps. Feel the pulse on the side of your neck and count for 1 minute – your partner will tell you when 1 minute is up by using a stopwatch. Do this 5 times and record the data in the table below. Then it's time for your partner to do 100 star jumps as you time them.

Time (in minutes)	Pulse Rate (beats per minute)
1	
2	
3	
4	
5	



Types of graphs – double line graphs

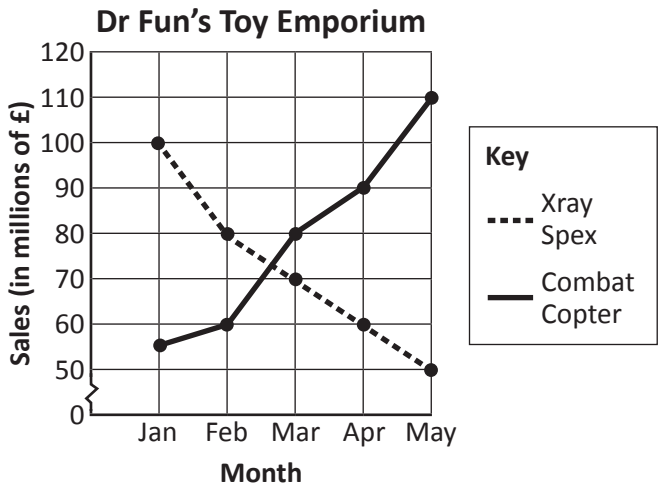
When we want to compare 2 sets of data in relation to the same thing, we use a double line graph. Double line graphs are the same as regular line graphs except they show 2 sets of data.

- 1 This double line graph shows the sales of two of Dr Fun's most popular toys over the last 5 months.

Because there is no data to show below 50 but we need the intervals to go up in tens, we use a break in the scale. We show this by having a crooked line between zero and 50 then use intervals of 10 each time.



THINK



- a Why is there a break in the scale from 0 to 50?

- b Molly described this graph in the next paragraph. Correct her errors.

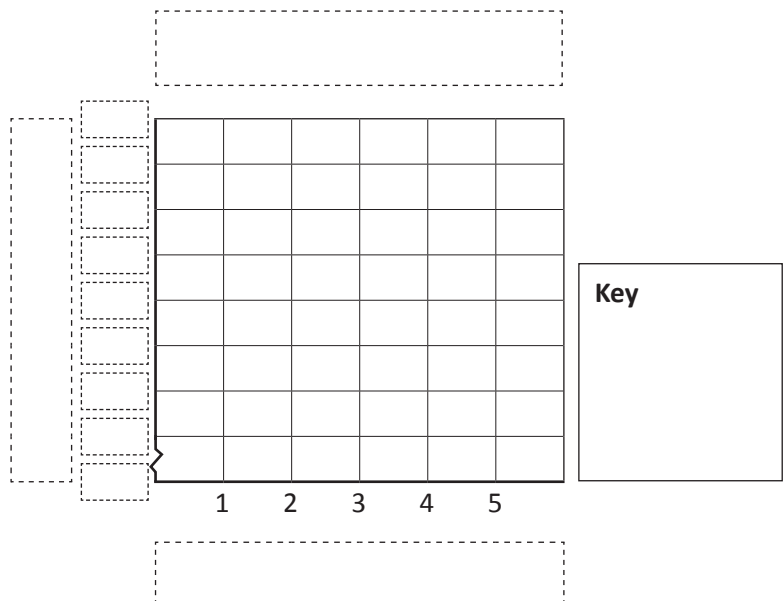
The vertical axis is showing us the year of the sale. The scale of this graph is going up by 50 each time. This graph shows that the sales of Xray Spex have been increasing rapidly while sales of Combat Copter have been decreasing over the same amount of time.

Corrections:

- 1 _____
- 2 _____
- 3 _____

- 2 Create a double line graph from the table below by plotting both sets of data and connecting the dots. You should use a solid line for one set of data and a dotted line for the other. You must label each axis and provide a key. There is a break in the scale, so where should the scale start? In what intervals should the scale go up by?

Live Mathletics Scores					
Game	1	2	3	4	5
Level 4	85	90	100	105	110
Level 5	50	55	70	85	90

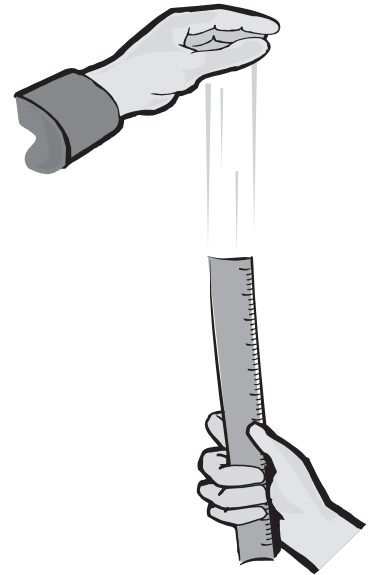


Types of graphs – double line graphs

3 In this activity you and your partner are going to test each other's reaction times with a 30 cm ruler.

How to test reaction time:

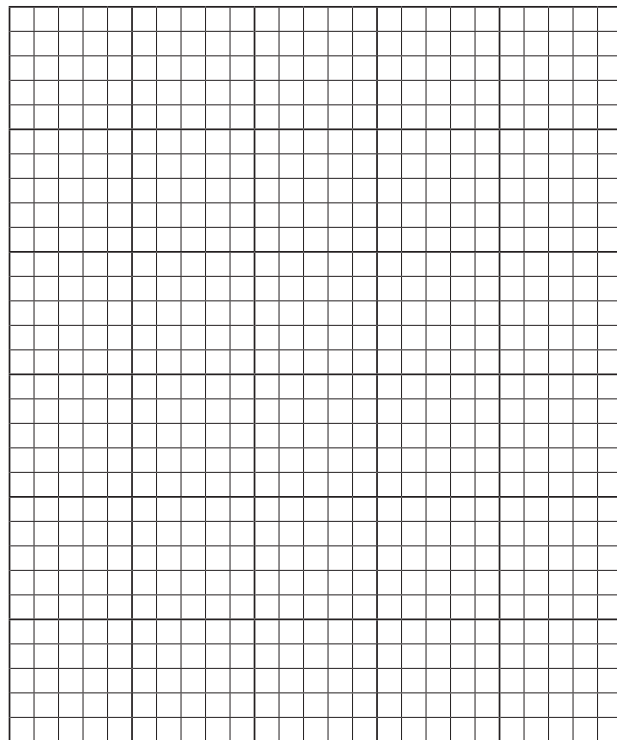
- 1 Place your arm or elbow on a desk, ready to catch the ruler.
- 2 Your partner hangs the ruler so that the tip near the 0 cm mark is close to your catching hand.
- 3 Your partner drops the ruler without warning you. You must try to catch the ruler as quickly as possible.
- 4 Read the cm marking closest to your finger where you caught the ruler and record it in the tables below.
- 5 Swap roles.



Name:					
Trial	1	2	3	4	5
Catch distance					

Name:					
Trial	1	2	3	4	5
Catch distance					

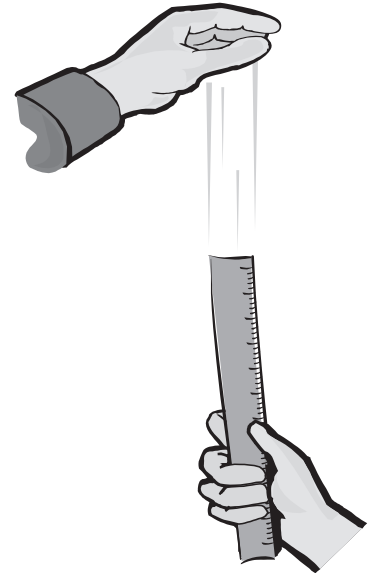
4 Graph the results by completing a double line graph.








Types of graphs – double line graphs

5 How did you go? Who was faster – you or your partner? What does the graph show? Find out your reaction rating. Work out the average of your catch distances and use the table below:

Catch Distance (in cm)	Reaction Time (in milliseconds)	Rating
1	50	Greased lightning!
2	60	
3	70	
4	80	
5	90	
6	100	
7	120	
8	130	
9	140	Dangerously dexterous
10	140	
11	150	
12	160	
13	160	
14	170	
15	170	Reasonable reaction time
16	180	
17	190	
18	190	
19	200	
20	200	
21	210	Room for improvement
22	210	
23	220	
24	220	
25	230	Wakey wakey
26	230	
27	230	
28	240	
29	240	
30	250	

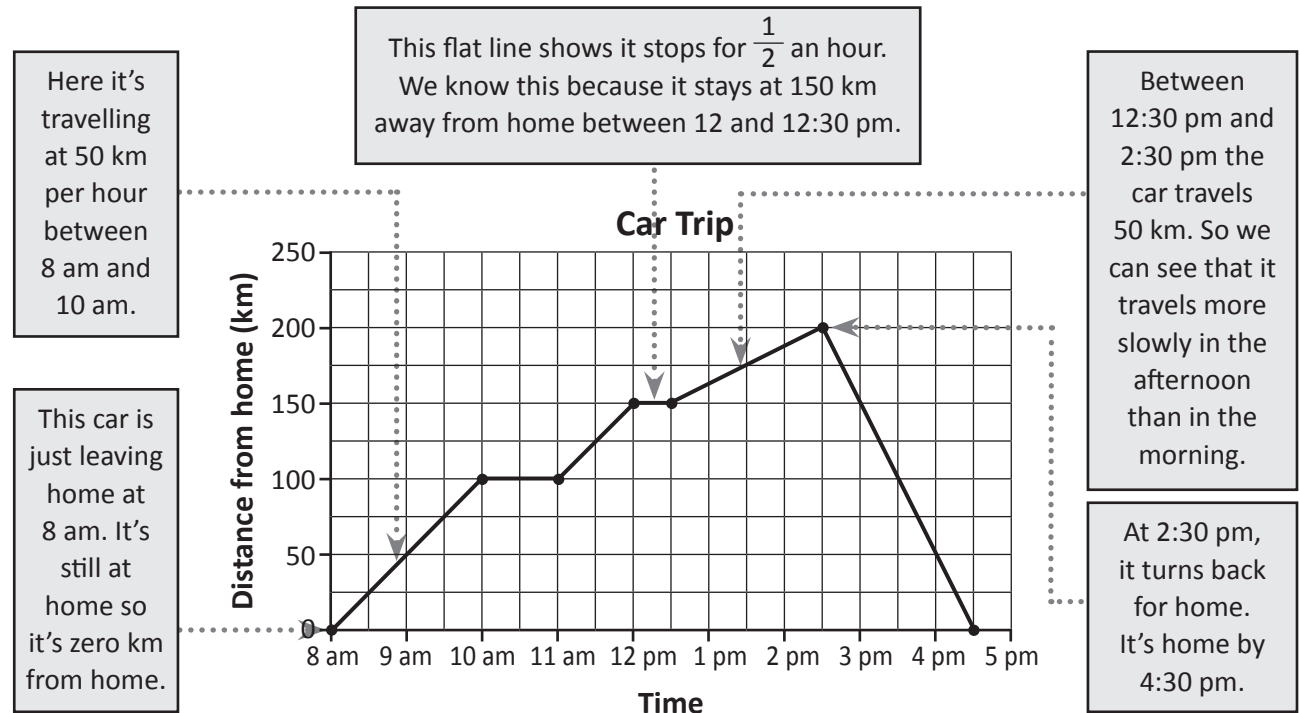


Key to Rating

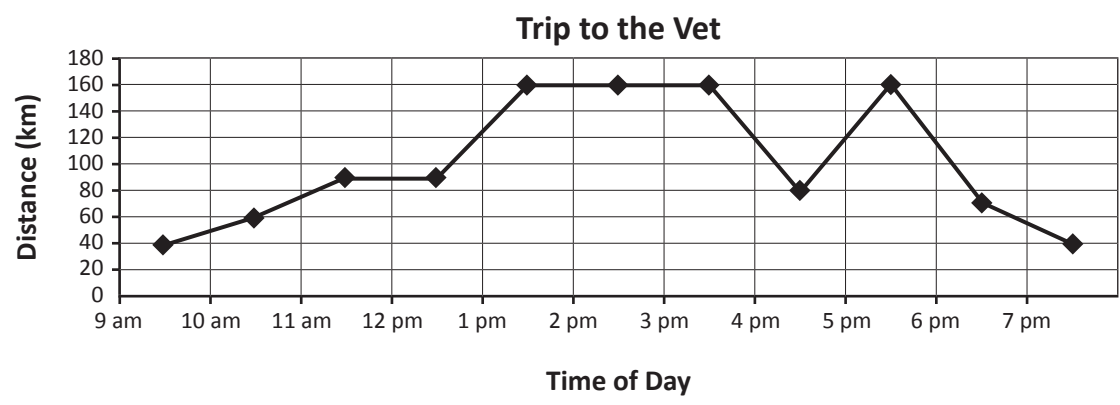
-  Greased lightning!
-  Dangerously dexterous
-  Reasonable reaction time
-  Room for improvement
-  Wakey wakey

Types of graphs – travel graphs

A travel graph is a type of line graph that shows the distance travelled and the time taken to travel that distance. We can tell a lot about a journey just by the shape of a line. Here's an example:



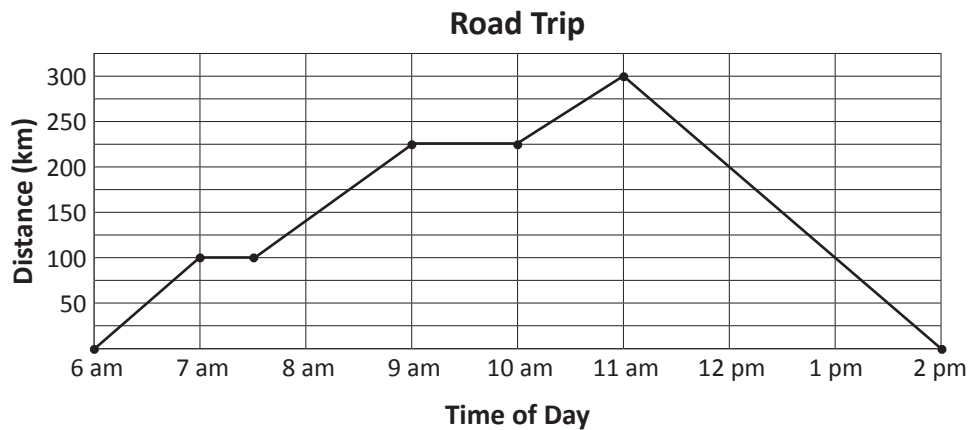
1 Examine this travel graph and answer the questions:



- a How long did they spend at the vet?
- b How far did they travel between 9 am and 1:30 pm?
- c How far did they travel between 3:30 pm and 4:30 pm?
- d For how long did they drive home before realising they had left something at the vet?

Types of graphs – travel graphs

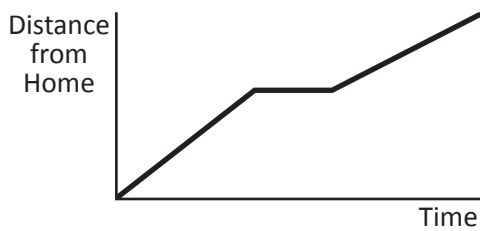
2 Study this motorcyclist's journey and fill in the blanks.



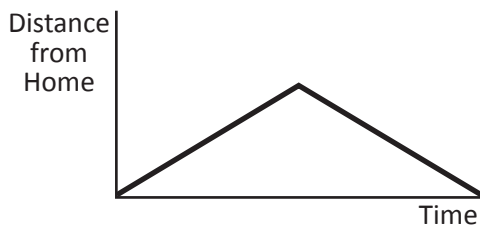
- He left for his road trip at _____.
- He stopped for breakfast at _____ and continued at _____.
- By 9 am, he'd ridden _____ km.
- He stopped to stretch his legs at _____.
- He turned round to ride home at _____.
- He rode at a speed of _____ km/h all the way home.



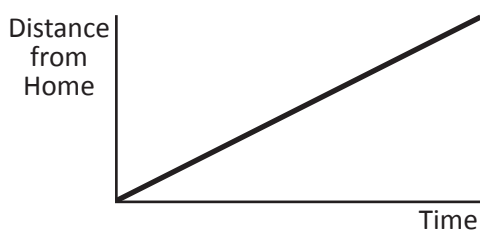
3 Link each travel graph to the matching statement by drawing a line:



I was on my way to a party when I realised I'd forgotten the present, so I turned round and went home again.



On the way to the beach, we stopped to buy sunscreen.



We travelled at the same speed, not stopping until we got there.

Collecting and analysing data – grouped data

If a large amount of data is gathered in a survey then it needs to be grouped. This makes it much easier to read and make sense of. In this example, 97 people were surveyed to find out the age of people entering a public swimming pool. Notice how the ages were organised into group intervals of similar amounts.

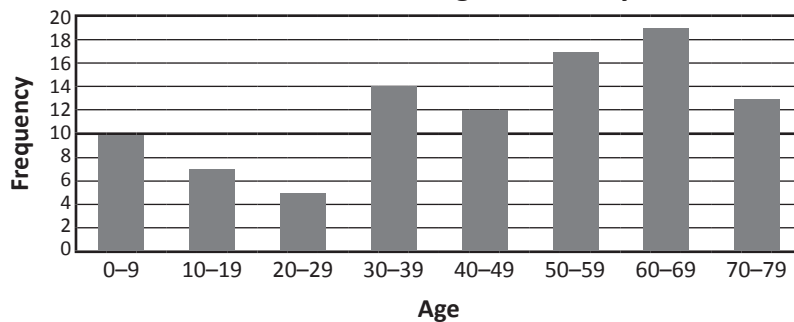
Age of Swimmer

1	11	29	31	40	55	60	77
1	11	22	32	44	51	61	77
3	14	25	39	49	52	62	78
5	16	23	30	44	53	60	71
2	12	22	31	41	55	69	79
7	15		32	40	54	68	76
3	14		39	42	55	61	77
3			36	44	58	66	70
1			39	41	56	60	71
2			30	47	51	65	72
			31	40	50	60	74
			32	48	50	65	73
			32		51	61	70
			37		50	60	
					57	66	
					56	67	
					59	66	
						67	
						69	

Public Swimming Pool Survey

Age	Tally	Frequency
0–9		10
10–19		7
20–29		5
30–39		14
40–49		12
50–59		17
60–69		19
70–79		13

Public Swimming Pool Survey



From the grouped data we can create a bar chart that clearly shows the frequency of each age range.

What do you think this graph would look like if the data wasn't grouped? Yes, it would be a very wide graph.

- 1 Your school holds a disco every year. You 5/6 pupils feel too mature to be surrounded by younger pupils while strutting your stuff on the dance floor. You petition for 3 separate discos: one for 5–8 year olds, one for 9–10 year olds and one for 11–13 year olds. Your headteacher wants a breakdown of numbers to see if it is worth all the extra planning and effort. He gives you a 50 pupil sample from the last disco:

- a Sort it into the appropriate sections on the frequency table:

Pupil Ages				
7	10	11	5	11
11	9	6	5	12
12	12	6	5	7
12	13	7	11	6
13	7	8	10	8
8	5	9	11	11
9	8	13	9	12
5	9	12	8	13
7	11	11	6	13
12	11	10	7	12

Attendance at Previous Disco		
Age	Tally	Frequency
5–8		
9–10		
11–13		

Collecting and analysing data – grouped data

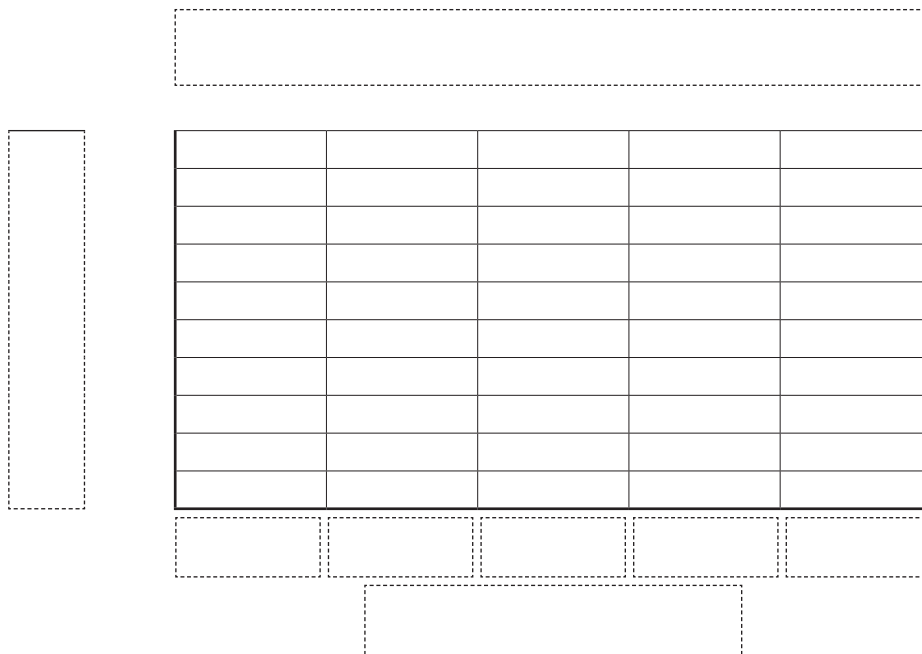
- 2** These are your class average scores for Level 2 Live Mathletics. Your school maths committee wants to see whether Level 2 is appropriate for your class but doesn't want individual pupils to be identified in the meeting.

Mia	45	Amber	50	Jamie	46	Paige	30	Max	59
Omar	22	Phoebe	47	Jacob	50	Nicole	43	Dylan	39
Pablo	36	Natasha	45	Ethan	36	Abbie	42	Sara	47
Sean	39	Niamh	23	Charlie	23	Mia	39	Sophie	13
Thanh	43	Zoe	13	Bradley	20	Imogen	9	Yasmin	50

- a Decide how you will group the data.
 b Tally the data in the frequency table. Remember to give it a title and category labels.

Scores	Tally	Frequency

- 3** Now take the grouped data from the table above and represent it on a bar chart for the committee. Give the graph the appropriate title and labels.



If a score between 20 and 30 means that the challenge level is about right, what recommendations would you make to the committee for this class?

Collecting and analysing data – range

The **range** is the spread of data. To find it, we subtract the lowest value from the highest value. Look at these sets of test scores from 2 different Maths groups. The tests were out of 20.

Group 1	Group 2
20, 19, 15, 11, 18, 4, 3	15, 13, 12, 11, 10
$20 - 3 = 17$	$15 - 10 = 5$
Range = 17	Range = 5

Group 1 has a far wider range of abilities. Their teacher will have to plan for kids who get the topic, kids who kind of get it, and kids who need lots of support.

Group 2's range is much smaller. No one has really mastered the concept and no one has really struggled. The teacher will have fewer different needs to meet.

1 Warm up with these. Find the range for each set of numbers:

a 22, 14, 17, 13, 2, 33

b 123, 148, 55, 89, 94, 131

c 4.5, 9.2, 10.7, 11.2

2 This table shows weekly rental prices for 3 bedroom houses in 2 suburbs:

Suburb 1	Suburb 2
£755 pw	£980 pw
£364 pw	£150 pw
£195 pw	£1,235 pw
£645 pw	£780 pw
£820 pw	£525 pw

- What is the price range for Suburb 1?
- What is the price range for Suburb 2?
- What do these ranges tell you about the kinds of housing in these suburbs?

Collecting and analysing data – mean

When we say we are finding the average, we are finding the mean. To do so, we find the sum of all the values and then divide by the number of values:

$$\text{For example, the mean of 2, 3, 4, 5, 6} = \frac{2 + 3 + 4 + 5 + 6}{5} = 4$$

The mean is just like fair shares. If all the values were shared out fairly, how many would each group receive?

1 Warm up with these. Find the mean for each set of numbers:

a 20, 6, 18, 4

b 13, 7, 5, 8, 3, 2, 4

c 45, 46, 47, 50, 57

2 Sean wanted to buy new football boots and priced the same boots in 4 different stores.

a What is the average or mean price of the boots?

b If Sean buys the cheapest option, how much less than the mean does he spend?

3 Imagine these people are all members of a basketball team.

Tom Cruise	1.73 m
Katie Holmes	1.75 m
Will Smith	1.88 m
David Beckham	1.8 m
Kevin Rudd	1.79 m
Paris Hilton	1.73 m
Hugh Jackman	1.89 m
Nicole Kidman	1.81 m
Nicole Richie	1.55 m

a Calculate the mean height:

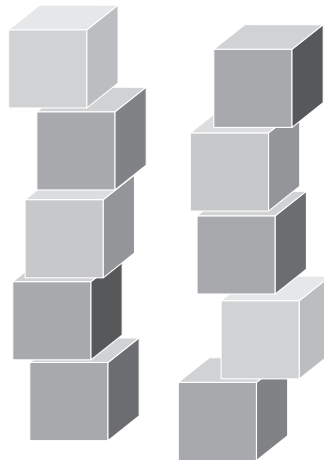
b If you wanted your tallest 5 players on court at the same time, who would they be and what is their mean height?

c Tom Cruise pulls rank and subs himself for Hugh Jackman and subs Nicole Richie for Nicole Kidman. What is the mean height of the group on court now?

Collecting and analysing data – mean

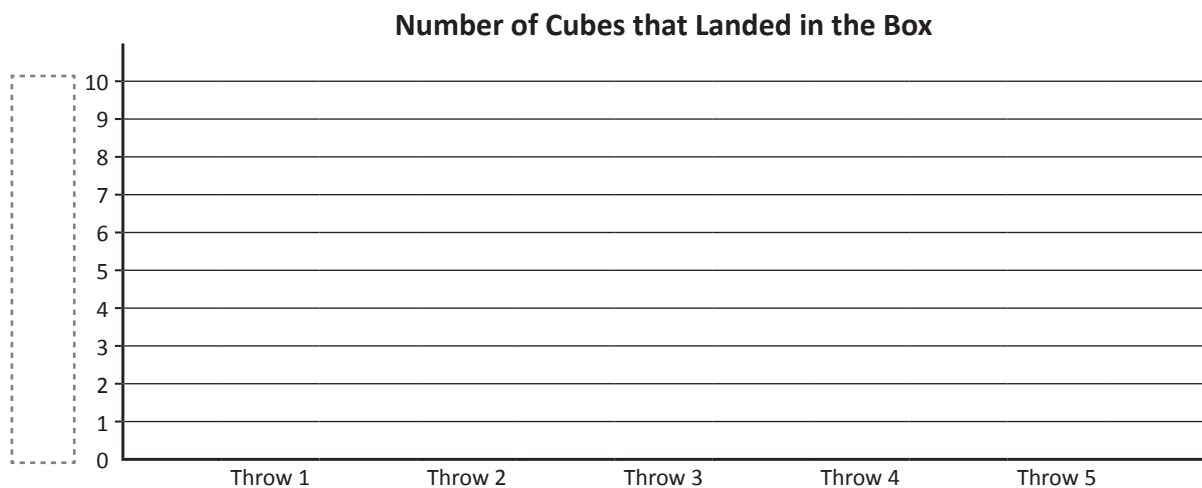
4 You and a partner are going to record how many cubes land in a box. You will need 10 unifix cubes and an empty lunchbox.

- 1 Place the lunchbox 1 metre in front of you.
- 2 Sit on the floor.
- 3 Take turns throwing all 10 cubes at the same time.
- 4 Each record your results in the data table on the right.
- 5 Repeat the process 5 times.



Throw	Tally
1	
2	
3	
4	
5	

5 Create a column graph of your results. Label each axis.



- a What is your mean number of cubes that landed in the box?
- b What was your partner's mean number of cubes that landed in the box?
- c What was the mean of both sets of data together?
- d Do you think the mean paints an accurate picture of the process?

Collecting and analysing data – median

Another statistic we use to analyse data is the median. The median is the middle number when the data is put in order. Look at:

17 12 3 5 25 33 12 14 36 22 23 29 37

We reorder the numbers and count in from either end:



22 is the median or middle number. There are 6 numbers on either side of it.

1 Order these sets of numbers and find the median for each:

a 13, 7, 5, 8, 3, 2, 4

b 22, 6, 18, 4, 7, 23

c 4.5, 8.2, 3.6, 4.1, 2.3, 3.7, 7.3

d 45, 46, 47, 50, 59, 102

If we have an odd number of values in the set, there is 1 median.
If we have an even number of values, there will be 2 median numbers. Or we can find the average of the two numbers and call that the median.



THINK

2 Remember your all-stars basketball team?

Tom Cruise	1.73 m
Katie Holmes	1.75 m
Will Smith	1.88 m
David Beckham	1.8 m
Kevin Rudd	1.79 m
Paris Hilton	1.73 m
Hugh Jackman	1.89 m
Nicole Kidman	1.81 m
Nicole Richie	1.55 m

a Put the players in order from shortest to tallest.

b Which player has the median height?

3 There are 7 values in a set of mystery numbers. 9 is the median. What could the set be?

Collecting and analysing data – mode

Another statistic we use when analysing data is the **mode**. The mode is the number that occurs most frequently in a set. Look at:

17 12 4 5 25 33 12 14 4 36 22 23 29 37 26 4 34

When working with a lot of numbers, it is a good idea to organise the data into a stem and leaf plot. This makes it easy to identify the mode. The stem and leaf plot below has all the tens on the left as the stem, and the ones on the right as the leaves.

We organise this as:

tens	ones
3	3 6 7 4
2	5 2 3 9 6
1	7 2 2 4
0	4 5 4 4

When we look at the numbers this way it is easy to see that 4 is the mode. It occurs 3 times.

A set of numbers can have 1 mode such as the one above. It can have no modes if no numbers are repeated or 2 or more modes if more than one value occurs with the same frequency.

1 Organise these sets of numbers into stem and leaf plots and identify the modes. The stems have been done for you:

a 29, 17, 17, 18, 19, 11, 13, 19, 20, 17, 17, 13

tens	ones
2	
1	
0	

The mode is:

b 24, 18, 27, 13, 16, 25, 32, 26, 31, 18, 17, 23, 16

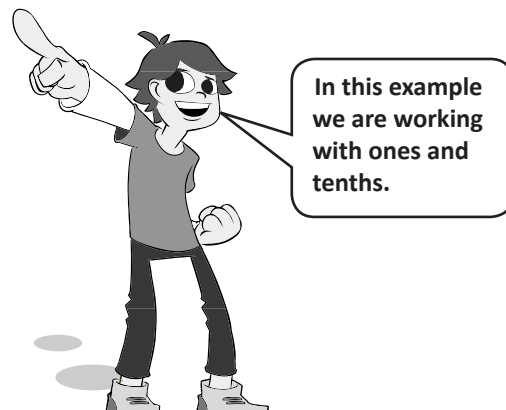
tens	ones
3	
2	
1	
0	

The mode is:

c 1.7, 2.2, 1.6, 1.8, 1.6, 1.5, 0.4, 1.6, 1.7, 2.1, 2.3

ones	tenths
2.	
1.	
0.	

The mode is:



Collecting and analysing data – mode

When we collect and analyse data, we often use frequency tables. These also tell us the mode. Look at this table. It shows the jumper sizes worn by the pupils in 6A.

Jumper Size	Tally	Frequency
10		10
12		6
14		15

Q: What size jumper is worn most frequently?

A: Size 14 jumpers.

14 is the mode as it's the number that occurs most often.

2 Complete the frequency tables below and identify the mode for each:

a

No. of Children in the Family	Tally	Frequency
1		
2		
3		

The mode is:

b

Shoe Size	Tally	Frequency
5		
6		
7		
8		

The mode is:

3 Wally is trying out for the Work Experience Boy Olympics. His favourite event is the Coffee Dash when he races to the local coffee shop and back for the morning espressos. Here are his times so far, rounded to the nearest minute:

12 min 11 min 13 min 9 min 8 min 14 min 16 min
 11 min 14 min 19 min 10 min 11 min 15 min 22 min
 17 min 23 min 22 min 12 min

a Choose a method to find the mode of this set of data and record it below:

Collecting and analysing data – range, mean, median and mode

When we analyse data we can look at the range, mean, median and mode. We most commonly use mean or average in our daily lives. It does have one drawback though – it is affected by outliers. These are numbers that might be much larger or smaller than the others in the set, and can drag the average up or down.

When there are outliers, the median can be more useful than the mean. The mode is most useful when we want to know which category or value is most popular.

1 Look at the table on the right. It shows the money raised by 6G each week in their cork drive.

a What is the mean (average) amount of money raised?

b What is the median amount of money raised?

c Which do you think better reflects the weekly figures? Why?

d Does this set of data have a mode?

e What is the range?

Week	Money Raised
1	£15
2	£12
3	£9
4	£13
5	£59
6	£14
7	£11

2 Survey your classmates on their shoe size. Find a way to record the data and present it below. Calculate the mean, median, mode and range of your data set.

Collecting and analysing data – range, mean, median and mode

- 3 Cupcake Creations has asked you to analyse their sales figures. Look at the table below. It represents cupcake sales over a 4 week period:

Type	Week 1	Week 2	Week 3	Week 4	TOTAL
Strawberry Kiss	155	150	125	146	
Mud Angel	207	185	167	193	
Vanilla Cream	25	95	33	143	
Blueberry Bubble	75	50	65	22	
TOTAL					



- a Use a calculator to find the total sales of each cupcake type over the 4 weeks and the total sold each week. Enter this data into the table above. Total each set of totals – they should match in the bottom right box. If you can do this, you have a future as an accountant.

- b Calculate the weekly mean sales for each type:

Type	Mean
Strawberry Kiss	
Mud Angel	
Vanilla Cream	
Blueberry Bubble	

- c Calculate the range of the weekly sales for each type:

Type	Range
Strawberry Kiss	
Mud Angel	
Vanilla Cream	
Blueberry Bubble	

- d On average, how many cupcakes sold each week?

- e Which type sold best over the 4 weeks?

- f Which type sold least and may need to be changed?

- g If the bakers bought their ingredients weekly, which type would be hardest to plan for and why?

- h The bakers want to add a novelty flavoured cupcake for a short special. Sketch or describe an idea for them:

Collecting and analysing data – surveys

A survey is a way of gathering information on a certain topic. Companies use surveys to find out people's likes and dislikes so they can sell more of their product. Governments use surveys to work out how many schools, hospitals and roads they need to build.

It's not practical to ask everyone in the country every question, so a sample is chosen. This must be small enough to be practical but large and diverse enough to provide a reasonable spread of answers.

When planning a survey we need to ask:

- What do we want to find out?
- What questions will give us this information?
- How will we collect the answers?
- Once we have our answers, how will we represent the data?

- 1** The Yummy Food Company recently added peanut butter to their range and want to research their customers' opinions on their new products. They want to know what types of peanut butter they should make and in what proportions. They also want to know who they should aim their marketing at. Here are two possible surveys:

Survey 1	
1	What kind of peanut butter do you like?
2	How often do you eat peanut butter?
3	How old are you?
4	Are you male or female?

Survey 2					
1	My age range	0–9 <input type="checkbox"/>	10–19 <input type="checkbox"/>	20–39 <input type="checkbox"/>	40 + <input type="checkbox"/>
2	I eat peanut butter	Daily <input type="checkbox"/>	Weekly <input type="checkbox"/>	Rarely <input type="checkbox"/>	Never <input type="checkbox"/>
3	I prefer	Smooth <input type="checkbox"/>	Crunchy <input type="checkbox"/>	Super Crunchy <input type="checkbox"/>	Whichever <input type="checkbox"/>

- a** Would one survey give you more useful information than the other? Why?
- b** Would one survey's data be easier to represent in graphs and if so, why?
- c** If the Yummy Food Company conducted their survey in the school playground, would this be a reasonable sample of people to use? Why or why not?
- d** Design some survey questions that would tell you what different types of peanut butter people preferred if you wanted tally marks for answers:

Collecting and analysing data – surveys

When we design surveys we have to think about the number and the variety of the different kinds of possible responses. We can't make the questions open ended or we will receive too many different answers that could be open to interpretation.

We can limit the options by asking closed questions that require specific answers. We must be careful though, that we don't limit the choices too much, with the respondents unable to give a true response. It's a fine balance!

- 2** Look at these surveys. They want to know about favourite after school activities. Comment on their usefulness. Think about the data they give you and whether you could graph the answers easily:

Survey 1

What do you like doing after school?

Survey 2

After school do you prefer to play sport, watch TV or go shopping?

- 3** Design your own survey to find out which after school activities are preferred by your classmates. Design it so that you receive one response from each pupil – so they can't say, 'Well, on Monday I like to ... but on Tuesday ...'. Test it out on 10 pupils. Do your questions work?

What are you trying to find out?
What questions do you need to ask?
How will you collect responses?



CHECK

- 4** If the headteacher wanted you to research preferred school starting times within the school community and asked you to survey 100 people, who would you ask and in what proportions? Explain your reasoning.

Collecting and analysing data – surveys

5 Chloe and her twin sister Zoe were planning their birthday party for 10 people. Chloe wanted to serve pizza and garlic bread, while Zoe wanted hamburgers or hotdogs. Zoe couldn't decide but knew there was no way she was going to let Chloe get her own way ... Their mother grew tired of all the bickering and threatened to cancel the party unless they decided once and for all. Zoe and Chloe decided to conduct a survey amongst their friends and then go with the favourite. Pretend that you are Zoe and Chloe and survey 10 people.

a Design your question:

b How should you collect the data? Set it up in this space:

c Zoe presented her findings in a pie chart and Chloe decided to do a bar chart. Create each graph here:

A pie chart visually shows the 'parts of the whole' better than a bar chart. However, it may be easier to compare categories using a bar chart.



REMEMBER

d Is one style of graph more effective than the other? And most importantly, what are they eating at the party?

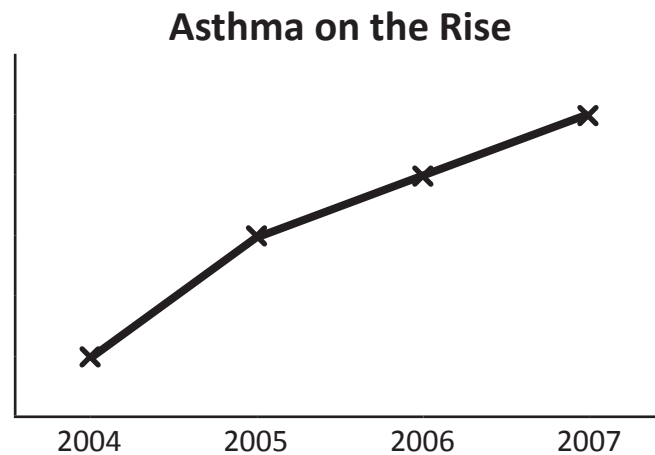
Collecting and analysing data – misleading graphs

Graphs can be seen everywhere. Companies, governments and all kinds of organisations use graphs to communicate to the world. You can see graphs on TV, on the internet and in advertisements.

Graphs can often be misleading. The way a graph looks does not always match the data it is representing. In this topic, we are going to look at some examples of misleading column and line graphs and show you how to not fall for any tricks!

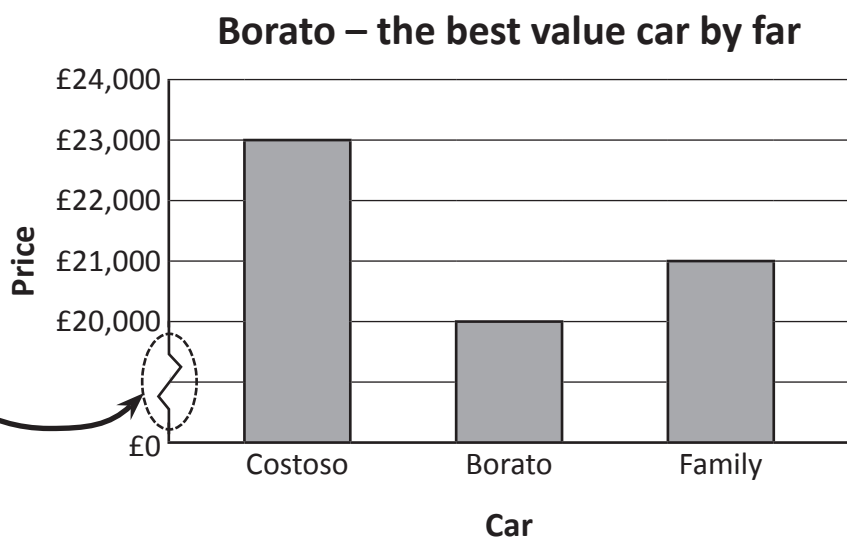
What is it about each of these graphs that gives a false impression? Look closely at each one with a partner and discuss before you look at the answers.

Graph 1



This line graph shows that the number of people who get asthma every year has risen sharply. Because it has no scale, we can't really tell how much it has risen. You might see this in a newspaper next to a report about how bad pollution is and that pollution is causing asthma to rise.

Graph 2



Did you know that it is ok to use a zig zag along the scale? This is to show that the scale is 'broken' and is used when the data starts at a high number. In this graph, none of the cars cost less than £20,000, so we do not need to show that part of the scale.

This bar chart is an advertisement for a brand of car. It is misleading because the column on the left looks more than twice as big as the Borato. When you look closely, you can see that the price difference is not half, it is much closer in price. This is due to the broken scale.

Collecting and analysing data – misleading graphs

Scale makes a big difference to how data is perceived.

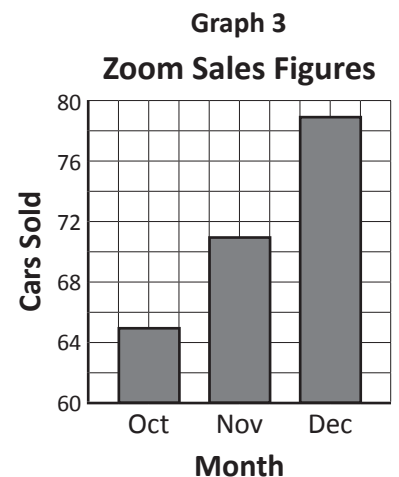
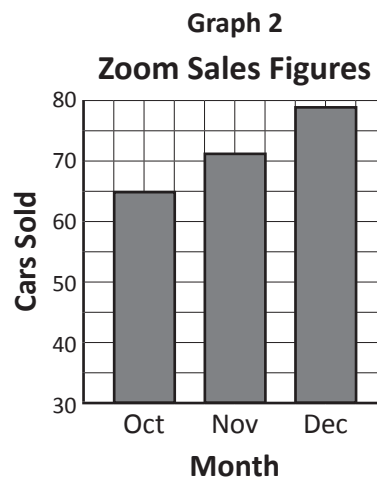
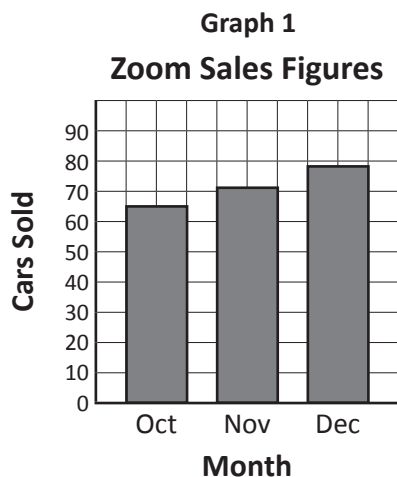
A graph should always have a scale, but did you know that it doesn't always have to start at zero and that a broken scale can be used? This is how advertisers, reporters and politicians often get away with exaggerating the truth. They want you to see things as cheaper, worse or better than they really are, depending on the situation.

Let's examine some misleading graphs.

- Zoom car dealers sell second hand cars. The sales manager is preparing a graph to show her boss the sales figures for the last 3 months of the year. She wants to make the sales figures look good so she can get her bonus.

Month	October	November	December
Number of cars sold	65	71	79

These bar charts show the same information but each graph looks different. Can you see why? Look at the scales carefully.



The sales manager started work at Zoom car dealers in November. Which graph do you think she will show her boss? Why?

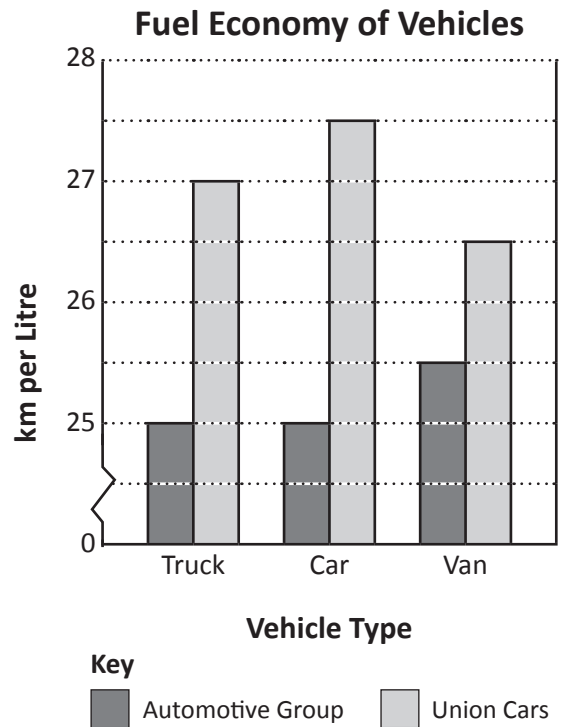
HINT: She started in November so she would want to show an improvement in sales figures.



Collecting and analysing data – misleading graphs

2 The bar chart on the right compares the fuel efficiency of three different types of vehicles. They are manufactured by 2 different car manufacturers – Automotive Group and Union Cars. Answer the questions about this misleading graph.

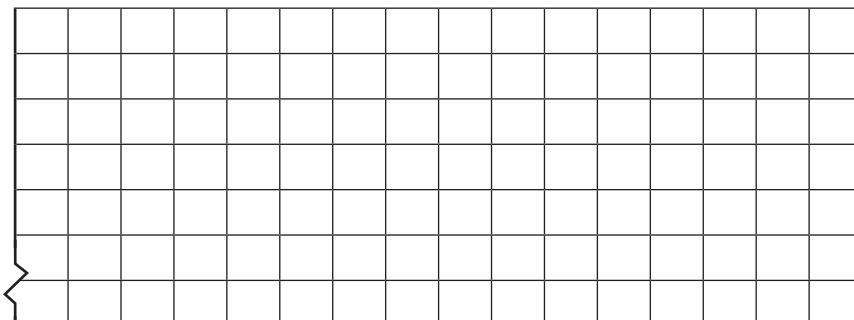
- What is the difference in fuel efficiency between the 2 brands of trucks?
- What do you notice about the length of the two bars for the trucks?
- What makes this graph misleading?



3 Monique gets £5 a week pocket money from her parents, provided she completes all of her chores. This includes: making her bed, feeding the dogs, keeping her room tidy, doing her homework, cleaning out the guinea pigs' cages and doing the washing up after dinner! Monique suspected she was due for a pay rise so she asked her friends how much pocket money they each got per week. The results are in the table.

Name	Weekly pocket money (£)
Monique	£5
Tash	£7
Bec	£8
Troy	£8
Matt	£9
Will	£10

- Help Monique to make a bar chart to show her parents that she is underpaid compared with her friends. Monique's parents are quite strict, so they will need a lot of convincing. How can you present this data in a way that will make them take notice? You should look over the graph in question 2 for some ideas.





Getting ready



Your class is hoping to raise money to donate to the World Wildlife Fund to help them in their fight to save endangered animals.

You want to show your fellow pupils how many of each type of animal is left in the world and decide to convey the information in a picture graph. This will hang in the office foyer next to a donations jar.



What to do



Work in a small group to design your graph. Remember it needs:

- A scale
- To be eye catching and clear
- To have a heading and labels

Think about how you will represent the numbers. They range from 2,000 to 172,000.



Animal	Estimated Numbers Left <small>(Source: WWF 2009)</small>
Chimpanzee	172,000
African rhino – white	14,000
Giant panda	2,000
Polar bear	20,000
Orangutan	50,000
Asian elephant	26,000
Tiger	4,000

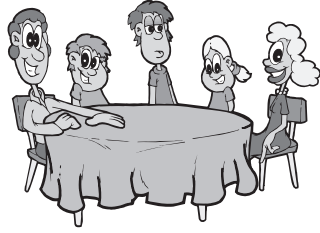


What to do next



Create your picture graph. Make sure it is bright and eye catching and that it conveys your message well.

- a There are 5 people in a family and the average age is 22. How old might each member be?



- b To make the District Diving Team, Dan must have an average of 7.2. His last five dives have scored: 8.3 6.7 9.2 4.5 6.8. What must he score in his last dive to achieve this? Do you think this is likely considering his previous dives?



- c The average attendance at Mr G's Experimental Dance Expo over 5 consecutive days was 24. On the last day, a huge crowd of 32 turned up. What could the attendances have been on the other days?



- d 7 pupils were playing football at lunch time. The mean number of goals scored by each player was 5. The median was 4 and the mode was 3. What could the scores have been?





Getting ready

Most countries have a Bureau of Statistics that collect statistics on seemingly everything. They even collect data on when kids go to bed at night and get up in the morning. Here is a sample from a census collected in 2006.



Sex	Age	Get up time when the pupil has school that day	Get up time when the pupil does not have school that day	Go to bed time when the pupil does have school the next day	Go to bed time when the pupil does not have school the next day
Female	15	7:30 am	9:00 am	10:30 pm	11:30 pm
Male	12	Before 6:00 am	9:30 am	9:30 pm	10:00 pm
Female	16	6:30 am	9:00 am	9:30 pm	11:00 pm
Female	14	7:30 am	8:00 am	9:30 pm	10:00 pm
Female	10	7:00 am	9:30 am	9:30 pm	10:00 pm
Male	11	8:00 am	7:30 am	7:30 pm	9:00 pm
Male	12	8:00 am	10:00 am	10:30 pm	11:00 pm
Male	13	6:30 am	8:30 am	9:30 pm	11:30 pm



What to do

Using the table as a guide, design and conduct your own survey about the times that the pupils at your school get up and go to bed. Work in a small group. Make your sample size 50 pupils but decide which age pupils you will survey. Will you keep it a Y6 project? Or will it be an across the school study?



What to do next

Find a way to present your data in graphical form. You have lots to think about:

- What information do you want to compare and analyse?
- What style(s) of graph(s) will you use?
- How many graphs will you need to create?
- Will you group the data?
- Will you use a spreadsheet program to help you or will you draw the graphs by hand?

Present your findings to the class. Compare your representation with that of others. Are they similar? If not, do other representations look clearer than yours?



Getting ready

An ice cream company decides to run a new competition to encourage more people to buy their ice creams. Their previous competition had failed badly. The major prize was a year's worth of free ironing. Yawn ...

The company decides to offer a range of prizes to the value of £2,000 and they want you to conduct a survey to find out the kinds of prizes people want.

Kids under the age of 16 are the main consumers so their campaign will be aimed at them.



What to do

Work as part of a team to design and conduct a survey to find out the kinds of prizes (to the value of £2,000) that will appeal to people under the age of 16.

Think about:

- Your sample size – how many people will you ask?
- Your sample range – how will you know you have asked a range of pupils that give a balanced picture?
- How you will phrase your questions? Remember open-ended questions are harder to handle than closed questions.
- How you will record the answers?
- When you will conduct your survey?

Practise your questions on each other to make sure they give you the information you are looking for and can record. When you are happy, conduct your survey.



What to do next

Once you have your data, your challenge is to now present it in a graph. Think about:

- What style of graph will best suit the data?
- Will you group the data or present individual responses? This may depend on your sample size.
- How will you create it – will you use a spreadsheet program or hand draw it?

Once you have created your graph, present your findings to the rest of the class.

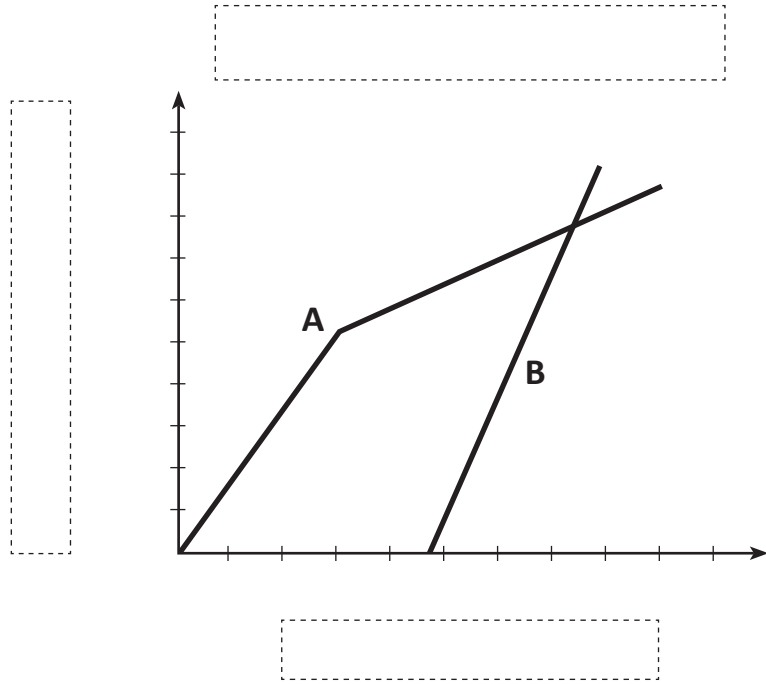


What to do



Add a title, axis labels and values to this line graph to make it a believable representation of a set of data. Think about:

- When do we use line graphs?
- What will line A represent?
- What will line B represent?
- What values are realistic for my chosen subject matter?



What to do next



Now try this one:

