KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS

KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 8

2023 Mathematics 2024

Unit 9 Booklet

HGS Maths

Tasks

Dr Frost Course

Name: _____

Class: _____

Contents

1 Proportion

1.1 Direct Proportion

Worked Example	Your Turn
It takes some bricklayers 6 hours to build a 30 m wall. How long will it take them to build a 5 m wall?	It takes some bricklayers 10 hours to build a 60 m wall. How long will it take them to build a 12 m wall?

1.2 Recipes

Worked Example	Your Turn
This is a list of ingredients for making a cake for 8 people. Ingredients for 8 people: 70 g flour 120 g fruits 150 g rolled oats 100 ml water 70 g butter Work out the amount of each ingredient needed to make a cake for 20 people.	This is a list of ingredients for making a cake for 6 people. Ingredients for 6 people: 100 g flour 190 g chocolate 7 eggs 180 g fruits Work out the amount of each ingredient needed to make a cake for 15 people.

1.3 Best Buys

Worked Example	Your Turn
Plants are sold in three different sizes of tray. A small tray of 20 plants costs £4.20. A medium tray of 40 plants costs £7.20. A large tray of 70 plants costs £13.30. Which size tray of plants is the best value for money?	Plants are sold in three different sizes of tray. A small tray of 20 plants costs £4.00. A medium tray of 40 plants costs £10.80. A large tray of 90 plants costs £9.00. Which size tray of plants is the best value for money?

1.4 Exchange Rates

Worked Example	Your Turn
a) Phil goes on holidays. Phil changes £640 to euros. The exchange rate is £1 = 1.14 euros. How many euros should Phil get? b) Dave hired a car in Germany. The cost of hiring the car was 429 euros. The exchange rate is £1 = 1.1 euros. Work out the cost of hiring the car in pounds.	a) Alice hired a car in Greece. The cost of hiring the car was £700. The exchange rate is £1 = 1.1 euros. Work out the cost of hiring the car in euros. b) Nina goes on holidays. Nina changes 147.60 euros to pounds. The exchange rate is £1 = 1.23 euros. How many pounds should Nina get?

1.5 Inverse Proportion

Worked Example	Your Turn
7 bricklayers can build a certain wall in 9 days. How long would it take 3 bricklayers to build it?	8 bricklayers can build a certain wall in 12 days. How long would it take 3 bricklayers to build it?

1.6 Direct and Inverse Proportion

Worked Example	Your Turn
15 machines work at the same rate. Together, the 15 machines can complete an order in 8 hours. 3 of the machines break down after 6 hours. The other machines carry on working until the order is complete. In total, how many hours does each of the other machines work?	27 machines work at the same rate. Together, the 27 machines can complete an order in 8 hours. 3 of the machines break down after 6 hours. The other machines carry on working until the order is complete. In total, how many hours does each of the other machines work?

2 Averages and Range

2.1 Range

Worked Example	Your Turn
Find the range of: 3, 5, 9, 13, 18	Find the range of: 1, 3, 7, 11, 16

2.2 Mode

Worked Example	Your Turn
Find the mode of: a) $5, 3, 2, 9, 13, 3$ b) $9, 13, 5, 2, 3, 18$	Find the mode of: a) $3, 2, 19, 14, 10, 2$ b) $10, 19, 5, 3, 14, 4$

2.3 Median

Worked Example	Your Turn
Find the median of: a) $5, 3, 2, 9, 13$ b) $9, 13, 5, 2, 5, 18$	Find the median of: a) $3, 2, 19, 14, 10$ b) $10, 19, 5, 3, 14, 4$

2.4 Mean

Worked Example	Your Turn
Find the mean of: 2, 4, 5, 6, 13	Find the mean of: 2, 4, 5, 6, 13, 30

2.5 Using Totals

Worked Example	Your Turn
Find the missing number: $5, 1, 10, ?$ $\text{Mean} = 6$	Find the missing number: $6, 2, 11, ?$ $\text{Mean} = 6$

Worked Example	Your Turn
Four numbers have a mean of 10. Three of the numbers are $8, 15, 7$. What is the fourth number?	Five numbers have a mean of 10. Four of the numbers are $8, 15, 7, 8$. What is the fifth number?

Worked Example	Your Turn
The mean height of 14 players is $172\ cm$. A player with a height of $197\ cm$ leaves the team. What is the new mean height of the team?	The mean height of 14 players is $127\ cm$. A player with a height of $142\ cm$ leaves the team. What is the new mean height of the team?

Worked Example	Your Turn
The mean score after six tests is 5. One more test is taken. After this test the mean score is 6. What was the score on the final test?	The mean score after five tests is 6. One more test is taken. After this test the mean score is 7. What was the score on the final test?

2.6 Combined Mean

Worked Example	Your Turn
A group of students take a test. The group consists of 24 boys and 16 girls. The mean mark for the boys is 36. The mean mark for the girls is 33. Calculate the mean mark for the whole group.	A group of students take a test. The group consists of 12 boys and 8 girls. The mean mark for the boys is 18. The mean mark for the girls is 16.5. Calculate the mean mark for the whole group.

Worked Example	Your Turn
A group of 40 men, 20 women and 20 children take a test. The mean score for women is 31.2. The mean score for children is 18.4. The mean score for all 80 people is 22.4. Work out the mean score for men.	A group of 20 men, 10 women and 10 children take a test. The mean score for women is 15.6. The mean score for children is 9.2. The mean score for all 40 people is 11.2. Work out the mean score for men.

2.7 Determining List of Numbers

Worked Example	Your Turn
Write a list of five numbers with: Mean $= 4$ Median $= 4$ Mode $= 4$ Range $= 4$	Write a list of five numbers with: Mean $= 5$ Median $= 5$ Mode $= 5$ Range $= 5$

Worked Example	Your Turn
Write a list of four numbers with: $\text{Mean} = 4$ $\text{Median} = 4$ $\text{Mode} = 4$ $\text{Range} = 4$	Write a list of four numbers with: $\text{Mean} = 5$ $\text{Median} = 5$ $\text{Mode} = 5$ $\text{Range} = 5$

2.8 Comparing Data

Worked Example

Zayd plants two different types of tomato plant. He record the number of tomatoes that he picks from each plant every day for 10 days. His records are shown below:

Plant A: $4 \quad 6 \quad 7 \quad 3 \quad 5 \quad 2 \quad 1 \quad 3 \quad 6 \quad 5$

Plant B: $5 \quad 6 \quad 7 \quad 6 \quad 8 \quad 9 \quad 6 \quad 7 \quad 8 \quad 9$

Compare the two plants and recommend which type he should buy next year.

2.9 Deciding which Average to Use

Advantages and Disadvantages

Choosing an Average to Use An average is used to **represent** a set of data. Using different averages can **distort** and possibly **misrepresent** the data.

	Average		
	Mean	**Median**	**Mode**
Advantages			
Disadvantages			
Used for			

Write each statement into the table.

Uses all values.
Finding the most likely value.
Not affected by outliers.
Does not use every piece of data.
Has to be calculated.
Easy to find.

May not exist.
Evenly spread data.
Not affected by outliers.
Outliers can distort it.
A total can be calculated from it.
Can average non-numerical data.

Easy to find.
Data with outliers.
Non-numerical data.
Easy to find with ungrouped data.
Does not use every piece of data.

Worked Example

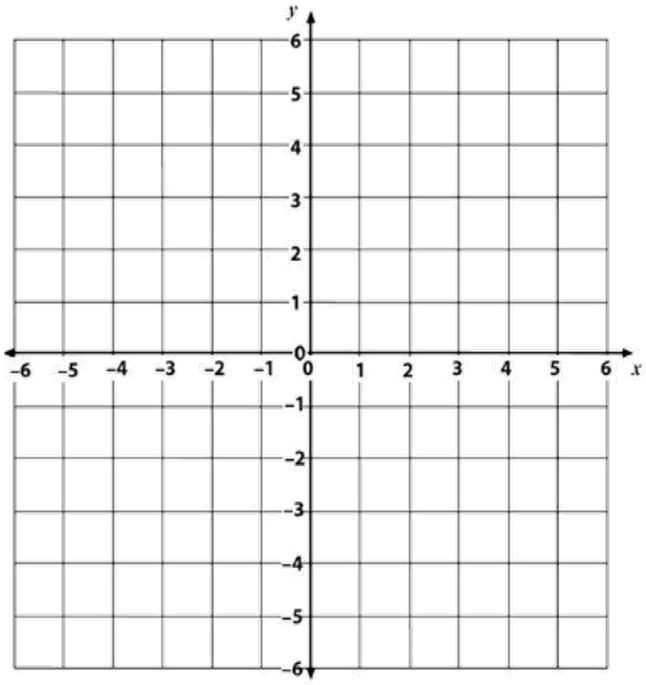
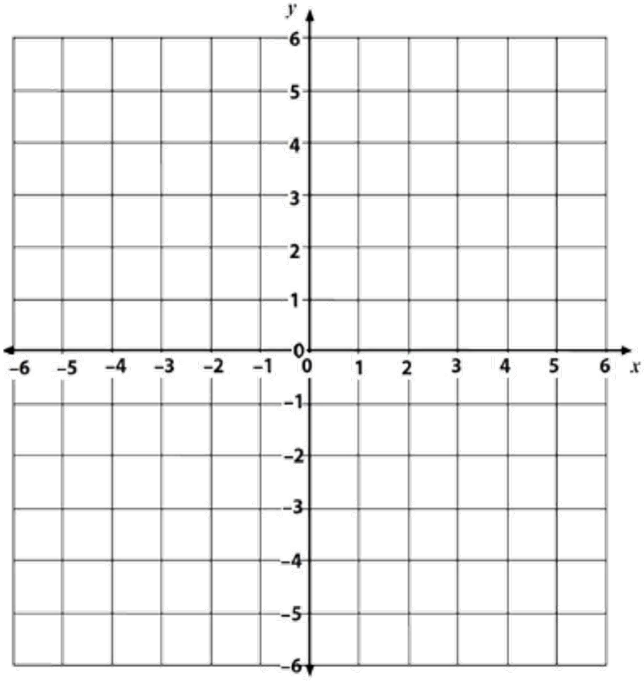
Charlie keeps a record of the number of carrier bags that he is given when he does his weekly shopping. The data he collects over 10 weeks is listed below:

$9, \quad 8, \quad 5, \quad 9, \quad 12, \quad 8, \quad 7, \quad 6, \quad 5, \quad 9$

a) Calculate: (i) the mean (ii) the median (iii) the mode
b) Explain why the mean is not very useful in this context.
c) Which value might be used by an environmental group who thinks that supermarkets cause pollution by giving out too many carrier bags?
d) Which value might be used by a shopper who thinks that the supermarket doesn't give him enough carrier bags for his shopping?

3 Coordinates

3.1 Plotting Coordinates

Worked Example	Your Turn
Plot the coordinates: $(2, 5)$ $(2, -5)$ $(-2, 5)$ $(-2, -5)$ 	Plot the coordinates: $(3, 4)$ $(3, -4)$ $(-3, 4)$ $(-3, -4)$ 

3.2 Reading Coordinates

3.3 Coordinates with Shapes

4 Charts

4.1 Bar Charts

Worked Example

Draw a bar chart for the data:

Sport	Frequency
Cricket	4
Football	3
Hockey	6
Rugby	1

Your Turn

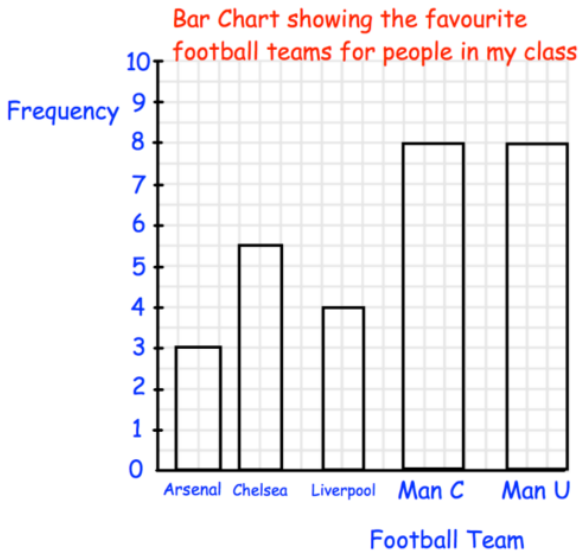
Draw a bar chart for the data:

Colour	Frequency
Blue	15
Green	8
Red	21
Yellow	3

Worked Example

Spot the mistakes in the bar chart:

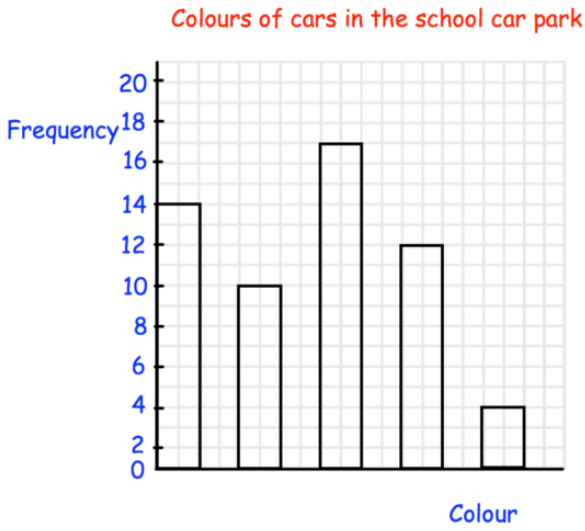
Football Team	Frequency
Arsenal	3
Chelsea	5
Liverpool	4
Man City	8
Man United	8



Your Turn

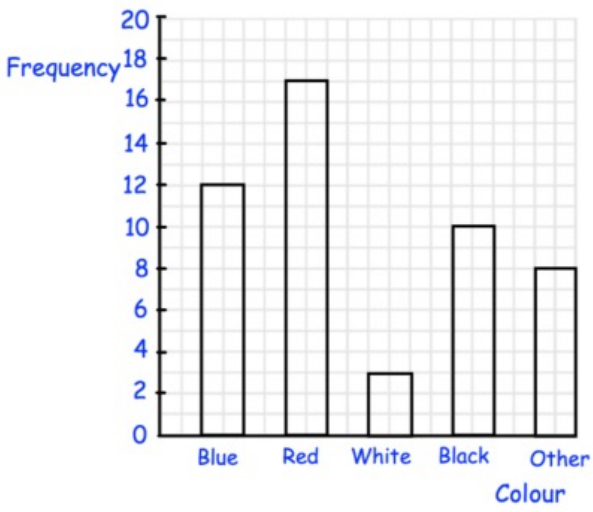
Spot the mistakes in the bar chart:

Colour	Frequency
Blue	14
Red	9
Silver	17
White	12
Green	4



Worked Example

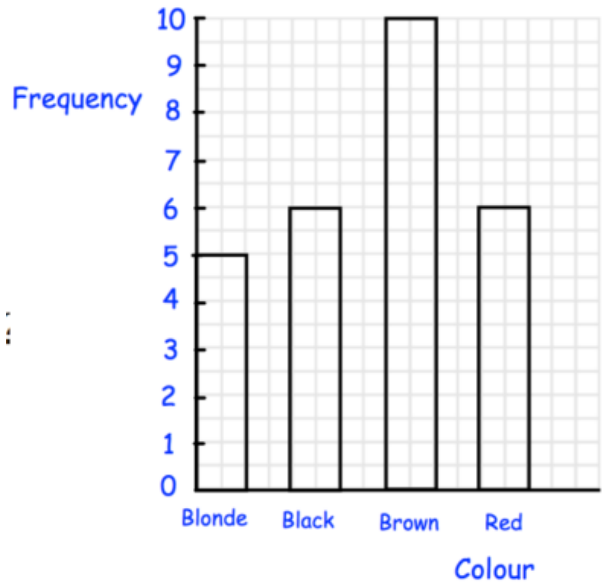
The bar chart shows the colour of cars in a car park:



- What is the most common colour?
- How many cars were blue?
- How many cars were white?
- How many more cars were red than other?
- How many cars were there in total?
- What fraction of the cars are black?

Your Turn

The bar chart shows the hair colour of students in a class:



- What is the most common hair colour?
- How many students had black hair?
- How many more students had red hair than blonde hair?
- How many students are in the class?
- What fraction of the students have brown hair?

Fluency Practice

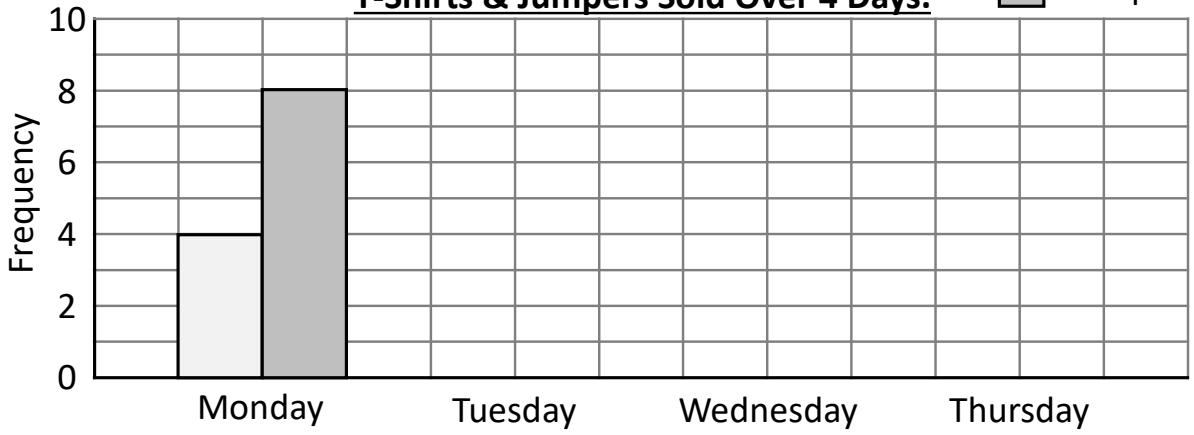
Dual Bar Charts: Drawing

1) The table shows T-shirts & Jumpers sold at a clothes shop over 4 days.
Use the information to complete the dual bar chart.

	T-Shirt	Jumper
Monday	4	8
Tuesday	5	6
Wednesday	2	3
Thursday	8	9

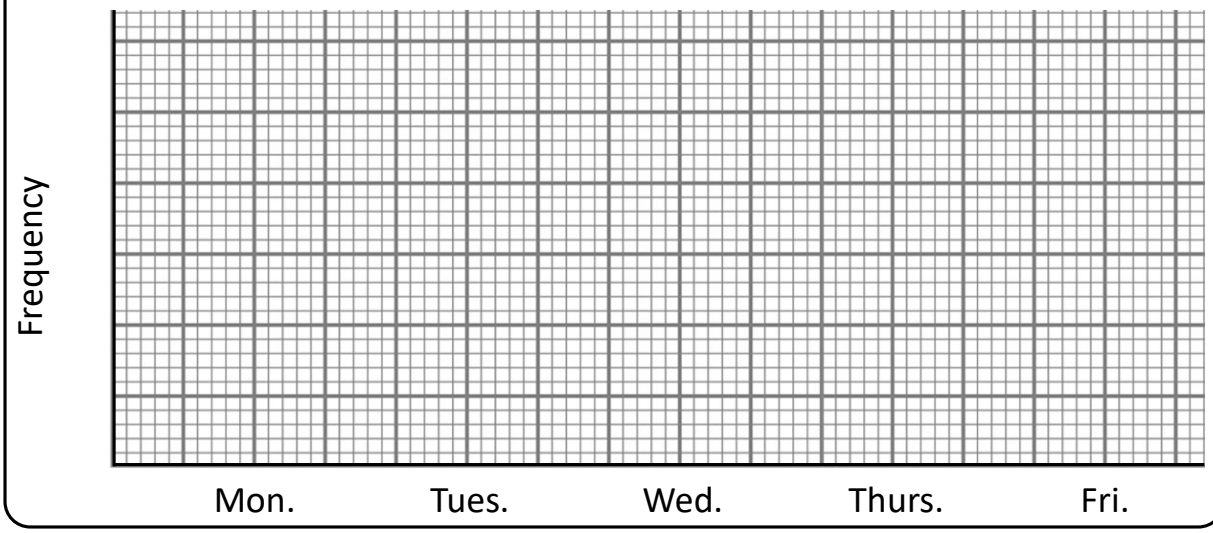
Key
T-shirts
Jumpers

T-Shirts & Jumpers Sold Over 4 Days.



2) The table shows Hoodies & Jeans sold in a shop over a week.
Use the information to complete a dual bar chart.

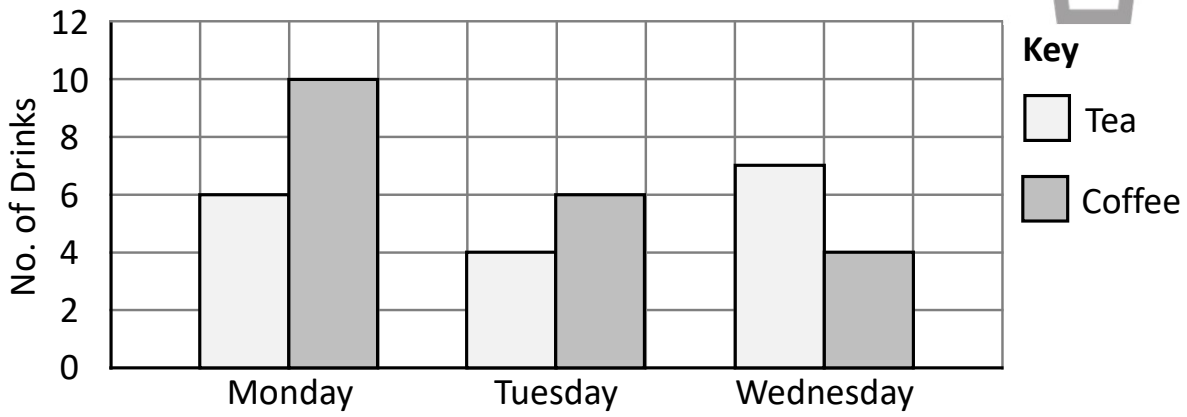
	Mon.	Tue.	Wed.	Thurs.	Fri.
Hoodies	20	10	0	14	26
Jeans	15	25	12	23	18



Fluency Practice

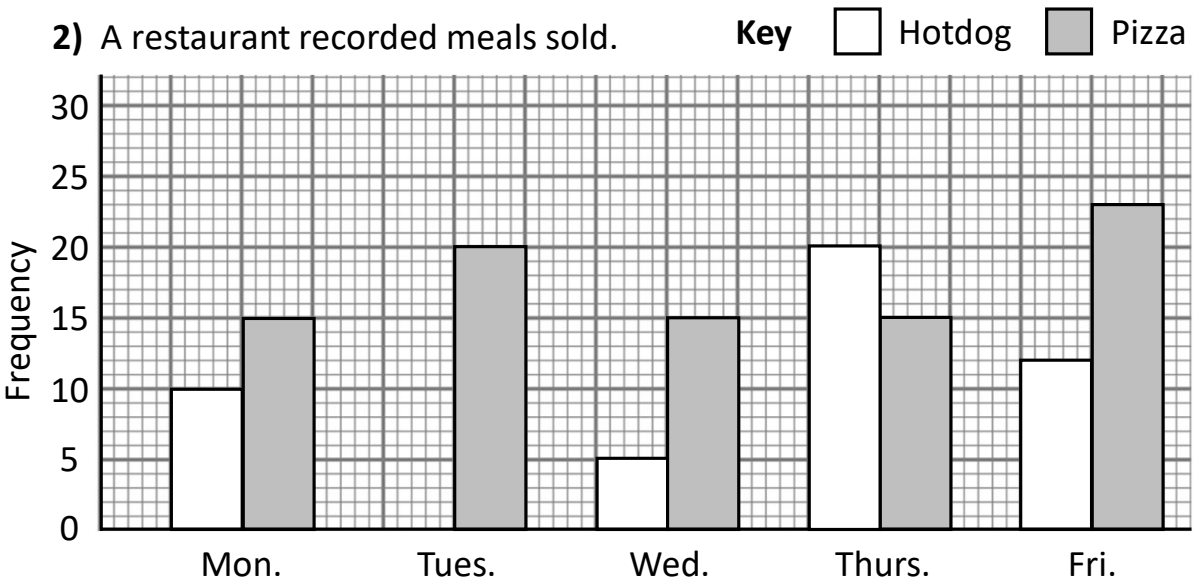
Dual Bar Charts: Reading

1) A cafe recorded the drinks it sold over 3 days. The results are represented in the bar chart.



a) How many coffees did the cafe sell on Tuesday?
b) How many teas did the cafe sell on Wednesday?
c) How many drinks did the cafe sell on Monday?
d) How many coffees did the cafe sell over the three days?

2) A restaurant recorded meals sold.



a) How many pizzas were sold on Wednesday?
b) How many meals were sold on Thursday?
c) On Friday how many more pizzas were sold than hotdogs?
d) Which day had a special offer on hotdog meals?
e) Over the week, how many meals were sold?
f) In total, how many more pizza meals than hotdog meals were sold?

Fluency Practice

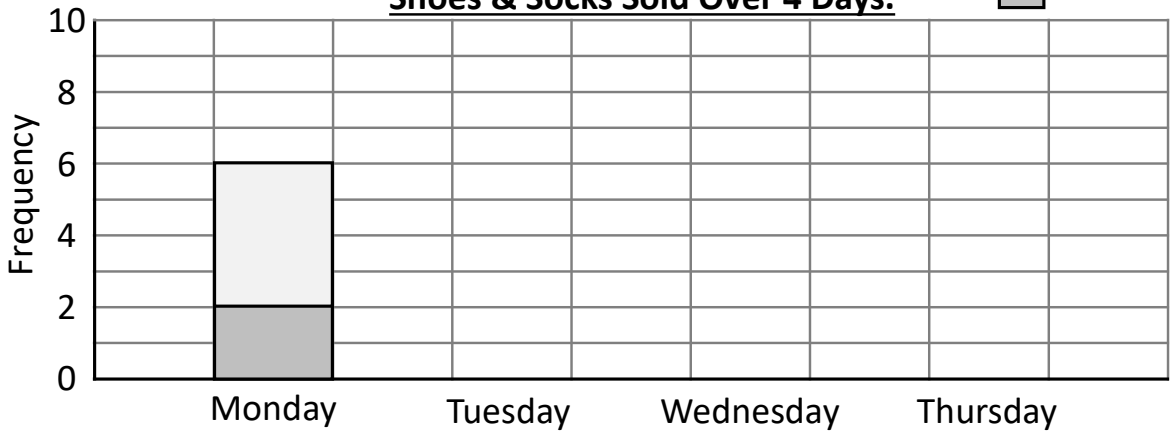
Composite Bar Charts: Drawing

1) The table shows pairs of Shoes & Socks sold at a shop over 4 days.
Use the information to complete the composite bar chart.

	Shoes	Socks
Monday	4	2
Tuesday	6	1
Wednesday	3	4
Thursday	3	6

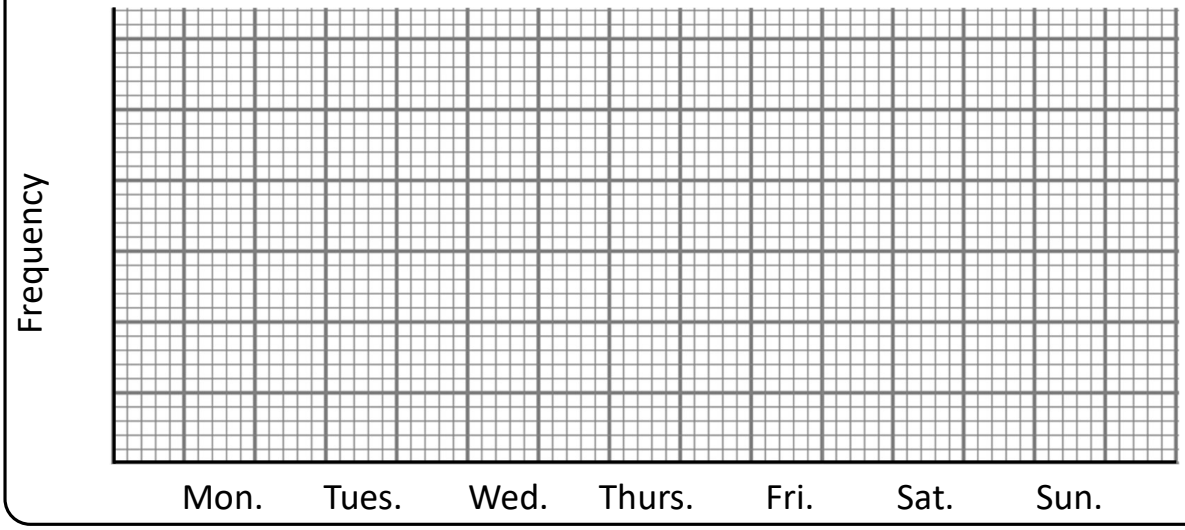
Key
Shoes
Socks

Shoes & Socks Sold Over 4 Days.



2) The table shows Trousers & Shirts sold in a shop over a week.
Use the information to complete a composite bar chart.

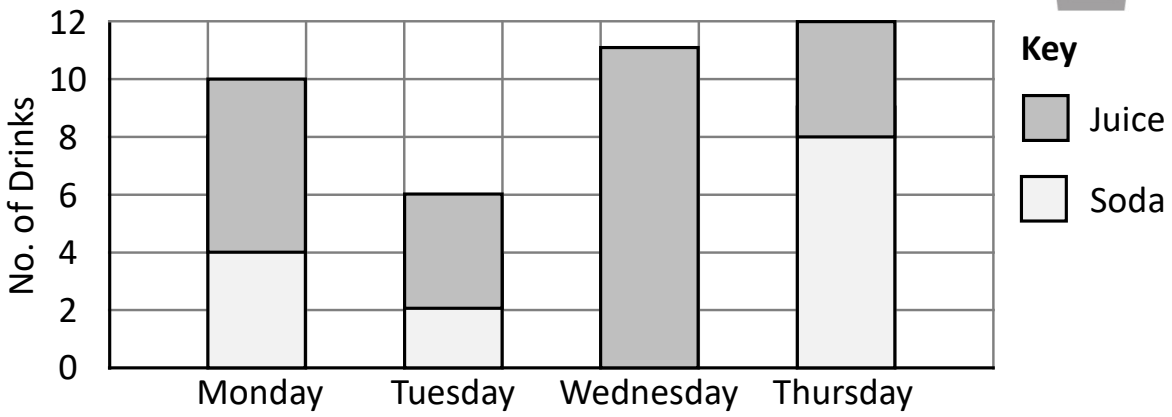
	Mon.	Tue.	Wed.	Thurs.	Fri.	Sat.	Sun.
Trousers	10	10	15	16	7	15	17
Shirts	5	10	5	10	4	9	14



Fluency Practice

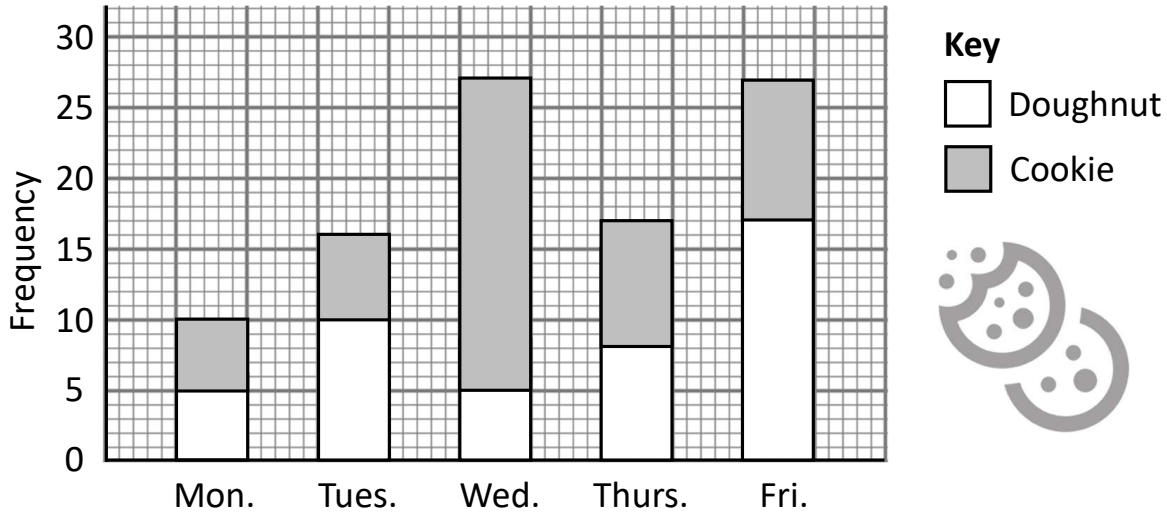
Composite Bar Charts: Reading

1) A cafe recorded the drinks it sold over 4 days. The results are represented in the bar chart.



a) How many sodas did the cafe sell on Monday?
b) How many drinks did the cafe sell on Tuesday?
c) How many juice drinks did the cafe sell on Thursday?
d) How many juice drinks did the cafe sell over the four days?

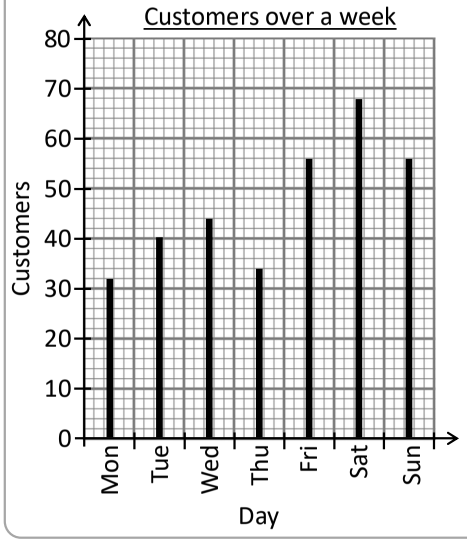
2) A shop recorded snacks sold.



a) How many doughnuts were sold on Tuesday?
b) How many cookies were sold on Thursday?
c) How many snacks were sold on Friday?
d) On Wednesday how many more cookies were sold than doughnuts?
e) How many doughnuts were sold on Monday and Tuesday?
f) In total, how many more cookies were sold compared to doughnuts?

4.2 Vertical Line Charts

① Vertical Line Charts



A shop recorded how many customers it had each day.

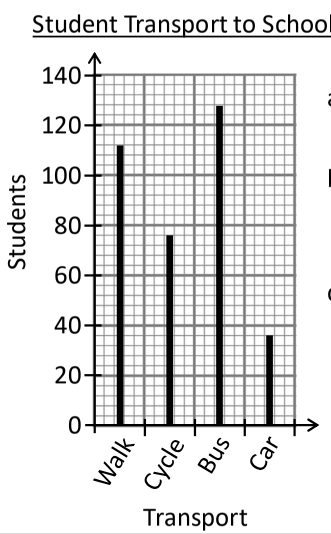
a) Which was the busiest day for the shop?

b) How many customers were there on Monday?

c) How many customers were there on the weekend?

d) How many more customers were there on Friday compared to Tuesday?

②



A headteacher recorded how some students travelled to school.

a) How many students took a bus to school?

b) How many more students walked compared to taking a car?

c) The school has 1000 students. Is the graph representative of all the school students?

③

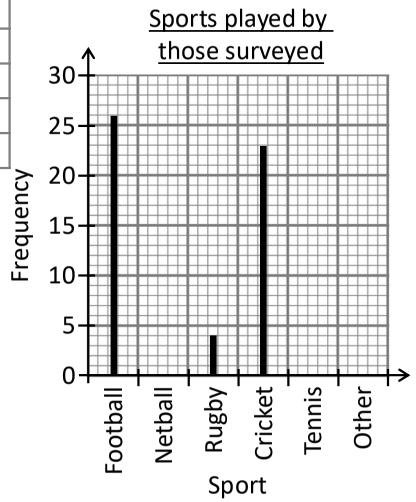
Leigh surveyed 100 people about the sport they played.

Football	
Netball	18
Rugby	
Cricket	
Tennis	8
Other	

Complete the table and the vertical line chart.

A lot of people answered 'Other'.

How might we change the data collection & representation?

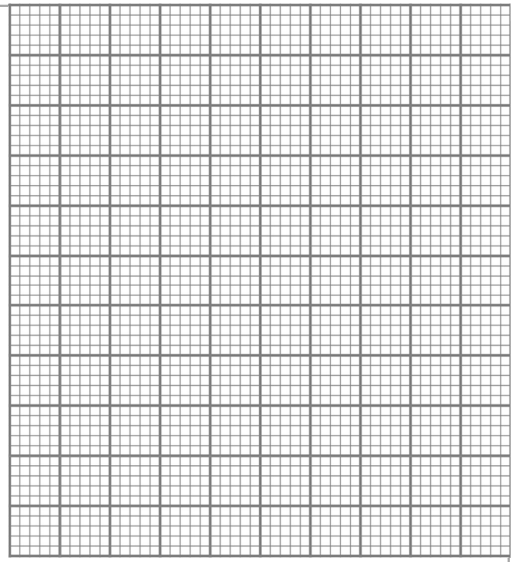


④

Lunch	Freq.
Pizza	29
Salad	8
Pasta	14
Sandwich	22
Lasagne	11

On the 3rd of February, the school cafeteria recorded student lunch meals.

Complete a vertical line chart to represent this data.



4.3 Pictograms

Worked Example

Students were asked their favourite subject. The results were:

Maths	Maths	Maths
English	Science	English
French	PE	PE
English	Maths	Maths
Maths	Maths	Maths
Maths	Maths	

Draw a pictogram for the results.

Your Turn

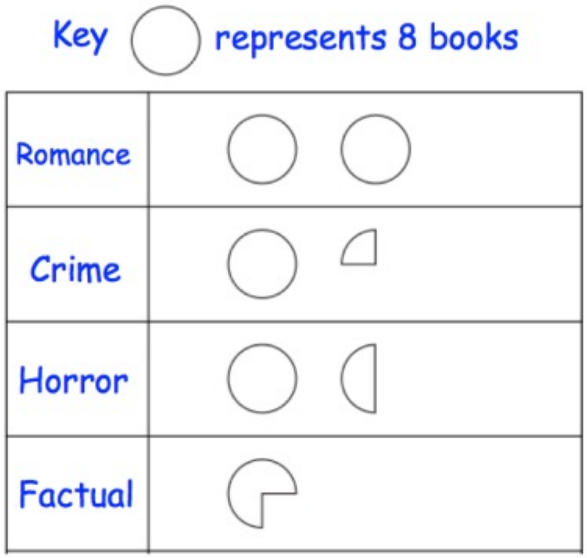
A person asked their friends for their favourite sport.

Rugby	Football	Rugby	Hockey	Cricket
Football	Football	Rugby	Hockey	Football
Rugby	Cricket	Hockey	Football	Football
Football	Rugby	Football	Football	Rugby

Draw a pictogram for the results, where a circle represents 2 people

Worked Example

The pictogram shows the type of books a person read last year.



How many books were:

Romance

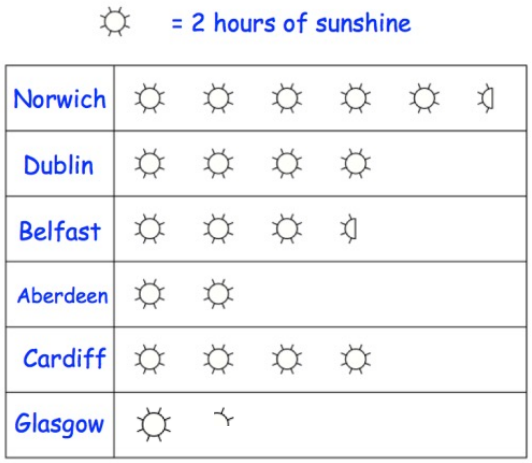
Crime

Horror

Factual

Your Turn

The pictogram shows the number of hours of sunshine in a day across various cities



How many hours of sunshine were there in:

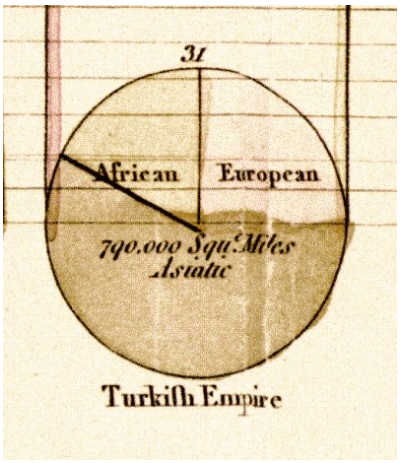
Dublin

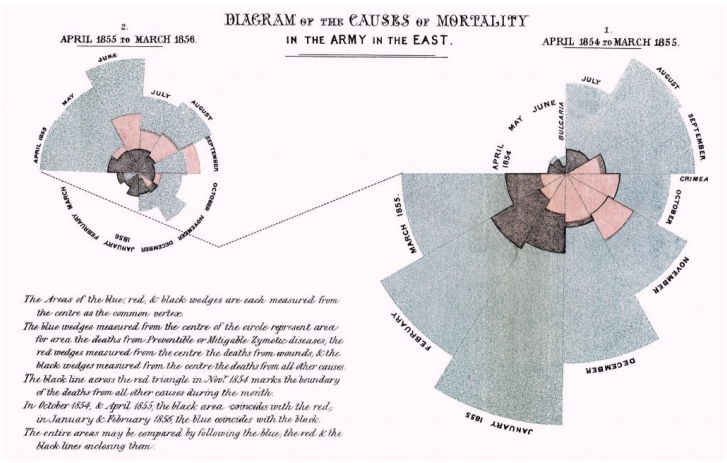
Belfast

Glasgow

4.4 Pie Charts

Pie charts have been around since William Playfair created his Statistical Breviary of 1801. They were later popularised by Florence Nightingale.

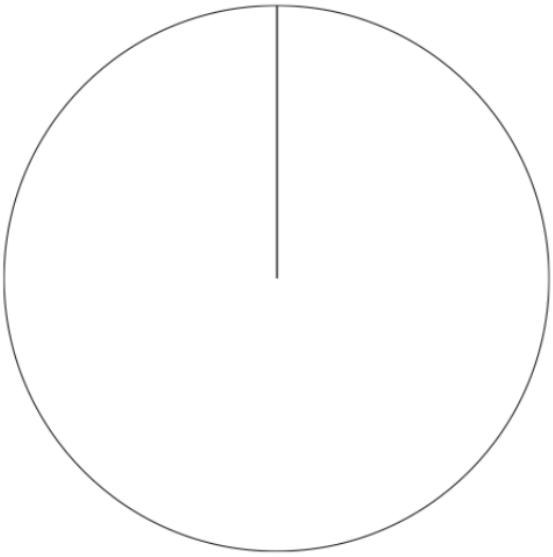




Worked Example

The table shows the number of ice creams sold in a day. In total 120 were sold. Draw a pie chart for the data.

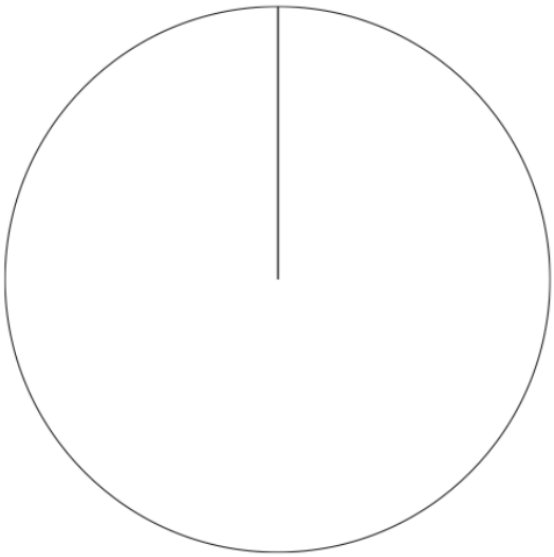
Flavour	Number sold
Vanilla	20
Chocolate	40
Strawberry	24
Honeycomb	24
Mint	12



Your Turn

The table shows the holiday destinations of 60 people. Draw a pie chart for the data.

Destination	Number of people
Italy	15
Portugal	10
Spain	12
France	23



Worked Example

Draw a pie chart for the data.

Jenny records how 70 pupils travelled to school on one day.

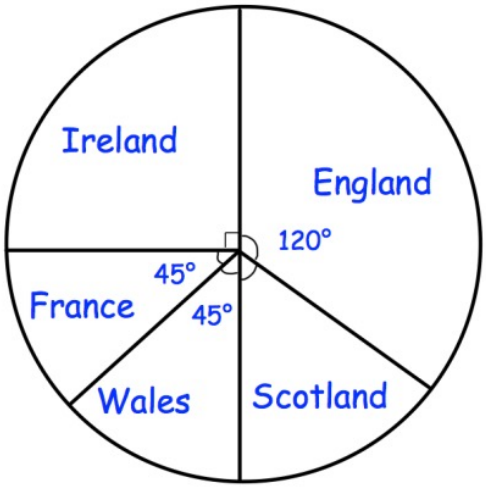
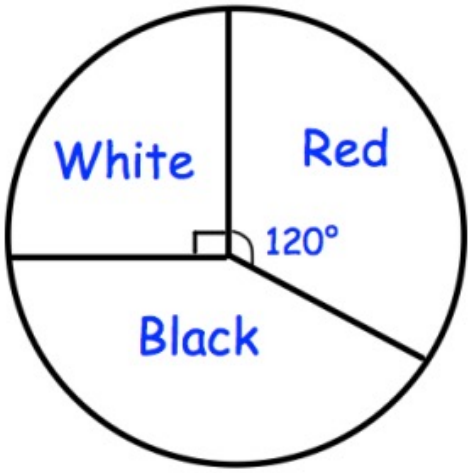
Type of transport	Frequency	Angle (°)
train	25	
walk	9	
cycle	10	
bus	26	

Your Turn

Draw a pie chart for the data.

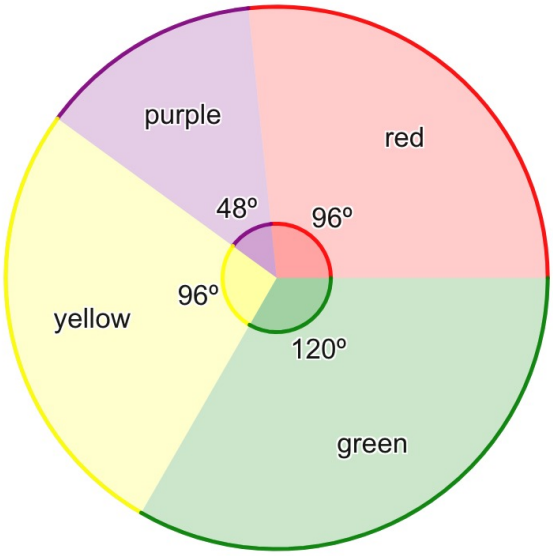
Joanna records how 130 pupils travelled to school on one day.

Type of transport	Frequency	Angle (°)
train	32	
walk	26	
bus	35	
cycle	30	
other	7	

Worked Example	Your Turn
A group of 720 people were asked which rugby team they support.  How many supported: Ireland England Wales Scotland	There are 1440 counters in a bag. Each is white, red or black.  How many counters are: White Red Black

Worked Example

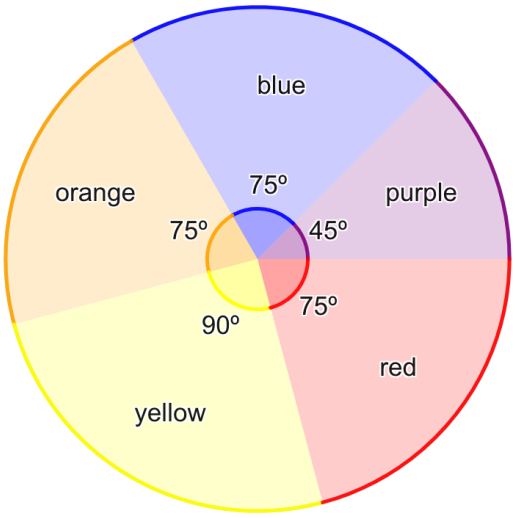
Joel records the favourite colours of 90 people and represents this information on the pie chart below.



Work out how many people prefer purple.

Your Turn

Joanna records the favourite colours of 144 people and represents this information on the pie chart below.



Work out how many people prefer blue.

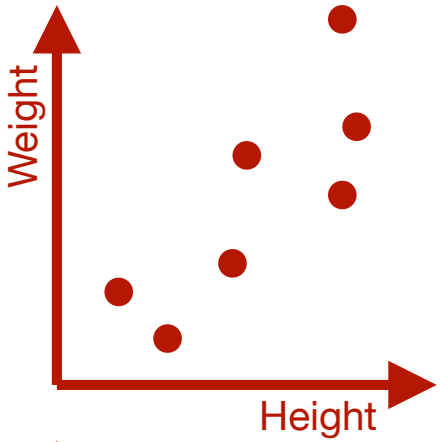
4.5 Stem and Leaf Diagrams

Worked Example	Your Turn
Draw an ordered stem and leaf diagram for this data: 12 21 13 31 53 47 29 21 18 46 21 53 45	Draw an ordered stem and leaf diagram for this data: 55 23 48 29 41 47 36 35 40 35 44 34 35
Work out the mode	Work out the mode
Write down the median	Write down the median
Work out the mean (1dp)	Work out the mean (1dp)
Work out the range	Work out the range

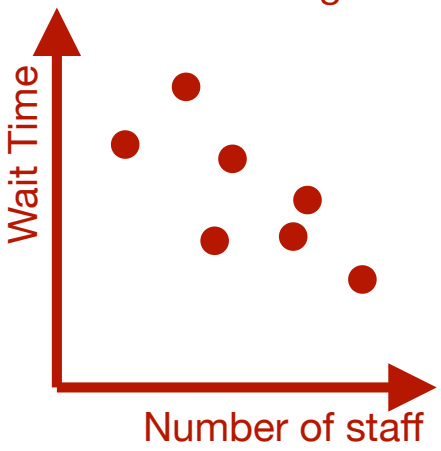
Worked Example	Your Turn
Draw an ordered stem and leaf diagram for this data: 12 21 13 31 53 47 29 21 18 46 21 53 45 21	Draw an ordered stem and leaf diagram for this data: 42 35 56 39 40 51 47 38 42 55 42 48 49 41
Work out the mode	Work out the mode
Write down the median	Write down the median
Work out the mean (1dp)	Work out the mean (1dp)
Work out the range	Work out the range

4.6 Scatter Diagrams

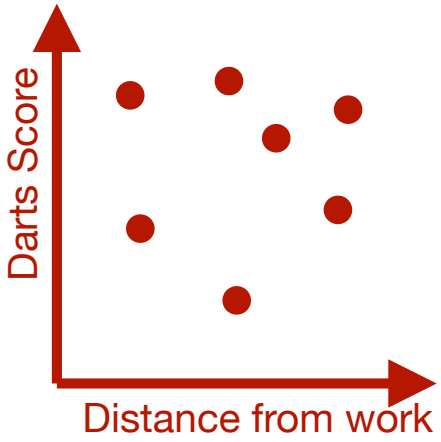
Scatter Graphs can show a relationship between two variables.



…such as people's height and weight.



…or the number of staff working in KFC and the wait time for food.



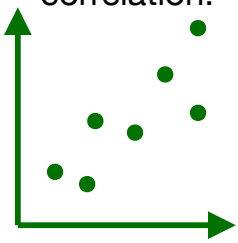
…or the distance people live from work and their best score in darts.

Correlation

If the two variables have a relationship we call it correlation.

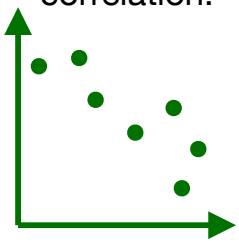
There are different types of correlation:

Positive correlation:



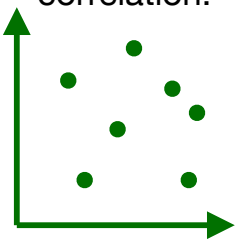
As one value goes up, so does the other.

Negative correlation:



As one value goes up, the other goes down.

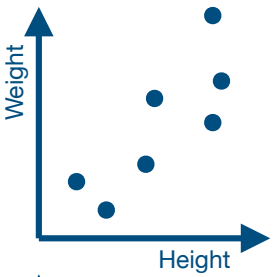
No correlation:



There is no obvious relationship.

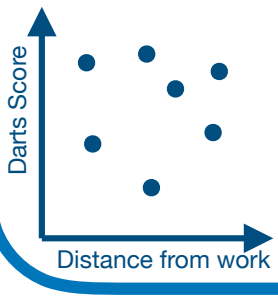
Sometimes you might be asked to explain the correlation in context.

This means describing what is actually happening. eg:



"Taller people are usually heavier."

"When there are more staff working, you wait less."

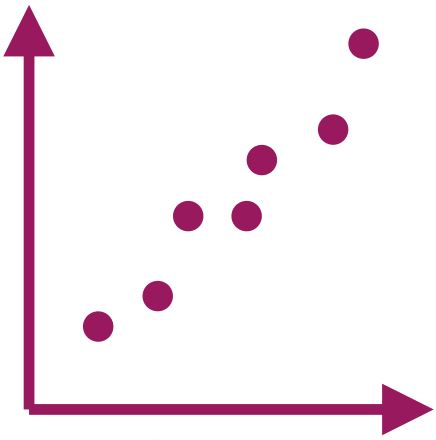


"There is no relationship between how far people live from work and their darts ability."

Correlation Strength

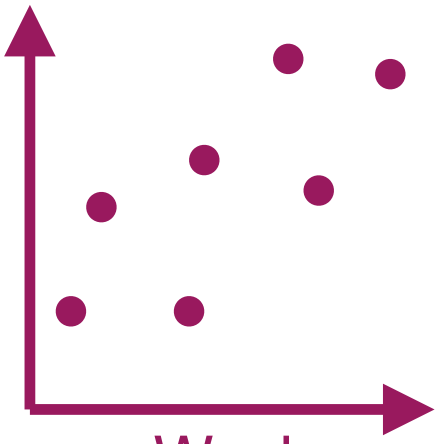
Correlation can be strong or weak.

If the correlation is strong, all the points will closely follow a straight line.



Strong correlation

If the correlation is weak, the points will follow the line more loosely.

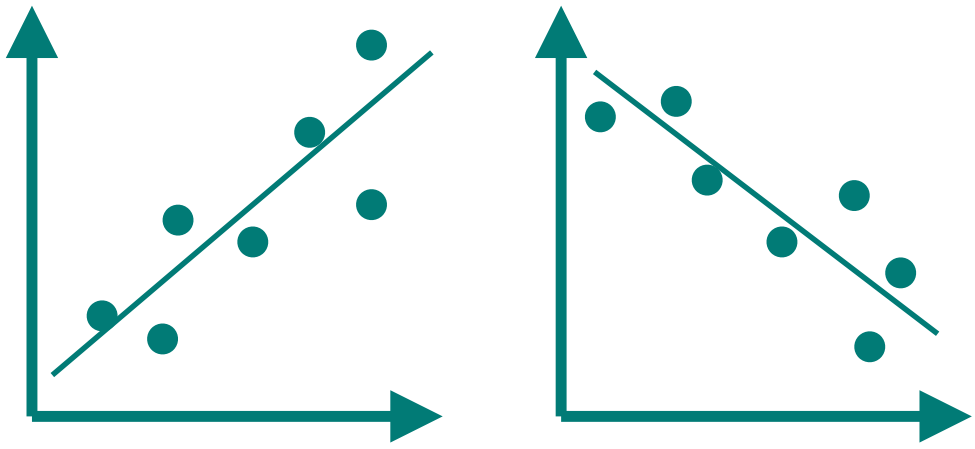


Weak correlation

Line of Best Fit

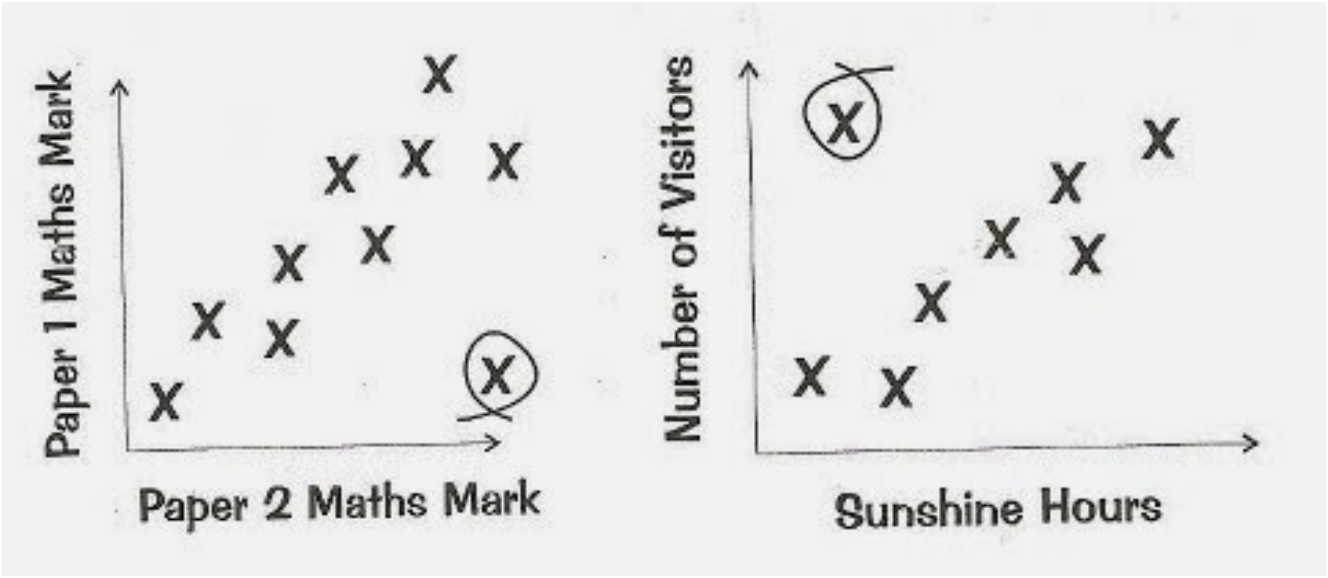
We can show the correlation more clearly by drawing a Line of Best Fit.

This should pass through the middle of all the points (but does not have to touch any of the points).



Outliers

Scatter plots often have a pattern. We call a data point an **outlier** if it doesn't fit the pattern.

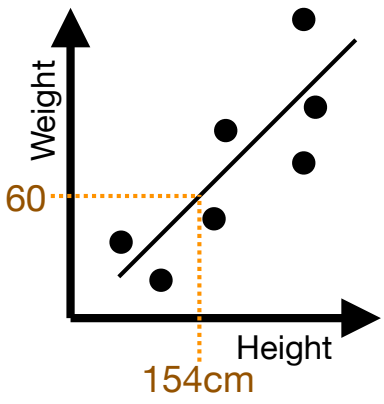


Drawing and Interpreting Scatter Graphs

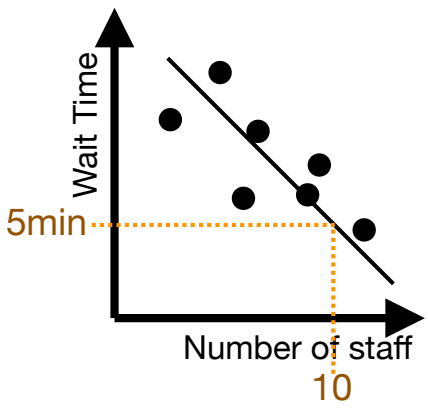
We can use the Line of Best Fit to make predictions of other results.

For example, we can estimate:

…someone's height if we know their weight is 60kg.



…or the wait time in KFC if we know they have 10 staff on today.

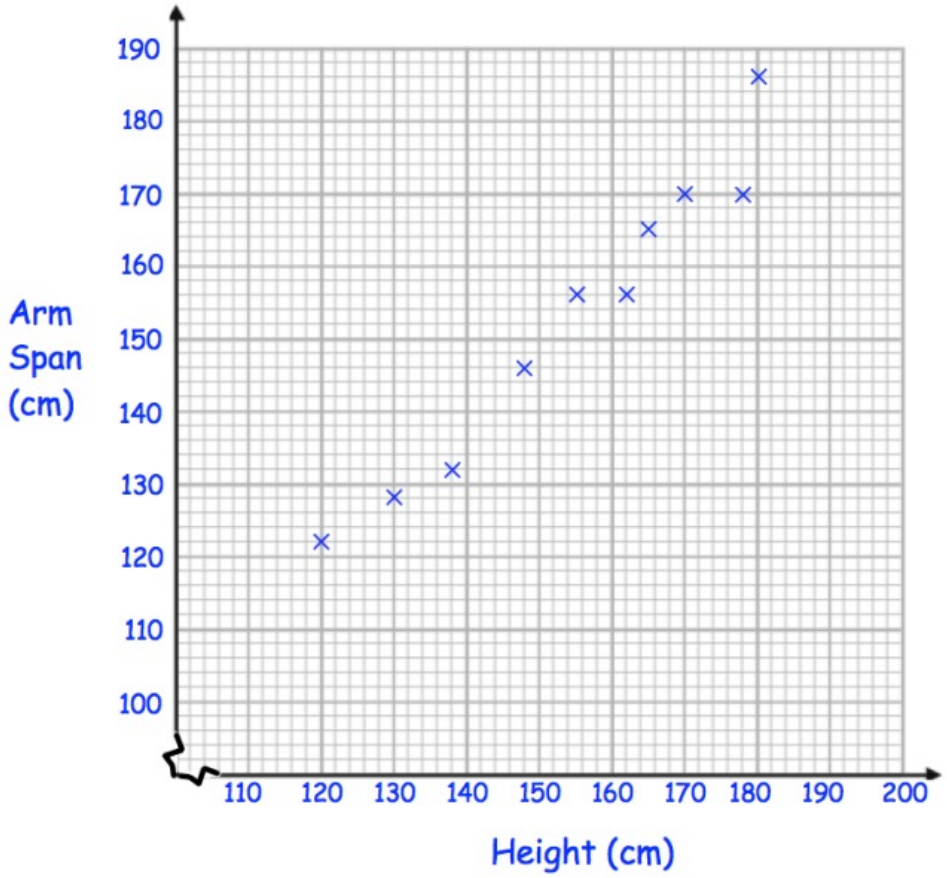


- When we use our line of best fit to estimate a value **inside** the range of our data, this is known as **interpolation**.

- When we use our line of best fit to estimate a value **outside** the range of our data, this is known as **extrapolation**.

Worked Example

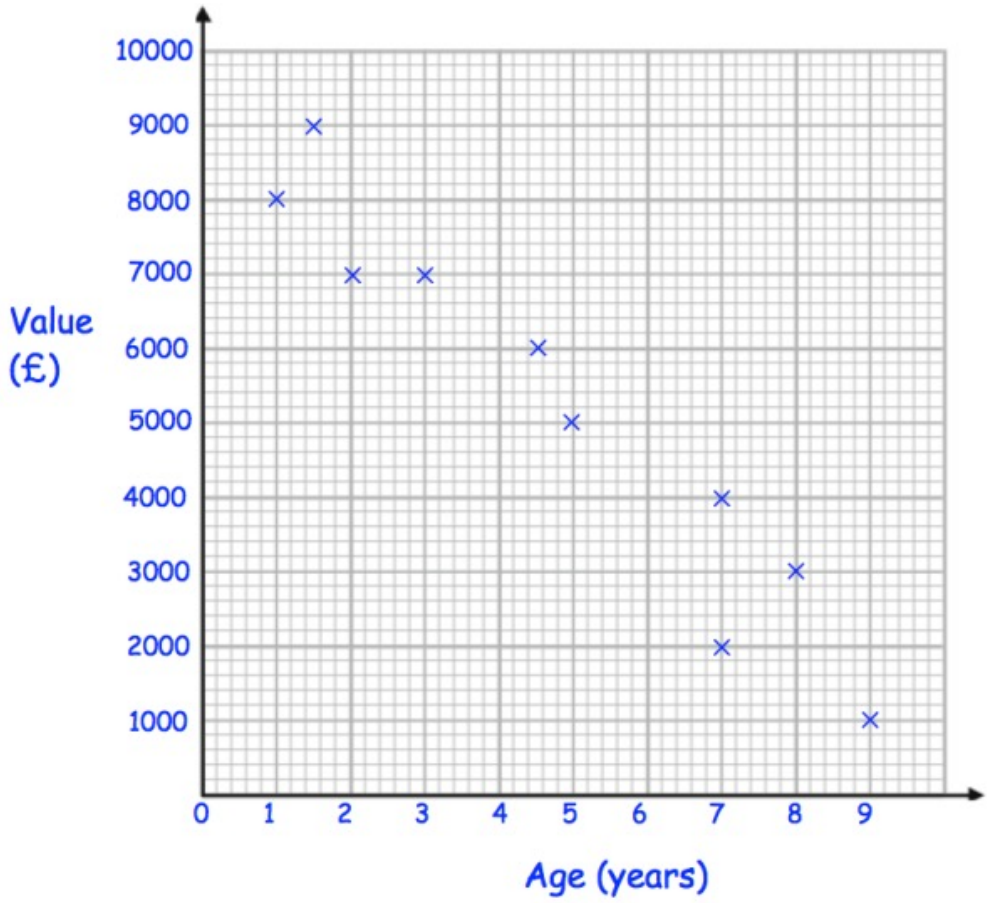
The scatter graph shows the height and arm span of ten students.



a) Describe the correlation.
b) Another student is $174\ cm$ tall and has an arm span of $180\ cm$. Plot this on the graph.
c) Another student is $142\ cm$ tall. Estimate the arm span of this student.

Your Turn

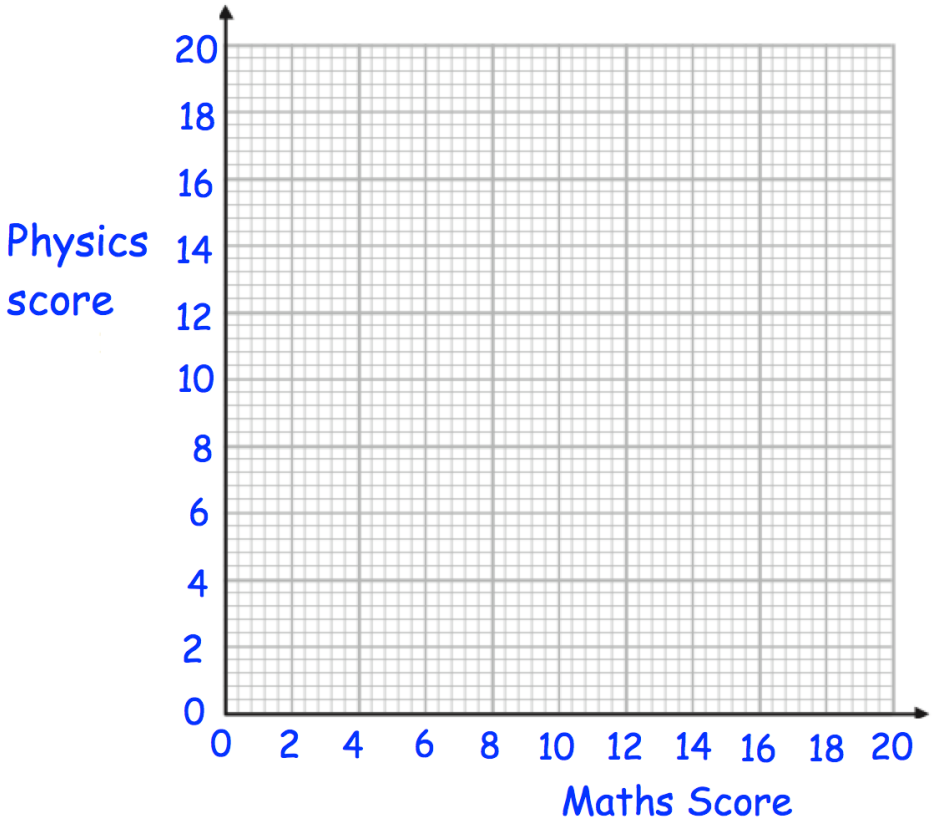
The scatter graph shows the value of cars and their age.



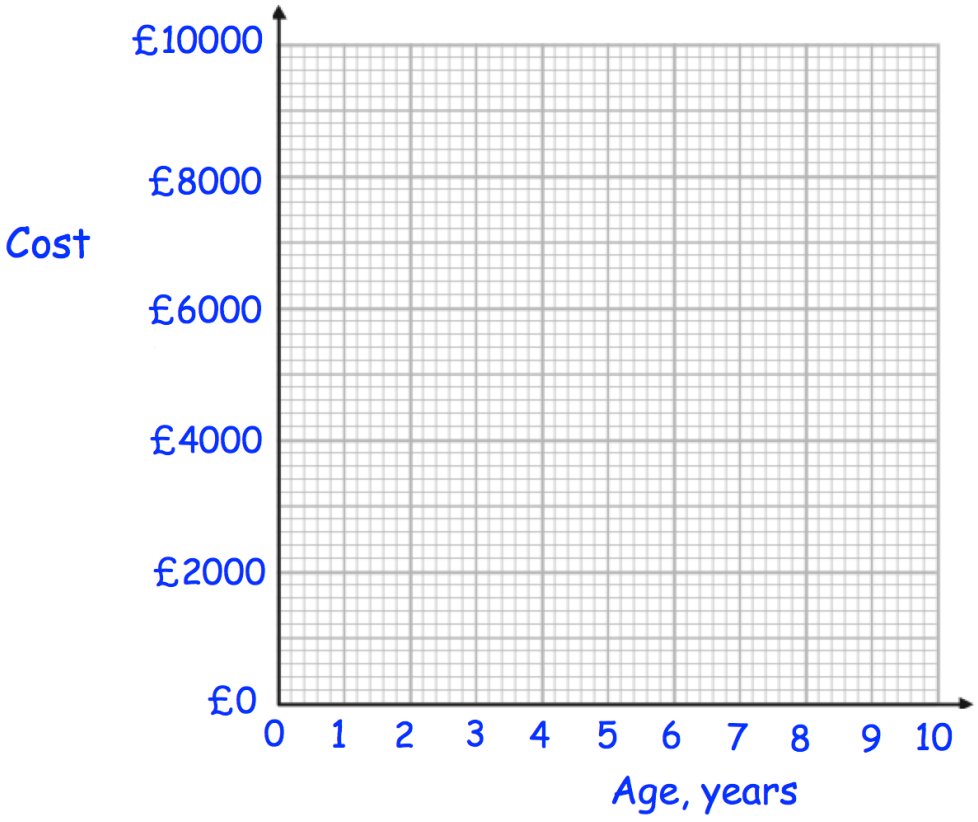
a) Describe the correlation.
b) Another car is 6 years old and worth £1500. Plot this on the graph.
c) Another car is 4 years old. Estimate its value.

Templates

Question 1(a)

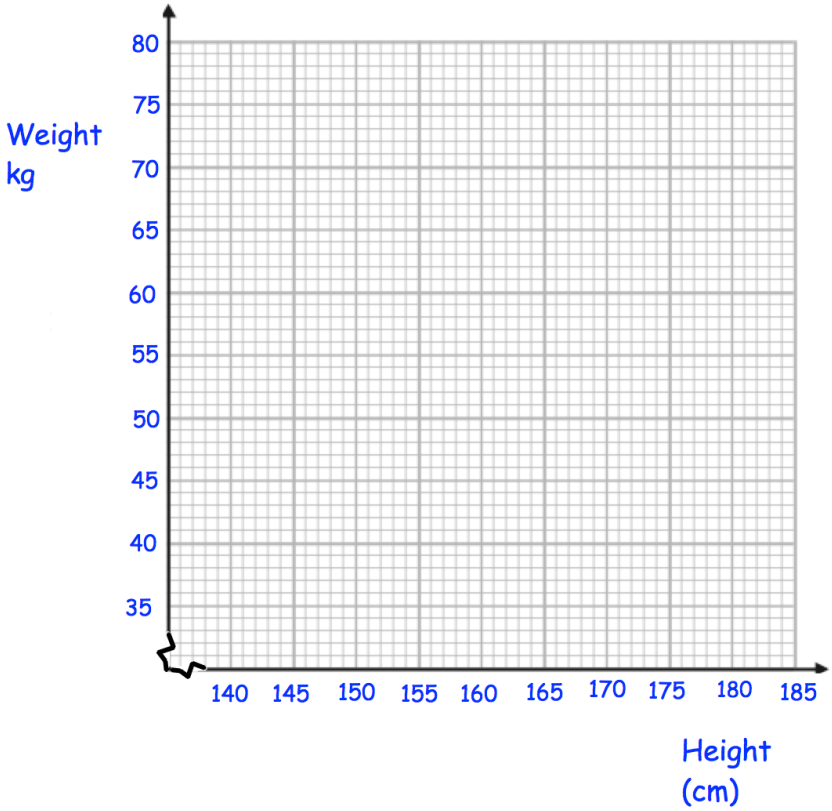


Question 1(b)

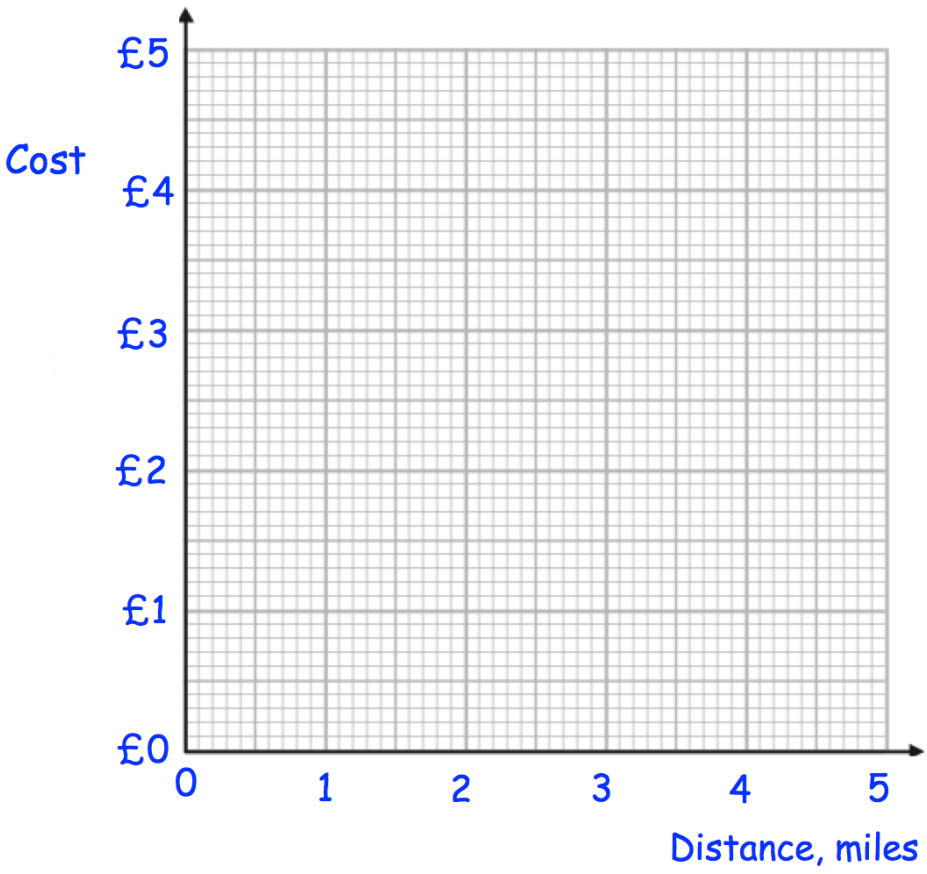


Templates

Question 1(c)

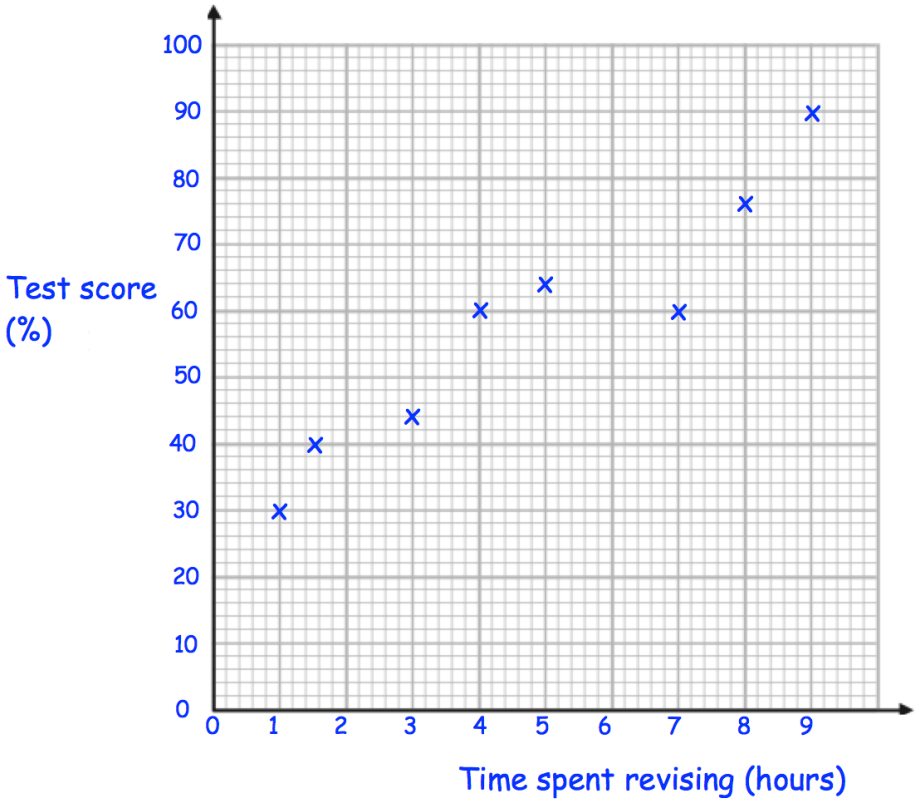


Question 1(d)

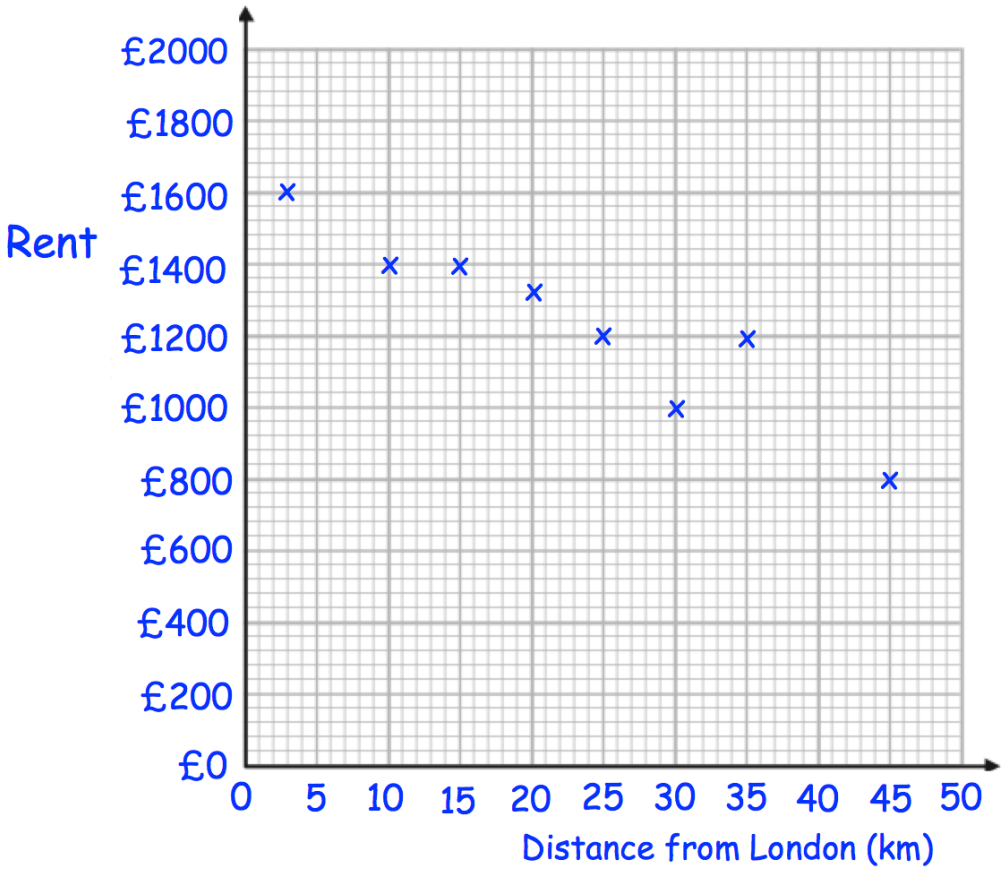


Templates

Apply 1

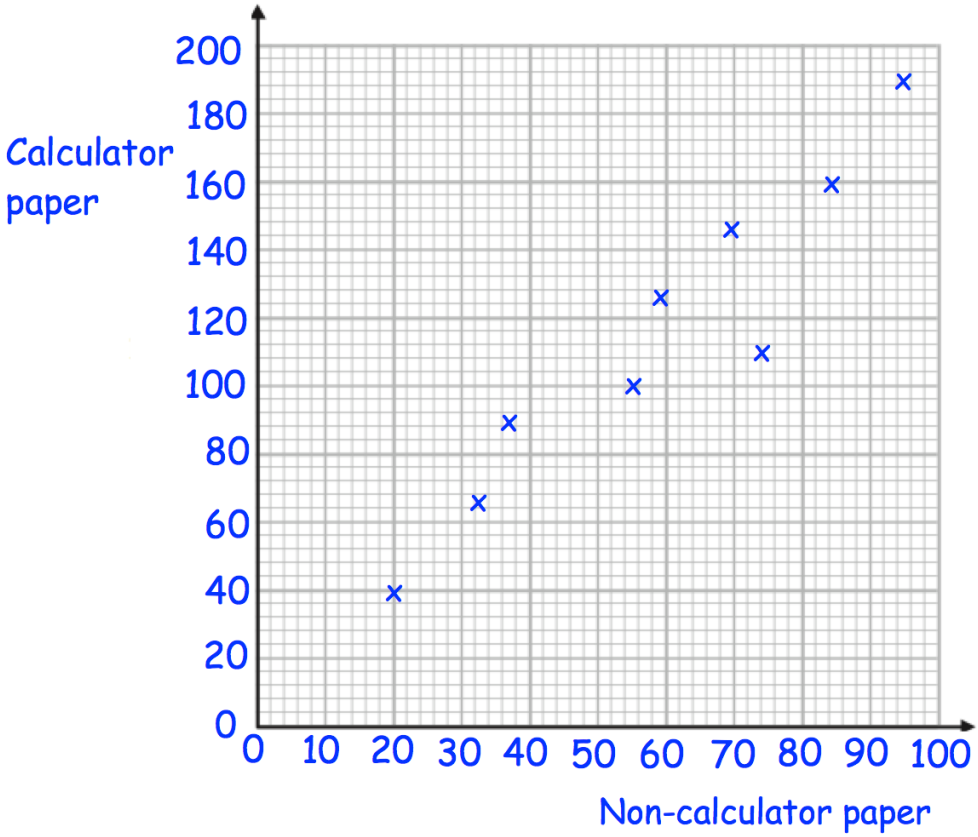


Apply 2



Templates

Apply 3



Apply 4