KING EDWARD VI
HANDSWORTH GRAMMAR
SCHOOL FOR BOYS

KING EDWARD VI
ACADEMY TRUST
BIRMINGHAM

Year 8

2024 Mathematics 2025

Unit 9 Booklet – Part 1

HGS Maths

Tasks

Dr Frost Course

Name: _____

Class: _____

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Unit 9 Booklet – Part 2

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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?	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) 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.	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?

Worked Example	Your Turn
Aditi went on holiday to Turkey. Whilst there, she bought a guitar for 11750 lira. At home in the USA, an identical guitar costs $\$357$. $\$1 = 29.60$ lira Work out how much more expensive the guitar is in Turkey. Give your answer in Turkish lira.	Benicio went on holiday to Brazil. Whilst there, he bought a games console for 4184 real. At home in Ireland, an identical games console costs 726 euros. 1 euro $= 5.24$ real The games console costs more in Brazil. Work out how much more. Give your answer in Brazilian real.

Worked Example	Your Turn
Joe went on holiday to Mexico. Before he left, he exchanged 350 euros for Mexican pesos at a bureau de change. 1 euro $= 18.40$pesos The bureau de change only had 200 peso notes. Joe exchanged as much money as possible. Calculate how much of his 350 euros he exchanged.	Lottie went on holiday to Thailand. When she arrived, she exchanged 740 euros for Thai baht at a post office. 1 euro $= 37.10$ baht The post office only had 500 baht notes. Lottie exchanged as much money as possible. Calculate how much of her 740 euros she exchanged.

Worked Example

Amelia and Catherine live in Scotland. Amelia imports a bottle of moisturiser from Ireland for 7.32 euros. Catherine imports an identical bottle of moisturiser from Denmark for 40 kroner.

£$1 = 1.18$ euros
£$1 = 8.36$ kroner

The bottle of moisturiser costs more in Ireland. Work out how much more. Give your answer in pounds.

Your Turn

Oliver and Tim live in Italy.
Oliver imports a notebook from the USA for $\$2.85$. Tim imports an identical notebook from Malaysia for 10.60 ringgit.

1 euro $= \$1.09$
1 euro $= 5.19$ ringgit

Work out how much more expensive the notebook is in the USA. Give your answer in euros.

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: a) $2, 4, 5, 6, 13$ b) $\frac{1}{6}, \frac{5}{6}, \frac{1}{2}, \frac{2}{3}$	Find the mean of: a) $2, 4, 5, 6, 13, 30$ b) $\frac{1}{2}, \frac{1}{5}, \frac{1}{2}, \frac{1}{4}$

Dr Frost 132a and 168f

2.5 Mixed

Intelligent Practice

Data	Mean	Median	Mode	Range
2, 2, 4, 5, 7				
2, 2, 4, 5, 12				
3, 3, 5, 6, 13				
6, 6, 10, 12, 26				
6, 6, 10, 18, 20				
6, 6, 13, 15, 20				
6, 6, 13, 15, 20, 24				
0, 6, 6, 13, 15, 20, 24				

Fluency Practice

Data	Mean	Median	Mode	Range
$1, 2, 3, 4, 5$				
$10, 20, 30, 40, 50$				
$0.1, 0.2, 0.3, 0.4, 0.5$				
$-1, -2, -3, -4, -5$				
$1a, 2a, 3a, 4a, 5a$				
$£1, £2, £3, £4, £5$				
$5, 2, 1, 4, 3$				
$2, 3, 4, 5, 6$				
$1, 2, 3, 4, 10$				
$0, 3, 3, 4, 5$				
$0, 0, 6, 4, 5$				
$-3, -2, -1, 0, 1, 2, 3$				
$1, 2, 3, 4, 500$				
$0, 1, 2, 3, 4, 5$				
$0, 0, 1, 2, 3, 4, 5$				
$1, 2, 3, 4, 5, 6$				
$0.4, 2.1, 0.9, 1.7, 2.9$				
$\frac{1}{2}, \frac{1}{5}, \frac{1}{10}$				
$4x, 2x, 7x, 3x, 9x$				
$3a + b, b, 6a$				

Fill in the Gaps

Data Set						Mode	Median	Range	Mean
2	3	3	3	4		3	3	2	3
2	2	3	4	5					3.1
4	4	6	8	10		4			
4	5	6	7	8					
6	6	6	6	6					
6	6	6	6	7					
−4	−2	−2	0	8					
0.6	0.6	0.8	0.8	1					
2	2	4	5	6	8				
−3	1	5	8	8	11				
8	2	5	9	5	10				
5.3	2.9	2.3	3.5	6.7	1.1				
5	7	7					7	6	
3	6	4							4
						8	8	10	7
						10	7	8	6.5
16	10	13				16	14		
						2	3	13	5.4
						7	4	10	3

2.6 Determining List of Numbers

Worked Example	Your Turn
Four integers have a mean of 2, median of 2, mode of 2 and a range of 4. Find the four integers.	Four integers have a mean of 7, median of 8, mode of 8 and a range of 6. Work out the four integers.

2.7 Using Totals

Worked Example	Your Turn
19 climbing ropes have an average length of 60 m. Calculate their total length.	7 climbing ropes have an average length of 61 m. Calculate their total length.

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?

2.8 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.

2.9 Comparing Data

Worked Example

Kathryn 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.

2.10 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

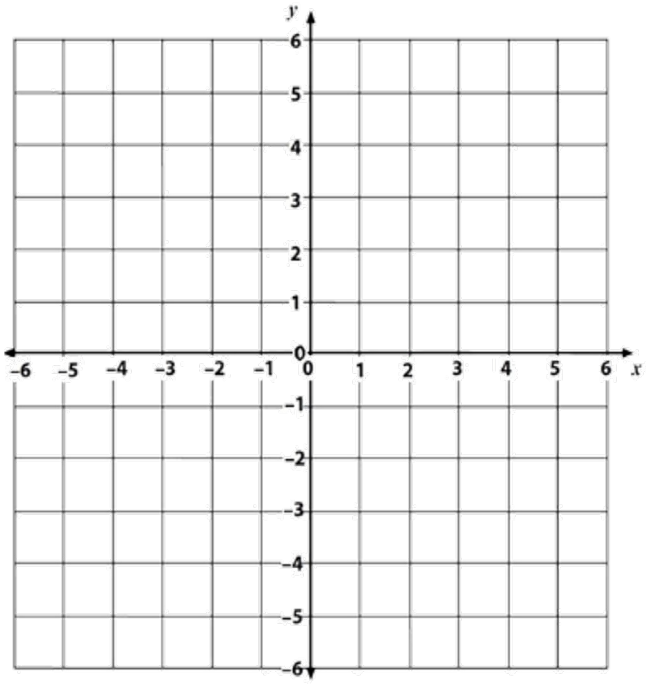
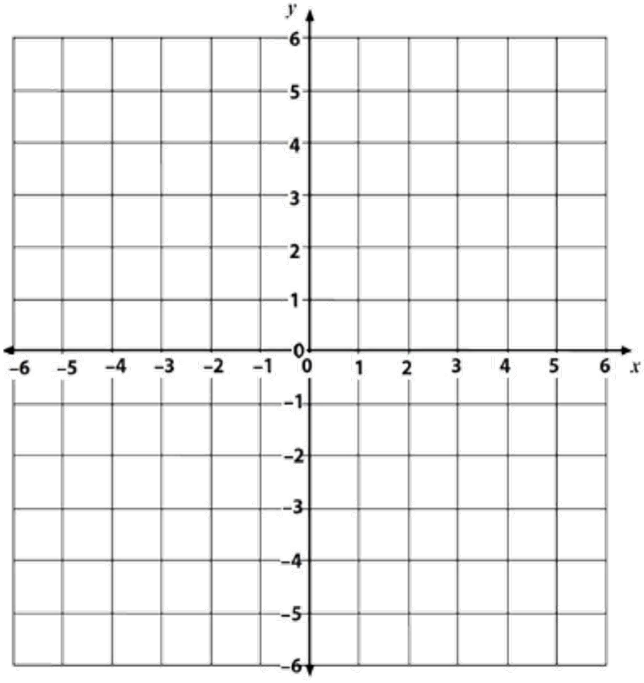
David keeps a record of the number of carrier bags that he is given when he does his weekly shopping. The data he collects over 10 weeks is listed below:

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

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: $A\ (2, 5)$ $B\ (2, -5)$ $C\ (-2, 5)$ $D\ (-2, -5)$ 	Plot the coordinates: $A\ (3, 4)$ $B\ (3, -4)$ $C\ (-3, 4)$ $D\ (-3, -4)$ 

3.2 Reading Coordinates

Fluency Practice

learn by heart

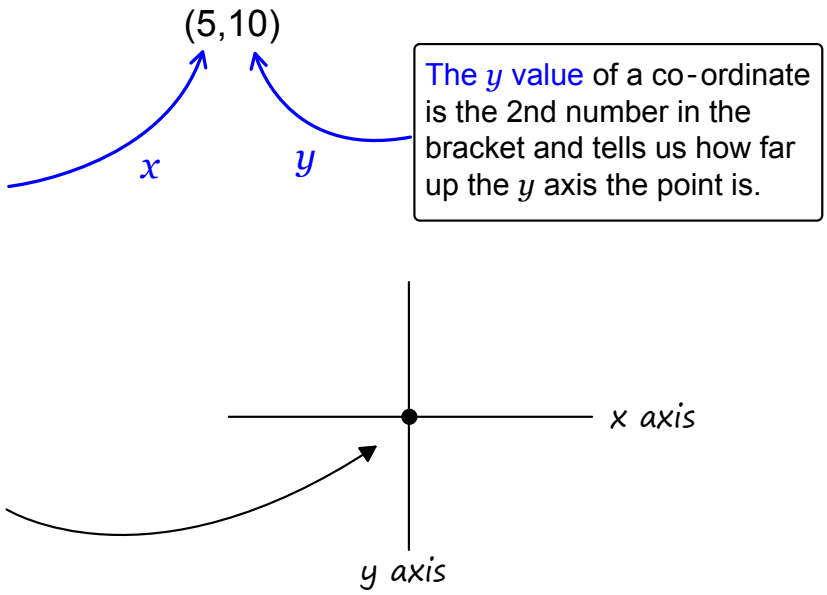
Co-ordinates are written (x, y)

The x value of a co-ordinate is the first number in the bracket and tells us how far along the x axis the point is.

The x axis is horizontal

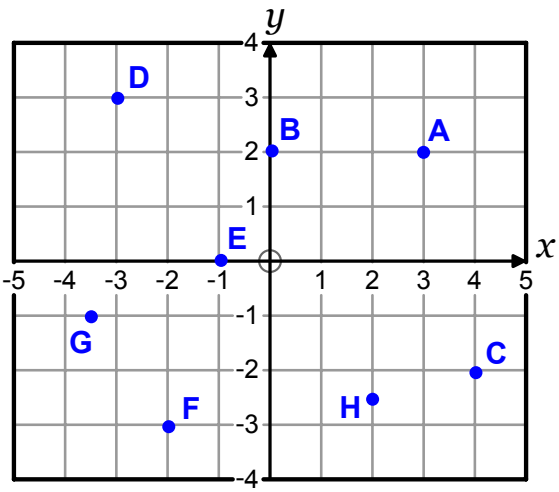
The y axis is vertical

The **origin** is the point (0, 0)



exercise 7b

1. State the coordinates of each point on the grid.



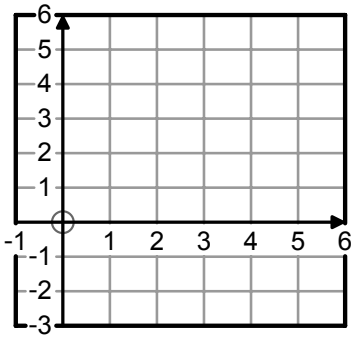
A (,) **B** (,)

C (,) **D** (,)

E (,) **F** (,)

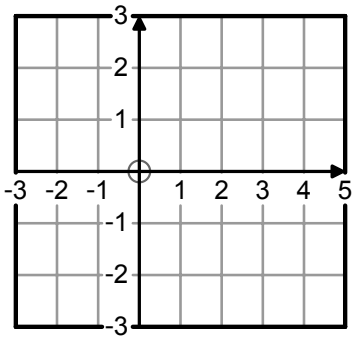
G (,) **H** (,)

2. a) On the grid, plot the points (0,3), (5,5) and (5,1).



b) Join up your points.
What type of triangle does it make?

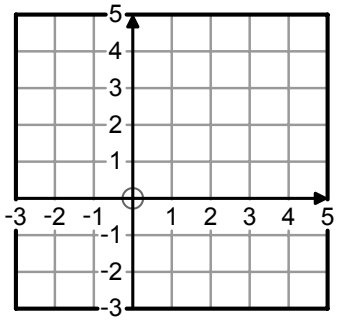
3. a) On the grid, plot the points (-2,2), (4,-1) and (-2,-1).



b) Join up your points.
What type of triangle does it make?

Fluency Practice

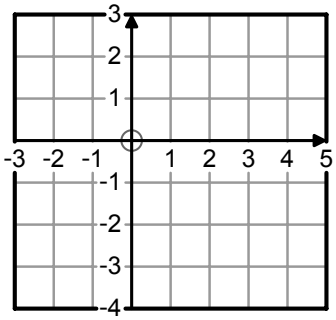
4. a) On the grid, plot the points (2,4), (4, -1), (2, -2) and (0,-1).



b) Join up your points.
What shape does it make?

kite | trapezium | square

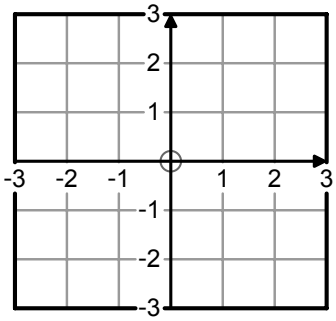
5. a) On the grid, plot the points (-2,0), (1, 2), (4,0) and (1, -2)



b) Join up your points.
What shape does it make?

rectangle | rhombus | square

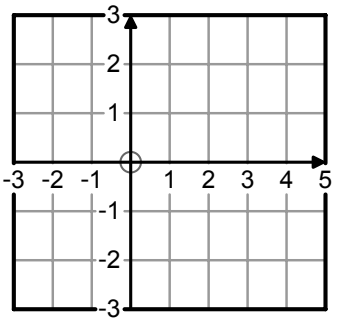
6. a) On the grid, plot the points (-2,-1), (-1,2), (1,2) and (2,-1).



b) Join up your points.
What shape does it make?

rectangle | trapezium | kite

7. a) On the grid, plot the points (-2,-1), (1,-1), (3,2) and (0,2)

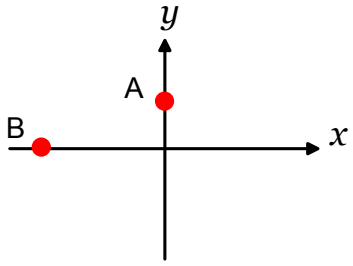


b) Join up your points.
What shape does it make?

parallelogram | rhombus | kite

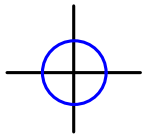
8. The grid shows two of the co-ordinates listed below.
Can you work out which two?

(-2, 3) | (0, 2) | (0,-2) | (2, 0) | (2, 3) | (-8,0)



Point A = _____ Point B = _____

9. A circle is drawn with its centre on the origin.
The circle has a diameter of 12 units.
Which of these points will lie on the circumference of the circle?



a) (12, 0) b) (0, 12) c) (6, 0) d) (6, 6)

Fluency Practice

learn by heart

Co-ordinates are written (x,y). The first numbers in the pair is the x-value, the second number is the y-value.

example

Which co-ordinate has an x value of -5?
A) (4,-5) B)(5,-5) C) (-5,5) D) (5,5)

The x value is the first number, so the answer is C.

exercise 7c

1. Fill in the table:

Co-ordinate	(5,2)	(-3,5)	(0,2)	(-2,0)	(0, 2.5)
x value					
y value					

2. Which of these co-ordinates has a y-value of -3? Select 2 answers.

   a) (0, 3) b) (3, 0) c) (-3, 0) d) (0, -3) e) (3, -3)

3. Which co-ordinate has an x-value of -2?

   a) (-2, 2) b) (2, -2) c) (0, 2) d) (0, -2)

4. Which of these co-ordinates have $\boldsymbol{x = 3}$? Circle all that apply.

   a) (-4,3) b) (3,1) c) (-3,1) d) (3,-3)

5. In which co-ordinates below is x a negative number? Choose 2 answers.

   a) (-5, 10) b) (5, -10) c) (5, 10) d) (-10, 5)

6. For which of the co-ordinates below does $x = y$? Choose 2 answers:

   a) (-3, -3) b) (-3, 3) c) (0, 0) d) (-3, 0) e) (0, 3)

7. Circle the co-ordinates below where $x + y = 10$.

   a) (4,5) b) (3,7) c) (-2,12) d) (-1,9)

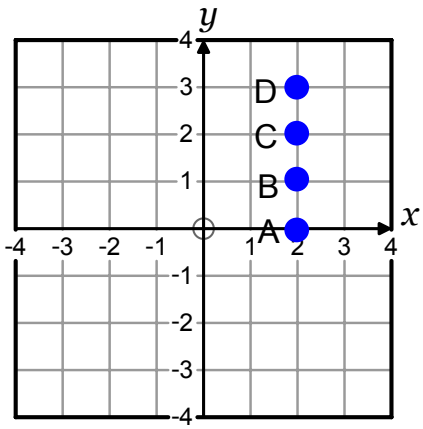
8. In which co-ordinates below is $x < 0$? Circle all that apply.

   a) (-5, 10) b) (5, -10) c) (5, 10) d) (-10, 5)

9. Write down the co-ordinate with an x value of 6 and a y value of -3.

Fluency Practice

10. Write down the co-ordinates of the points on this grid. What do they have in common?



A = (,)

B = (,)

C = (,)

D = (,)

11. True or false?

a) The co-ordinate (3,-4) has a positive x value.

b) The co-ordinate (0,-4) is below the x axis.

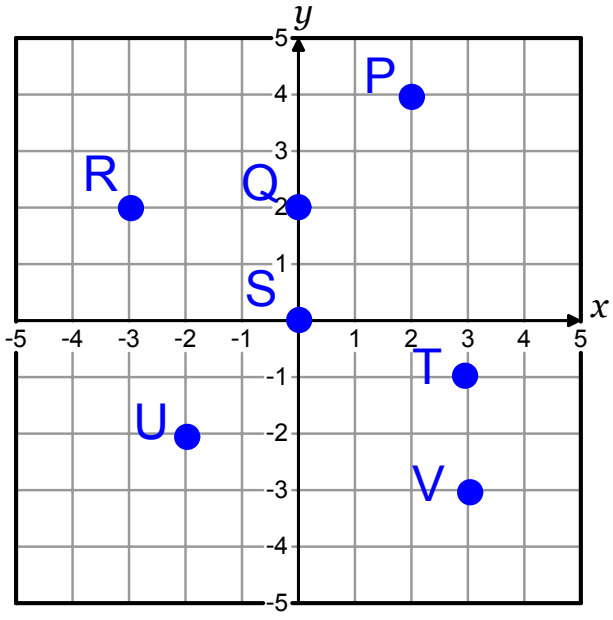
c) For the co-ordinate (-2,6), $x = 6$.

d) For the co-ordinate (-2,0), $y = 0$

e) A co-ordinate can not be a decimal

f) The co-ordinate (0,-2) has a negative y value

12. Seven points are shown on the coordinate grid.



Decide which points follow each rule:

a) $x = 3$

b) $y = x$

c) $y = 2$

d) $y = -x$

e) $y > 2$

f) $x \leq -1$

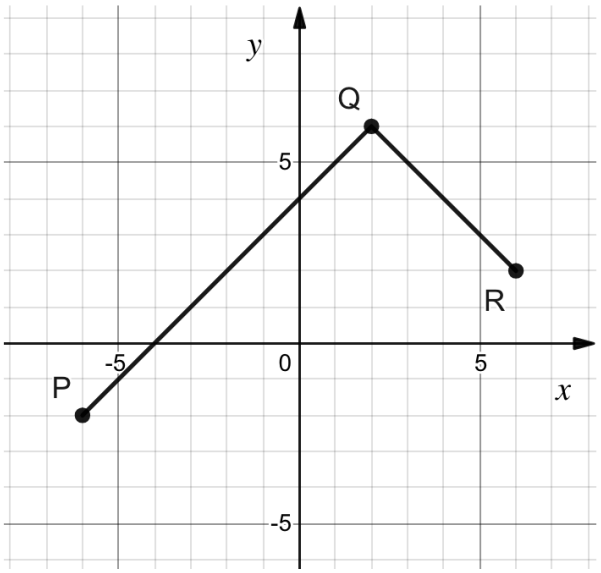
g) $x + y = 2$

h) $x = 0$

3.3 Coordinates with Shapes

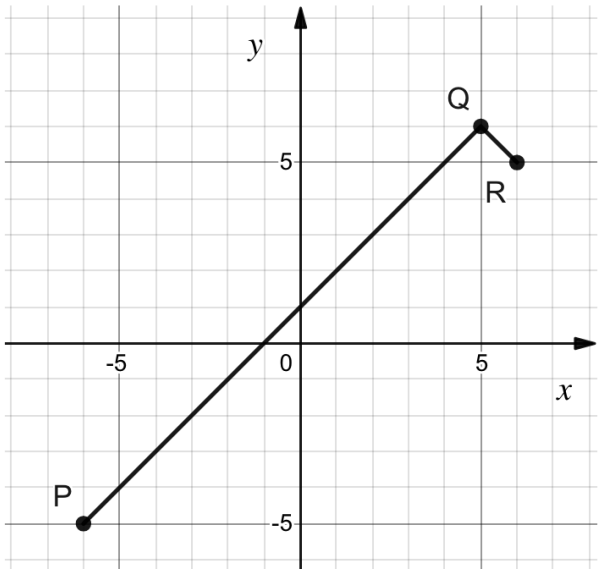
Worked Example

The diagram shows points P, Q and R on a square grid. On the grid, mark the point S so that $PQRS$ is a rectangle.



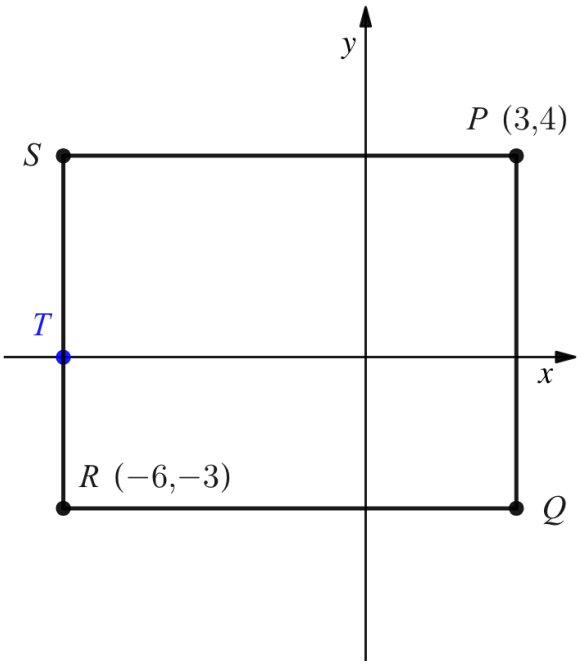
Your Turn

The diagram shows points P, Q and R on a square grid. On the grid, mark the point S so that $PQRS$ is a rectangle.



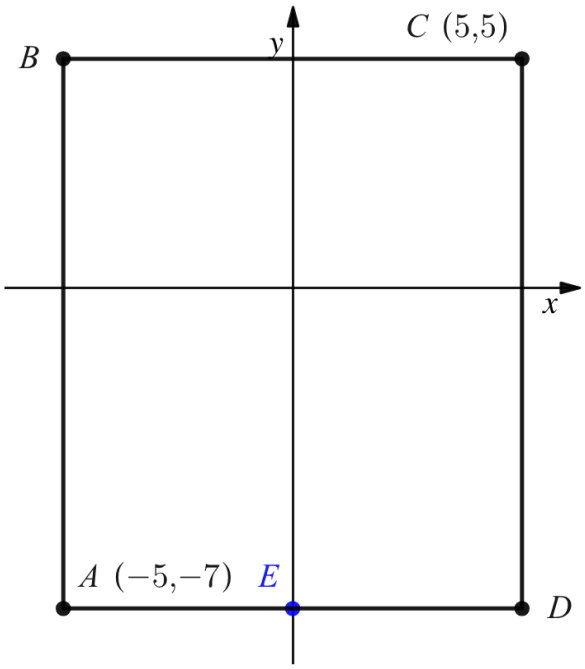
Worked Example

$PQRS$ is a rectangle. The sides of the rectangle are parallel to the axes. Find the coordinates of point T.



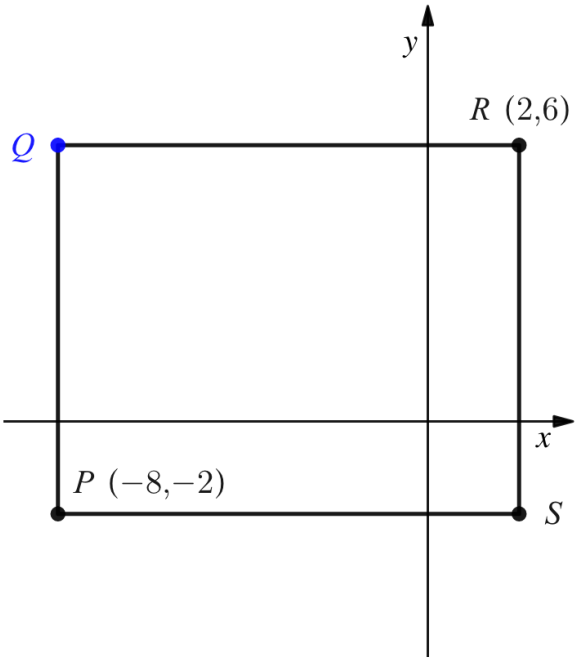
Your Turn

$ABCD$ is a rectangle. The sides of the rectangle are parallel to the axes. Find the coordinates of point E.



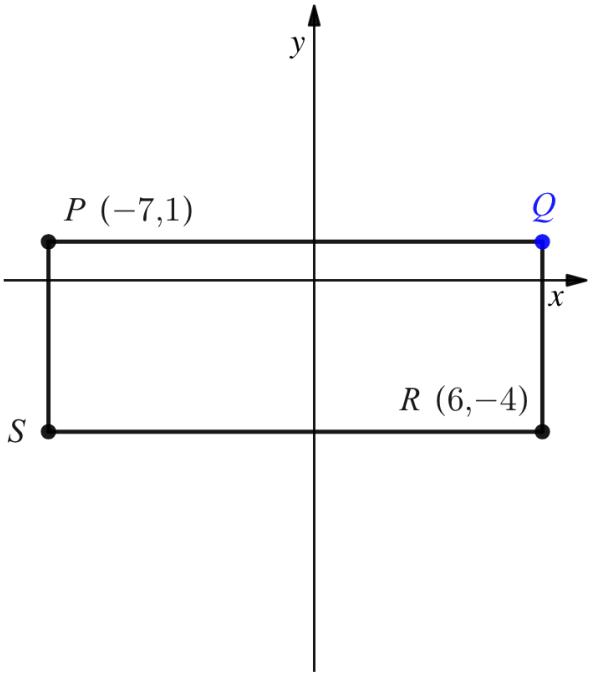
Worked Example

$PQRS$ is a rectangle. The sides of the rectangle are parallel to the axes. Find the coordinates of point Q.



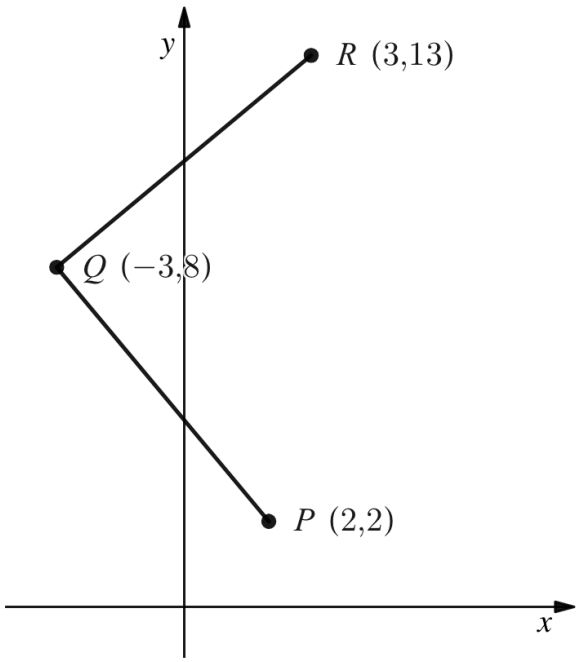
Your Turn

$PQRS$ is a rectangle. The sides of the rectangle are parallel to the axes. Find the coordinates of point Q.



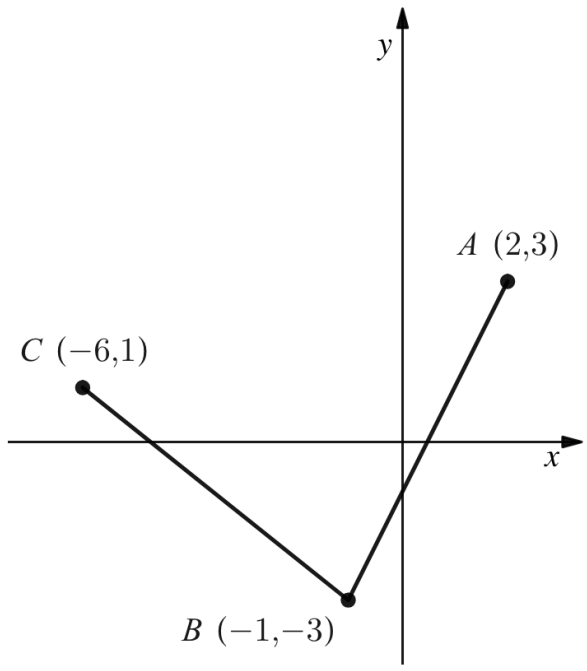
Worked Example

The diagram shows points P, Q and R on a coordinate grid. Find the coordinates of point S so that $PQRS$ is a square.



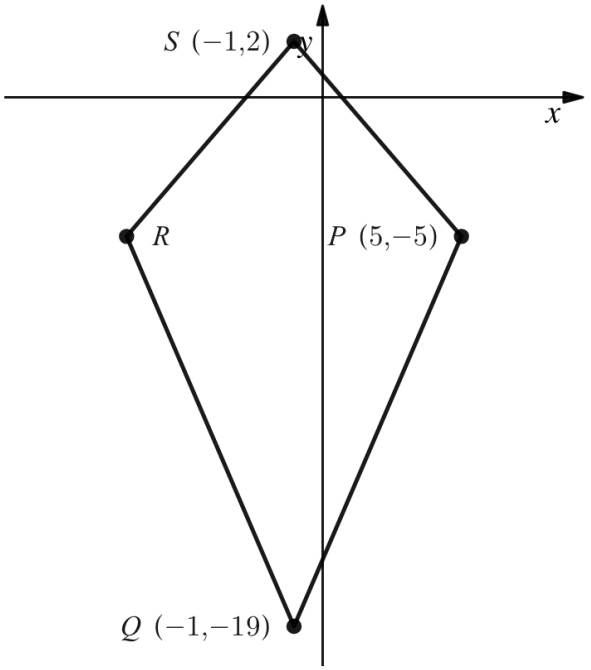
Your Turn

The diagram shows points A, B and C on a coordinate grid. Find the coordinates of point D so that $ABCD$ is a parallelogram.



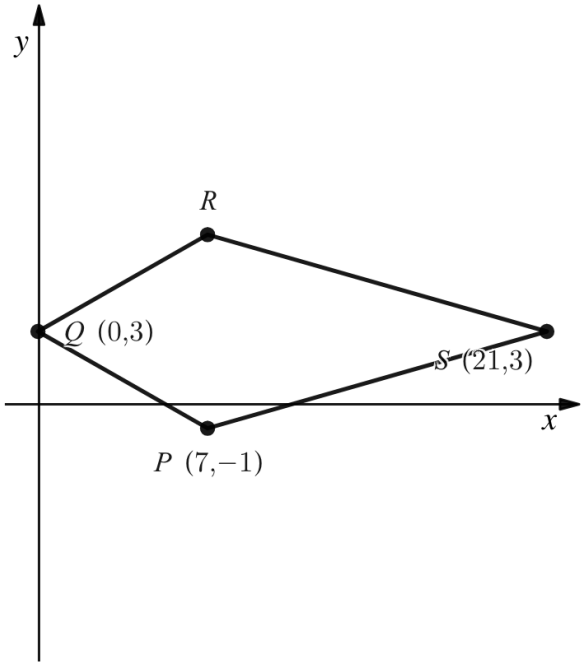
Worked Example

$PQRS$ is a kite. Find the coordinates of point R.



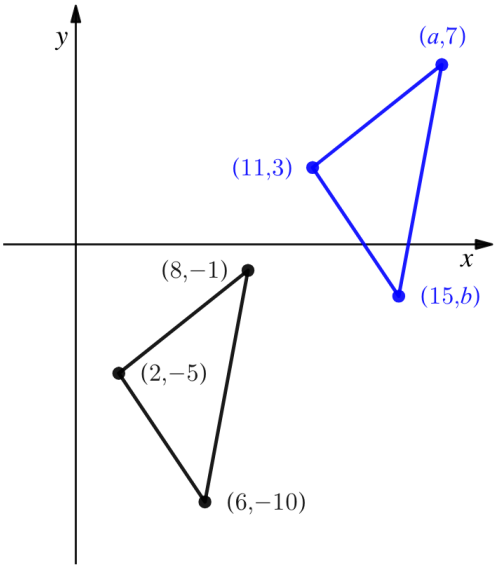
Your Turn

$PQRS$ is a kite. Find the coordinates of point R.



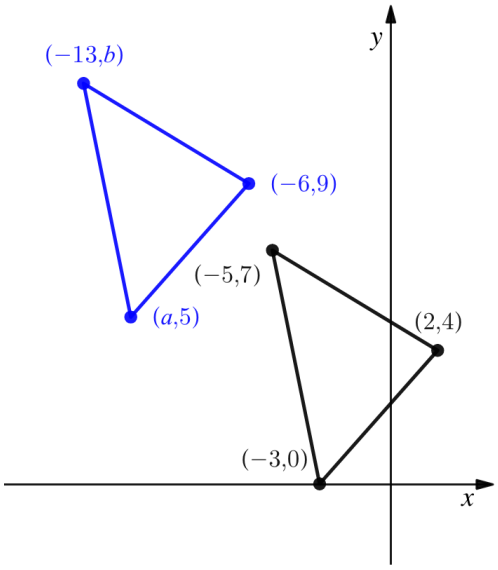
Worked Example

The diagram shows two identical triangles on coordinate axes. Find the value of a and the value of b.



Your Turn

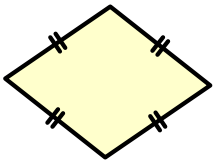
The diagram shows two identical triangles on coordinate axes. Find the value of a and the value of b.



Fluency Practice

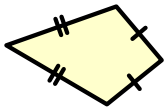
recall

Rhombus



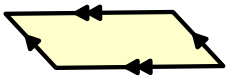
Four equal sides

Kite



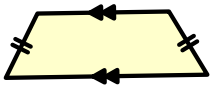
Two pairs of equal sides

Parallelogram



Opposite sides parallel

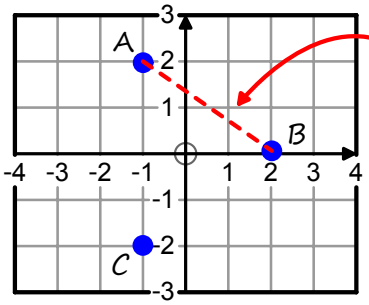
Isosceles Trapezium



One pair of parallel sides, other pair equal length

example

Plot point D so that ABCD is a rhombus.



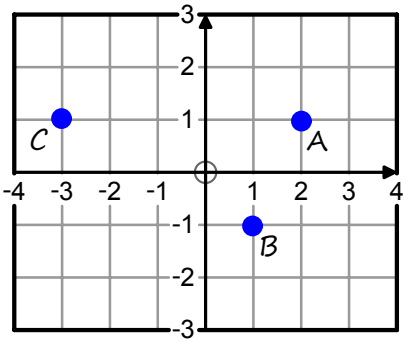
We can think of this distance as 3 across (horizontal) and 2 down (vertical).

To be a rhombus, all the sides must follow this same journey – 3 horizontally and 2 vertically. This will make the sides the same length.

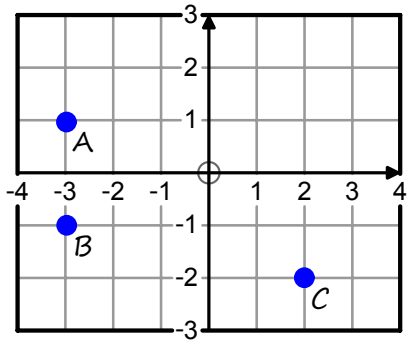
So point D must be at (-4,0).

exercise 7e

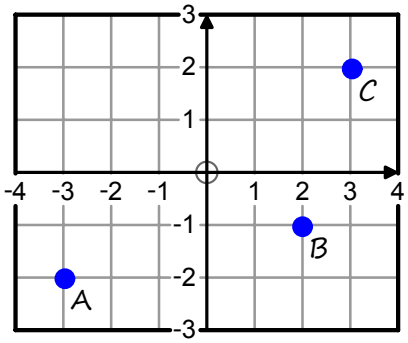
1. Plot point D so that ABCD is a kite. Join up your points.



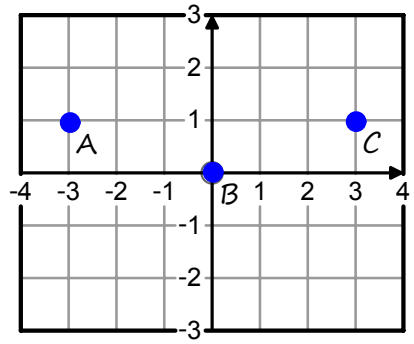
2. Plot point D so that ABCD is an isosceles trapezium. Join your points.



3. Plot point D so that ABCD is a parallelogram. Join up your points.

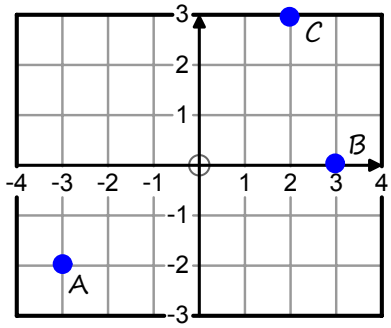


4. Plot point D so that ABCD is a rhombus. Join up your points.

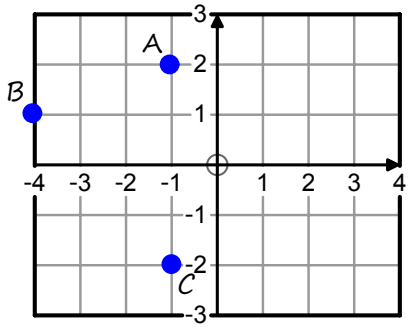


Fluency Practice

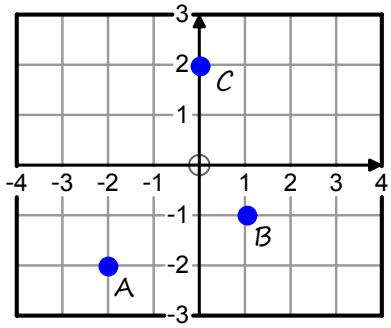
5. Plot point D so that ABCD is a rectangle. Join up your points.



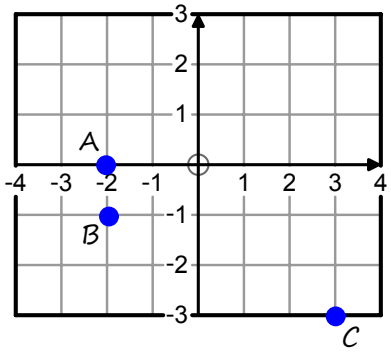
6. Plot point D so that ABCD is a kite. Join up your points.



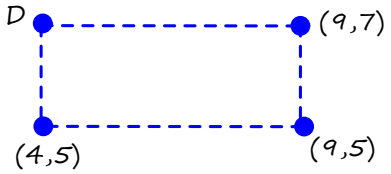
7. Plot point D so that ABCD is a square. Join up your points.



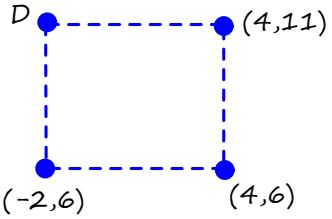
8. Plot point D so that ABCD is an isosceles trapezium. Join your points.



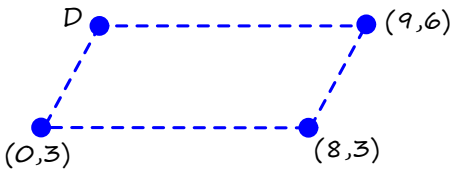
9. The diagram shows three corners of a rectangle. What would be the co-ordinate of point D, the 4th corner?



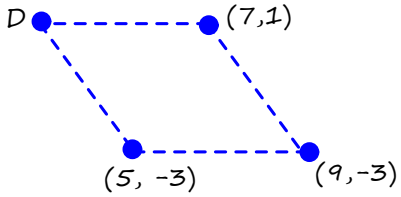
10. The diagram shows three corners of a rectangle. What would be the co-ordinate of point D, the 4th corner?



11. The diagram shows three corners of a parallelogram. What would be the co-ordinate of point D, the 4th corner?



12. The diagram shows three corners of a parallelogram. What would be the co-ordinate of point D, the 4th corner?



Fluency Practice

13. If the points (-6, 0), (-6, 2) and (4, 2) are 3 corners of a rectangle, what is the co-ordinate of the 4th corner?

a) (6, 2) b) (6, -2) c) (4, -2) d) (0, 4) e) (4, 0)

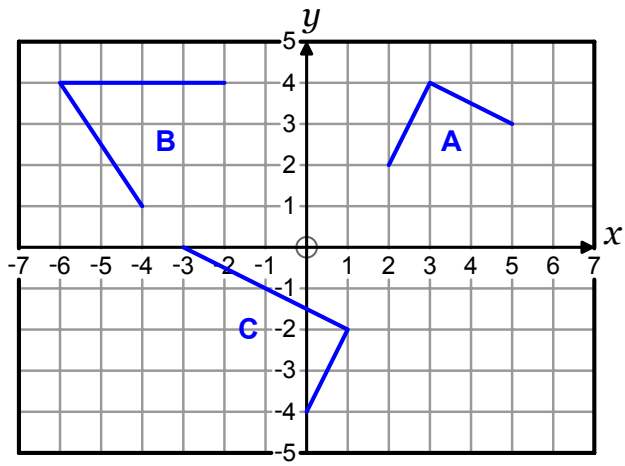
14. Each quadrilateral has two sides shown on the grid.

Complete the shapes and give the coordinates of the fourth vertex of each shape.

A Square (,)

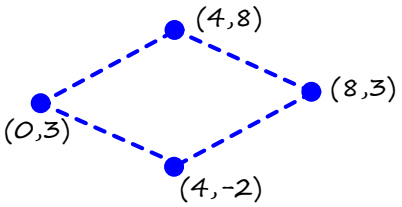
B Parallelogram (,)

C Rectangle (,)



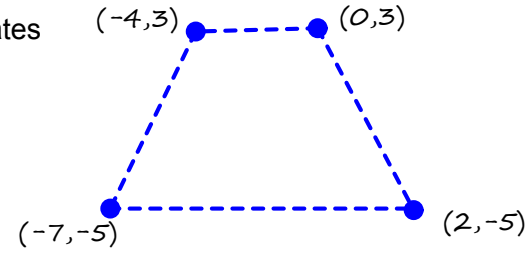
15. The diagram shows the co-ordinates of the corners of a quadrilateral (not drawn accurately).

Is this quadrilateral a **rhombus**? Explain your answer.



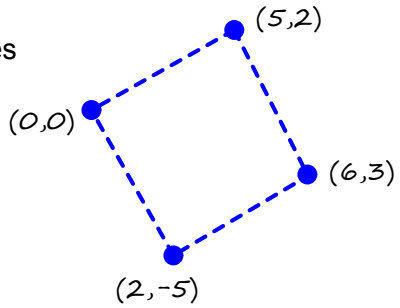
16. The diagram shows the co-ordinates of the corners of a quadrilateral (not drawn accurately).

Is this quadrilateral an **isosceles trapezium**? Explain your answer.



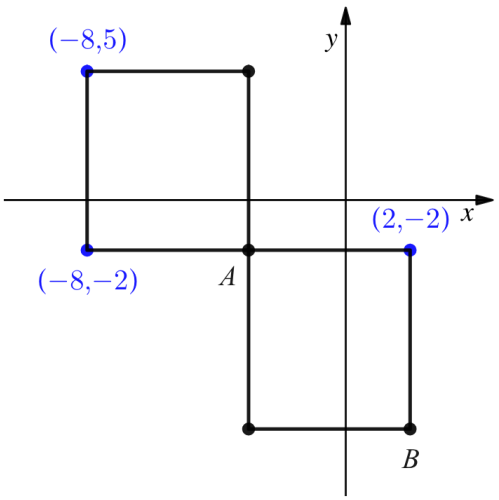
17. The diagram shows the co-ordinates of the corners of a quadrilateral (not drawn accurately).

Is this quadrilateral a **square**? Explain your answer.



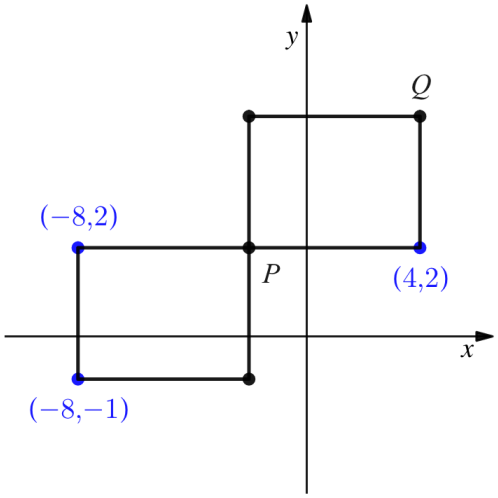
Worked Example

The diagram shows two identical rectangles on coordinate axes. Find the coordinates of point A.



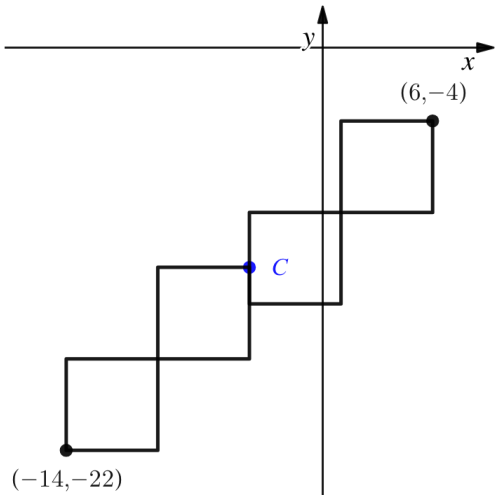
Your Turn

The diagram shows two identical rectangles on coordinate axes. Find the coordinates of point P.



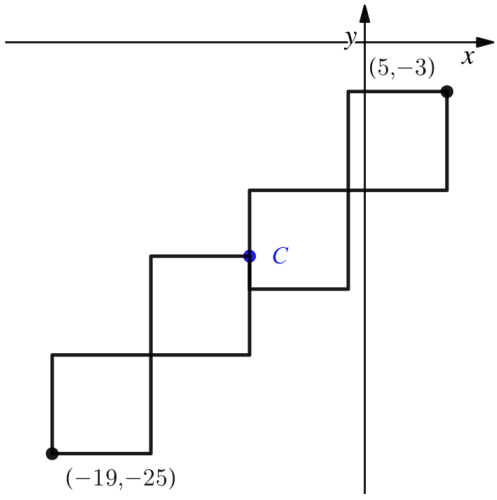
Worked Example

A pattern is made from identical squares. The sides of the squares are parallel to the axes. Find the coordinates of point C.



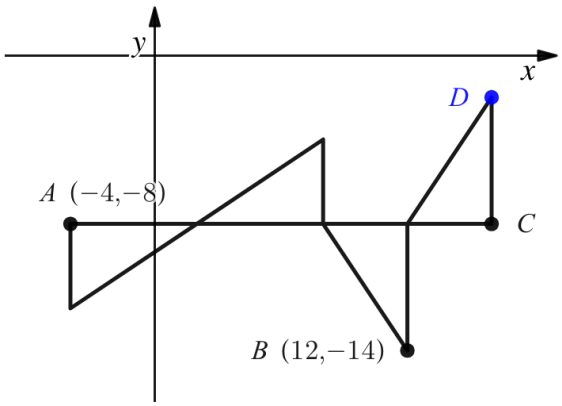
Your Turn

A pattern is made from identical squares. The sides of the squares are parallel to the axes. Find the coordinates of point C.



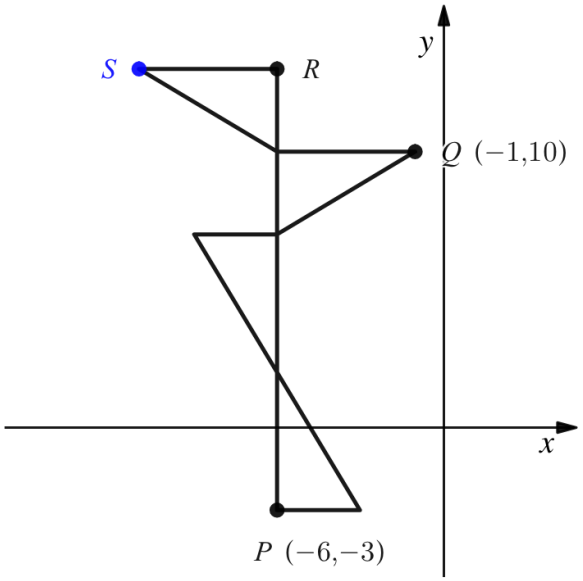
Worked Example

A pattern is made from identical triangles. The line AC is parallel to the x axis. Find the coordinates of point D.



Your Turn

A pattern is made from identical triangles. The line PR is parallel to the y axis. Find the coordinates of point S.

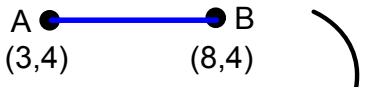


Fluency Practice

learn by heart

We can find the horizontal distance between two points by looking at the difference in their x co-ordinates.

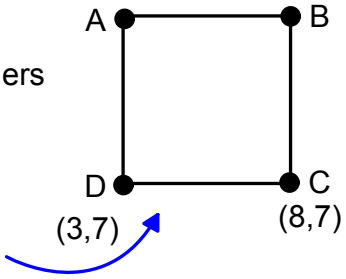
We can find the vertical distance between two points by looking at the difference in their y co-ordinates.



The horizontal distance between these points is 5 units (8 – 3 = 5)

examples

Work out the co-ordinates of A and B for the corners of this **square.**

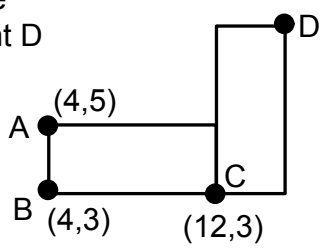


Side DC must be 5 units long because D is 3 along, but C is 8 along (8 – 3 = 5)

Therefore all sides are 5 units, so we need to go up 5 units from a height of 7.

So A = (3, 12) and B = (8, 12)

Two **identical** rectangles are shown. Work out the co-ordinates of point D



AB = 2 units
BC = 8 units
Each rectangle is 2 by 8

So we need to along 2 units from C and then up 8 units, so point D is (14,11)

exercise 7d

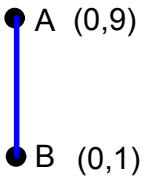
1. Work out the distance AB in each diagram:

a)

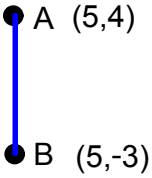
b)

c)

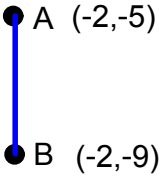
d)



e)



f)

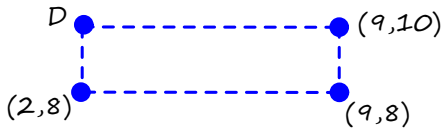


2. What is the distance between (-4,5) and (6,5)?

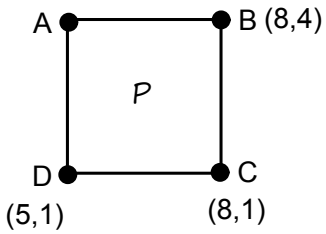
3. What is the distance between (-5,2) and (-5,-15)?

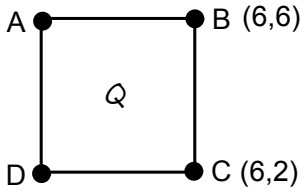
Fluency Practice

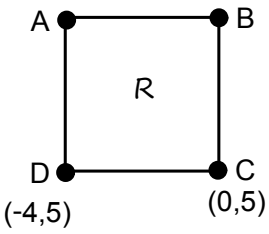
4. The diagram shows a rectangle.
Work out the co-ordinates of point D.

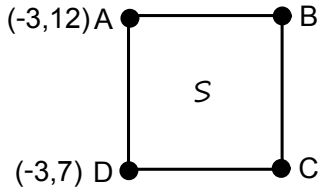


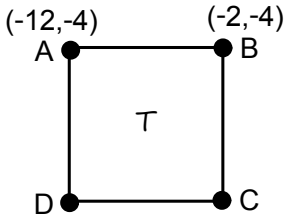
5. Work out the missing co-ordinates in each square:

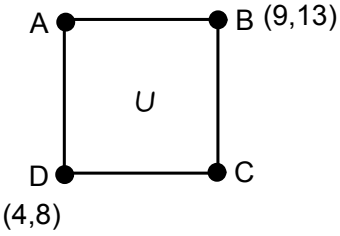




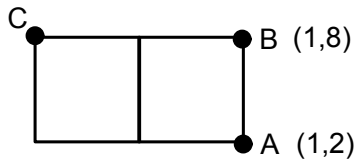




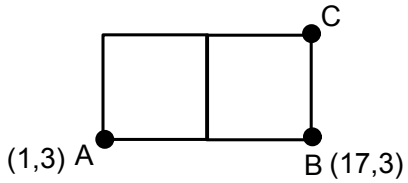




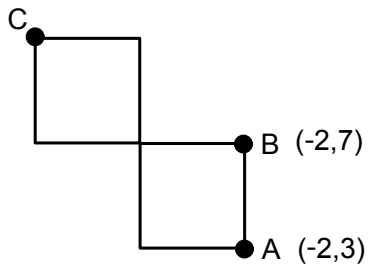
6. The diagram shows two identical squares. Work out the co-ordinates of point C.



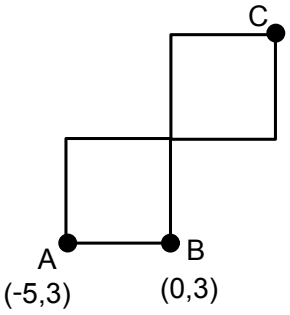
7. The diagram shows two identical squares. Work out the co-ordinates of point C.



8. The diagram shows two identical squares. Work out the co-ordinates of point C.

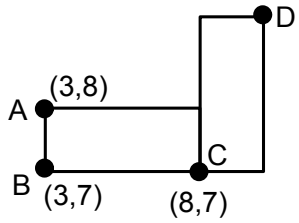


9. The diagram shows two identical squares. Work out the co-ordinates of point C.

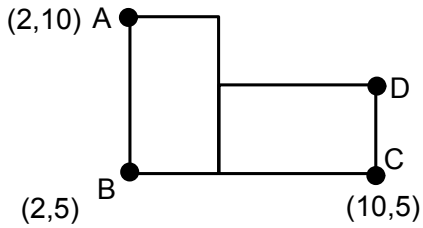


Fluency Practice

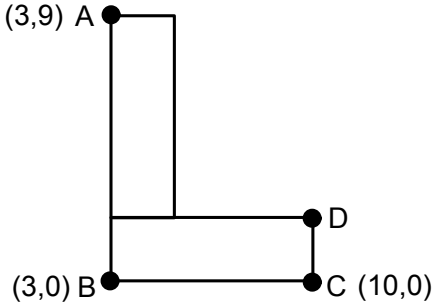
10. The diagram shows two **identical** rectangles. Work out the co-ordinates of point D.



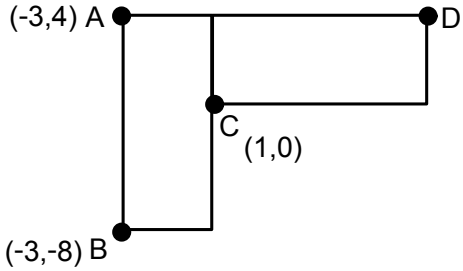
11. The diagram shows two **identical** rectangles. Work out the co-ordinates of point D.



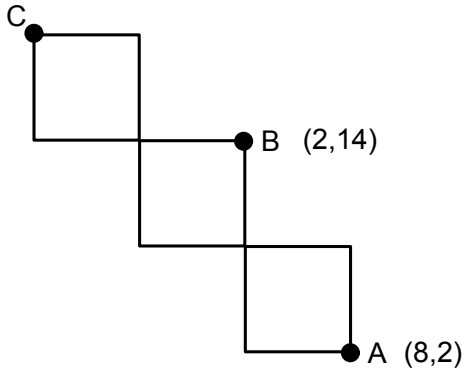
12. The diagram shows two **identical** rectangles. Work out the co-ordinates of point D.



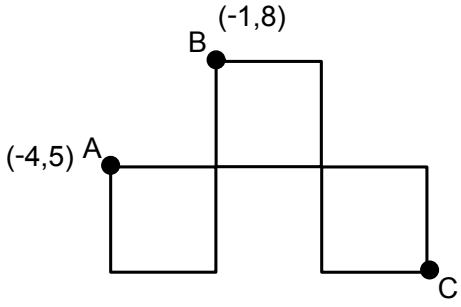
13. The diagram shows two **identical** rectangles. Work out the co-ordinates of point D.



14. The diagram shows **three identical squares.** Work out the co-ordinates of point C.



15. The diagram shows **three identical squares**. Work out the co-ordinates of point C.



16. Three vertices of a square have co-ordinates (7,2), (10,2) and (10,5). What is the fourth co-ordinate?

17. Opposite vertices of a square have co-ordinates (8,3) and (3,-2). What are the other two co-ordinates?

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

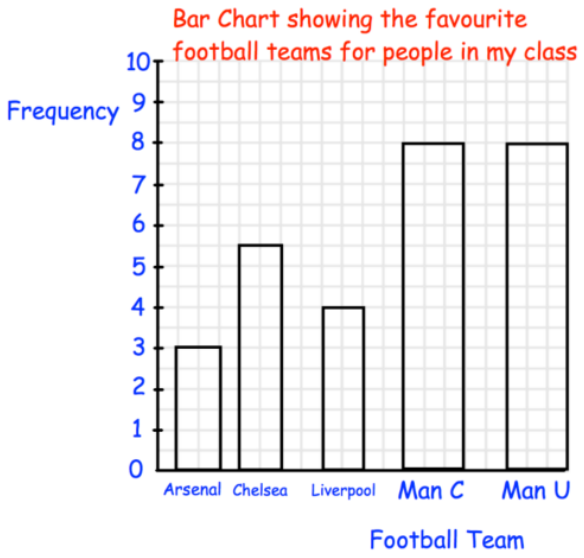
Draw a bar chart for the data:

Colour	Frequency
Blue	15
Green	8
Red	21
Yellow	3

Worked Example

Spot the mistakes in the bar chart:

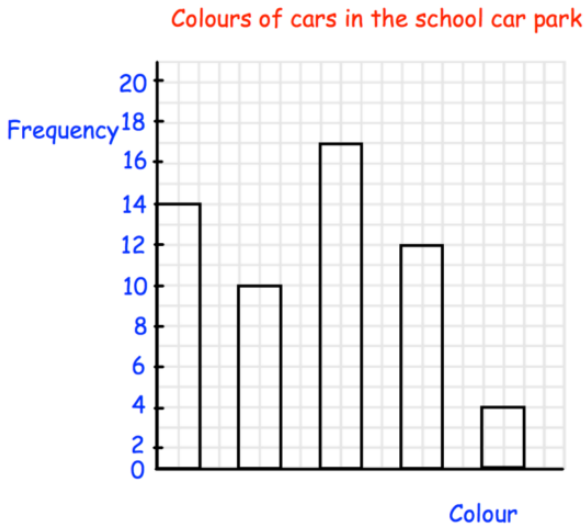
Football Team	Frequency
Arsenal	3
Chelsea	5
Liverpool	4
Man City	8
Man United	8



Your Turn

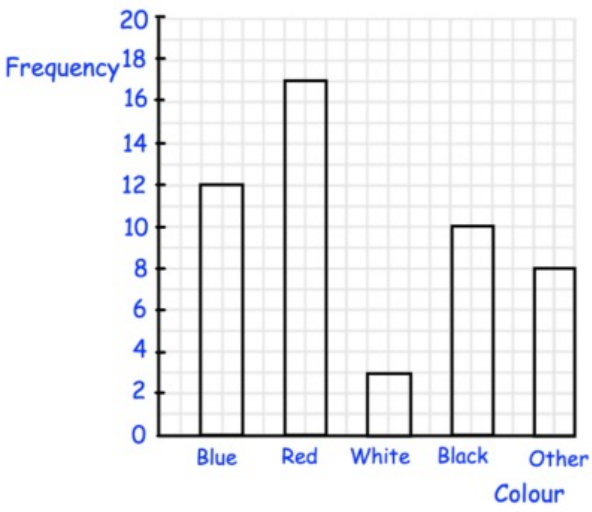
Spot the mistakes in the bar chart:

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



Worked Example

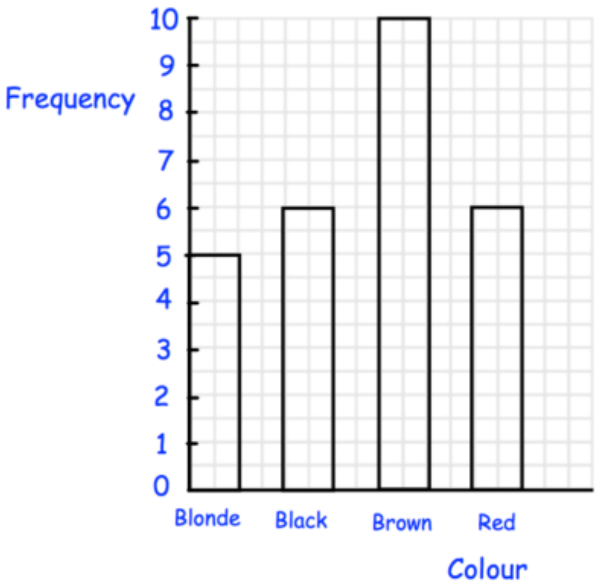
The bar chart shows the colour of cars in a car park:



- 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

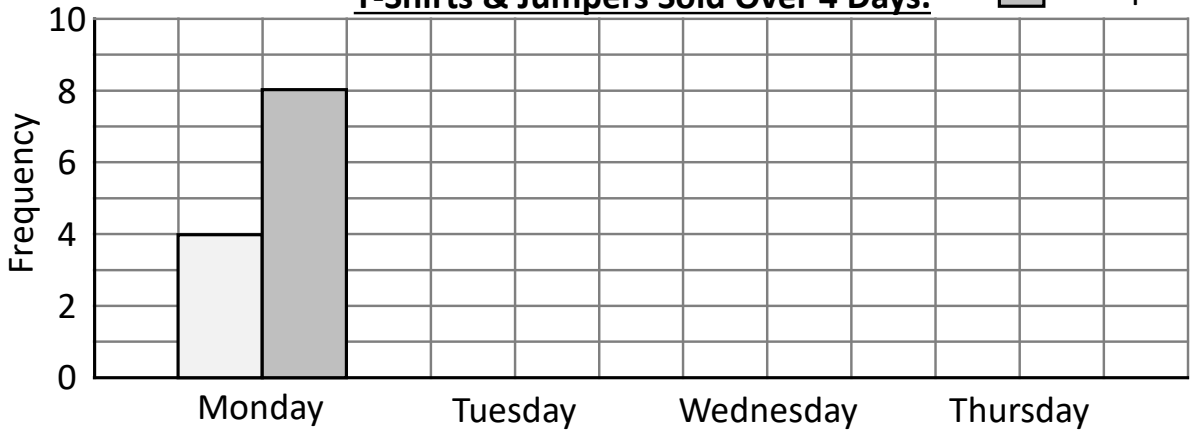
Dual Bar Charts: Drawing

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

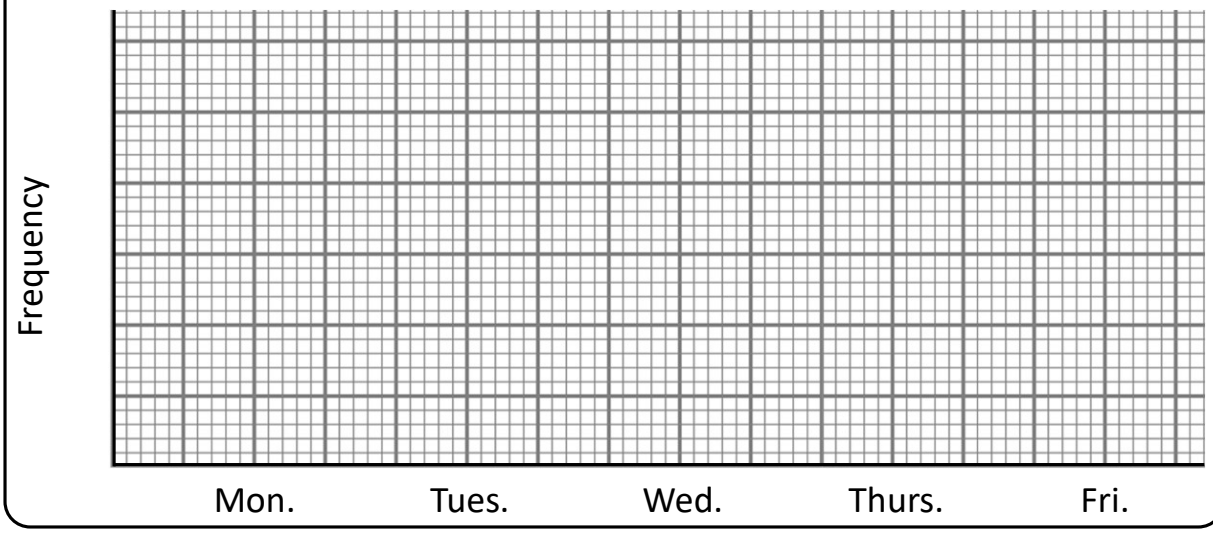
Key
T-shirts
Jumpers

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.

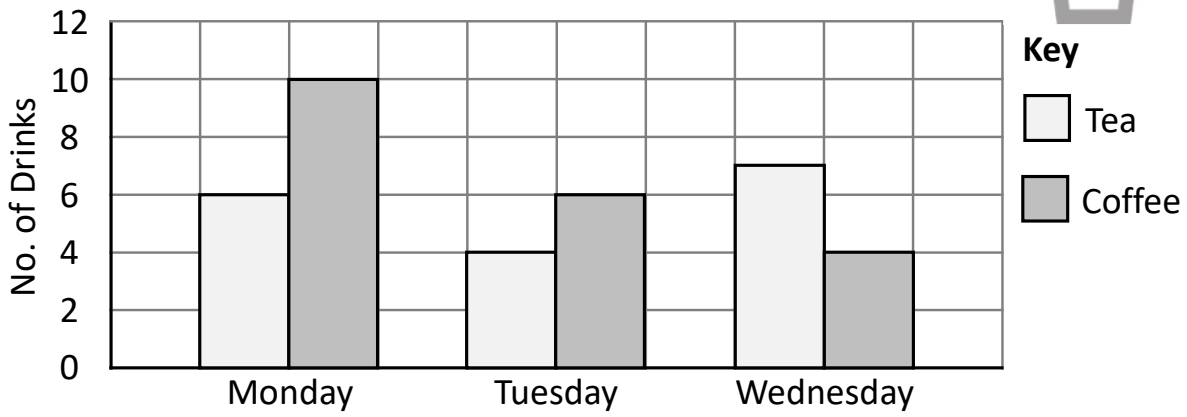
	Mon.	Tue.	Wed.	Thurs.	Fri.
Hoodies	20	10	0	14	26
Jeans	15	25	12	23	18



Fluency Practice

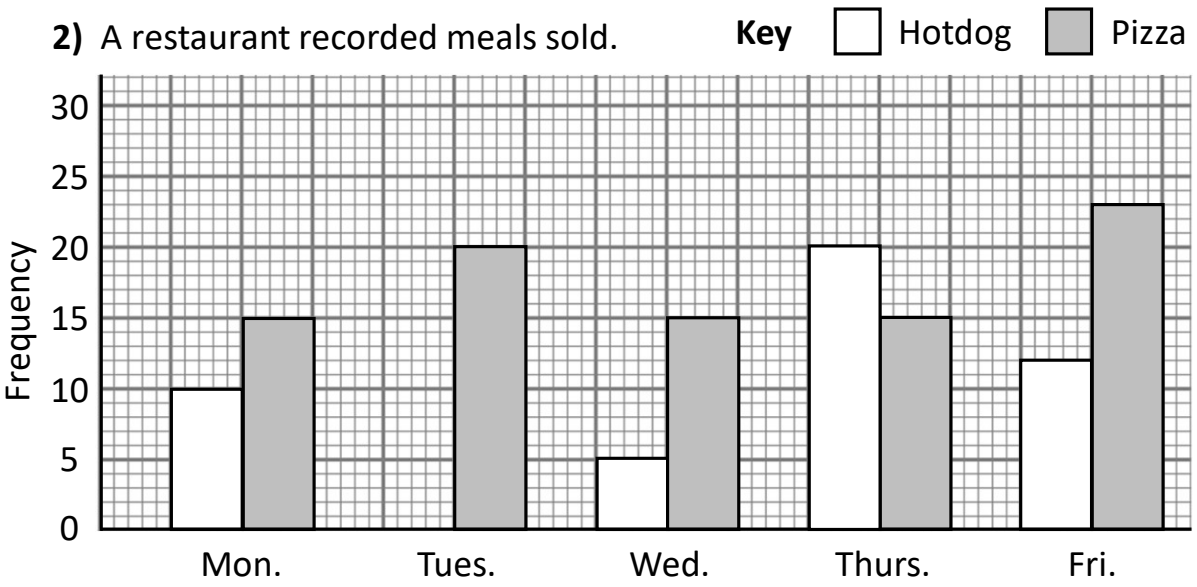
Dual Bar Charts: Reading

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

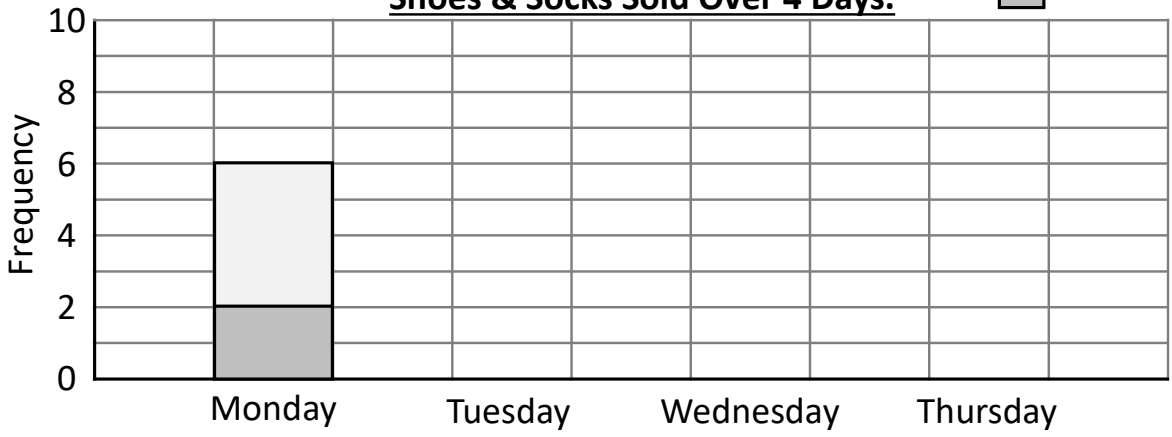
Composite Bar Charts: Drawing

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

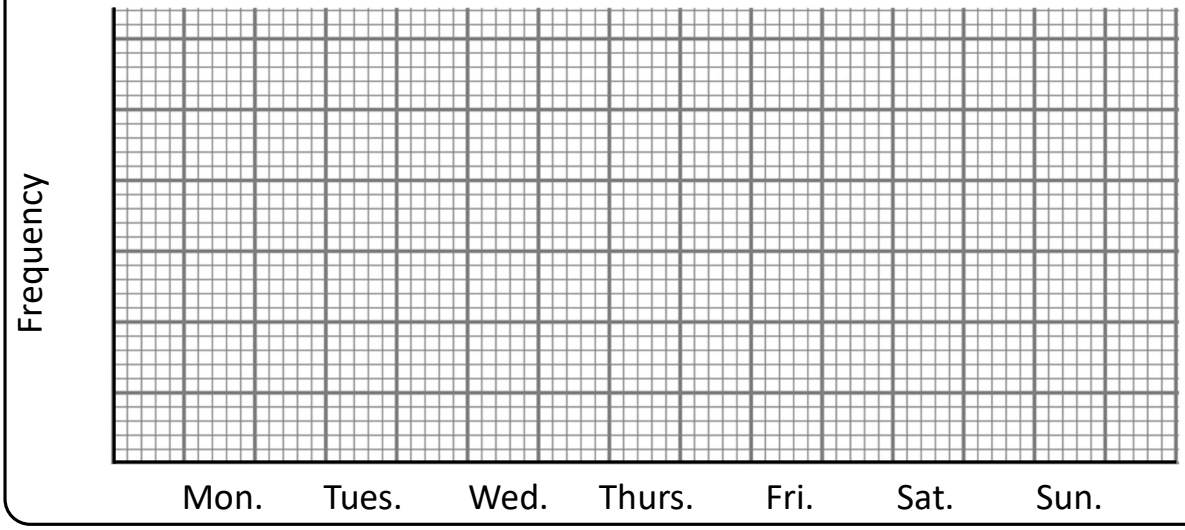
Key
Shoes
Socks

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.

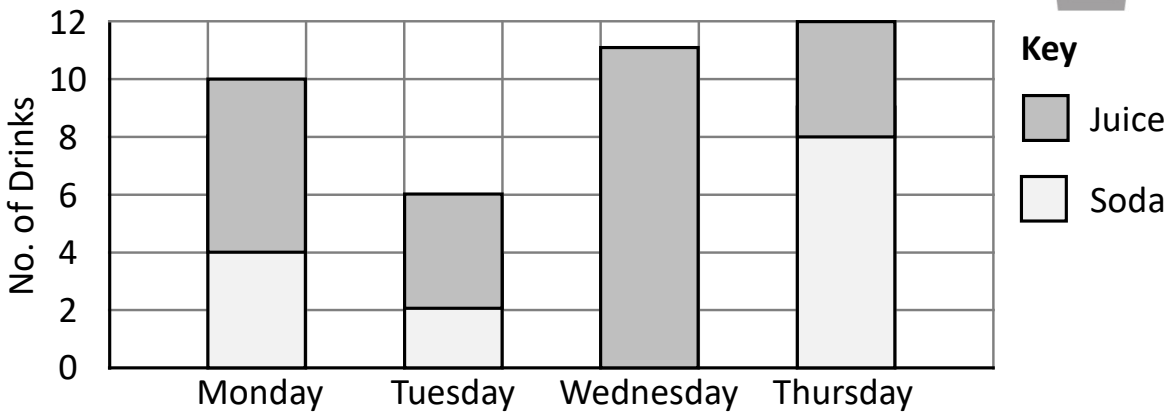
	Mon.	Tue.	Wed.	Thurs.	Fri.	Sat.	Sun.
Trousers	10	10	15	16	7	15	17
Shirts	5	10	5	10	4	9	14



Fluency Practice

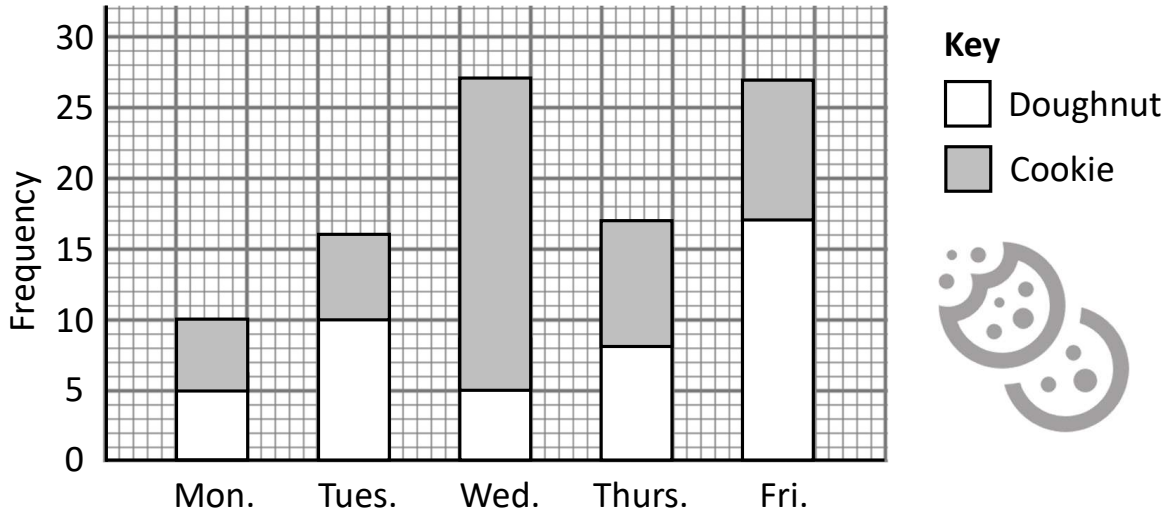
Composite Bar Charts: Reading

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.

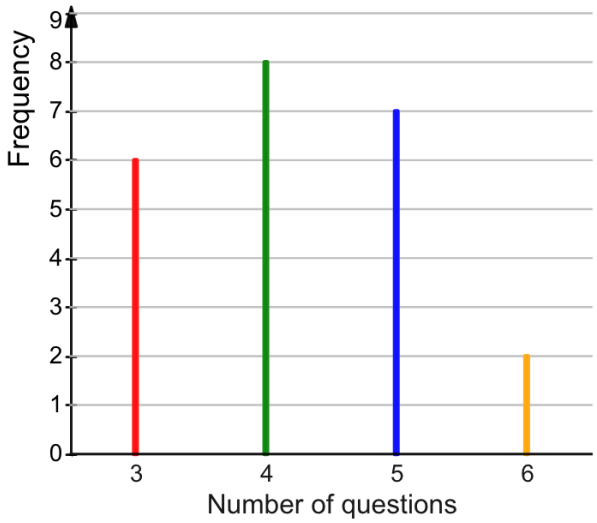


a) How many doughnuts were sold on Tuesday?
b) How many cookies were sold on Thursday?
c) How many snacks were sold on Friday?
d) On Wednesday how many more cookies were sold than doughnuts?
e) How many doughnuts were sold on Monday and Tuesday?
f) In total, how many more cookies were sold compared to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

4.2 Vertical Line Charts

Worked Example

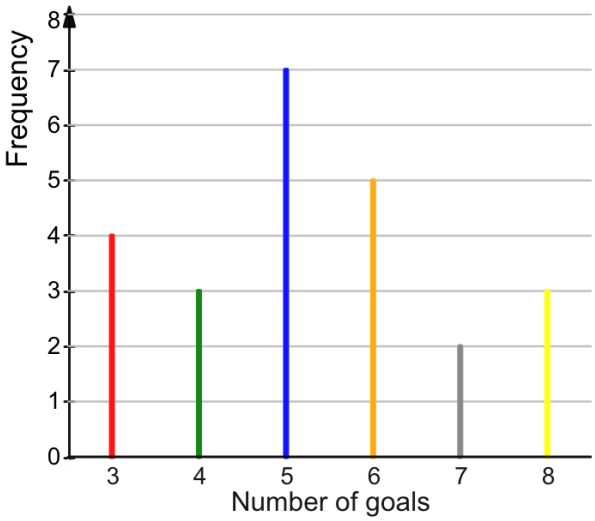
George records the number of questions he answered on DF per day over 23 days and represents the data in a line chart.



Find the number of questions that were answered on 7 of these days.

Your Turn

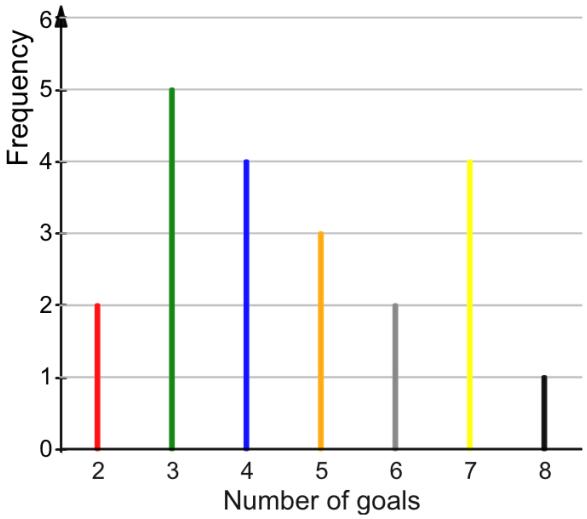
Amelia records the number of goals her team has scored over 24 matches and represents the data in a line chart.



Find the number of goals that were scored in 5 of these matches.

Worked Example

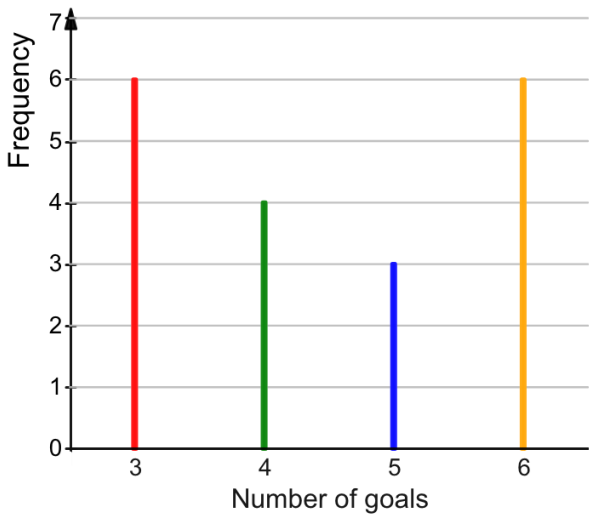
Hannah records the number of goals her team has scored over the season's matches and represents the data in a line chart.



Find the number of matches where Hannah's team scored 2 goals.

Your Turn

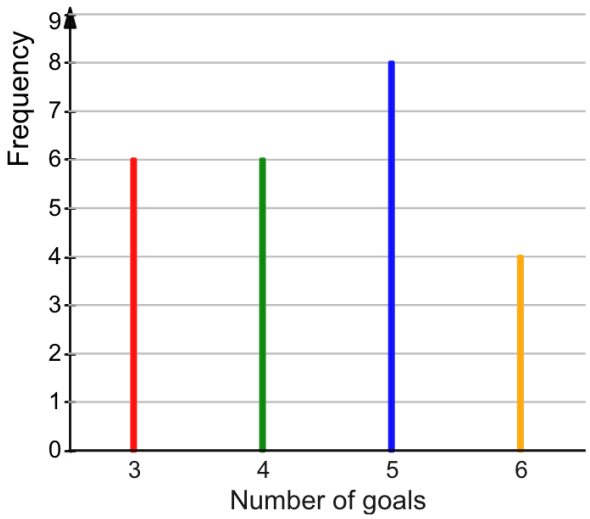
Said records the number of goals his team has scored over the season's matches and represents the data in a line chart.



Find the number of matches where Said's team scored 6 goals.

Worked Example

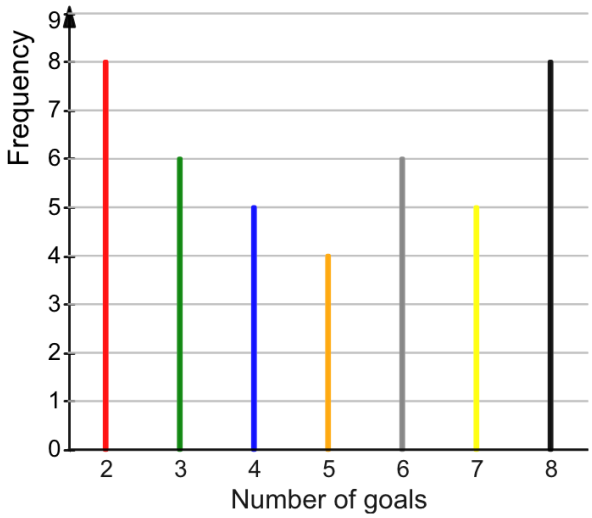
Oumou records the number of goals her team has scored over the season's matches and represents the data in a line chart.



Find the number of goals that were scored the most often.

Your Turn

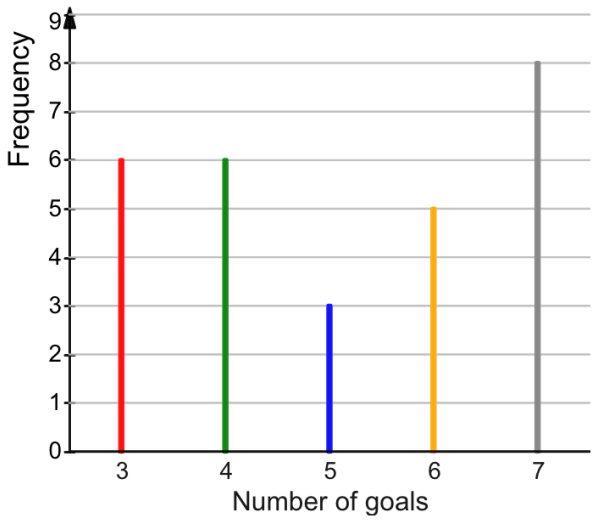
Tareq records the number of goals his team has scored over the season's matches and represents the data in a line chart.



Find the number of goals that were scored the most often.

Worked Example

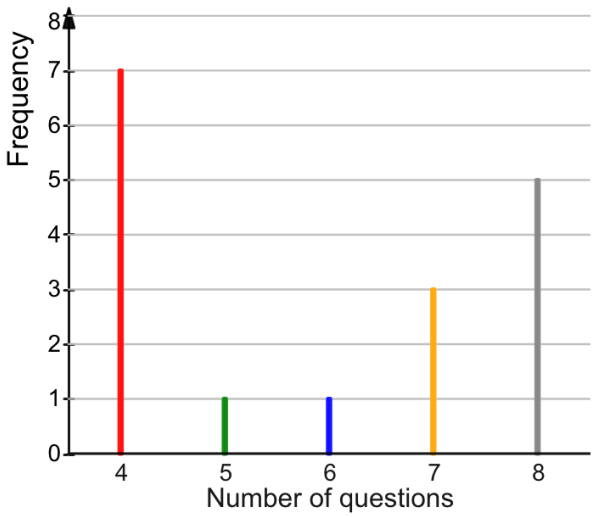
Lexi records the number of goals her team has scored over the season's matches and represents the data in a line chart.



Find the number of goals that were scored in more than 4 matches but fewer than 7 matches.

Your Turn

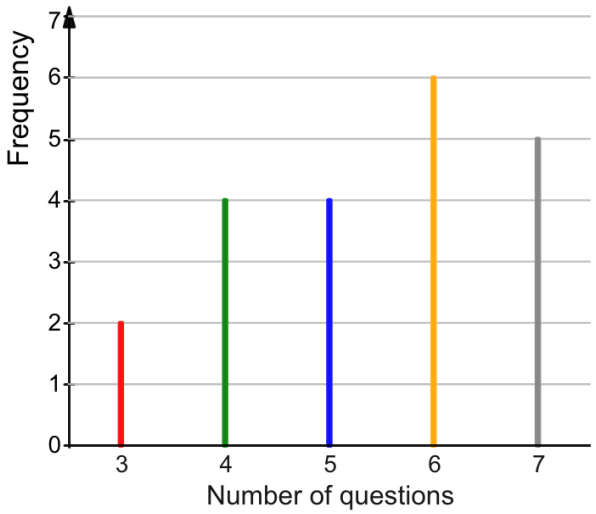
Diego records the number of questions he answered on DF per day during a holiday and represents the data in a line chart.



Find the number of questions that were answered on more than 5 days.

Worked Example

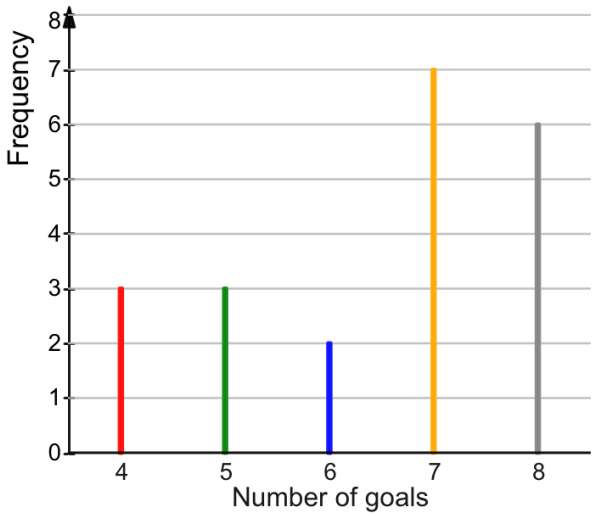
Tim records the number of questions he answered on DF per day during a holiday and represents the data in a line chart.



Find the number of days that Tim answered questions.

Your Turn

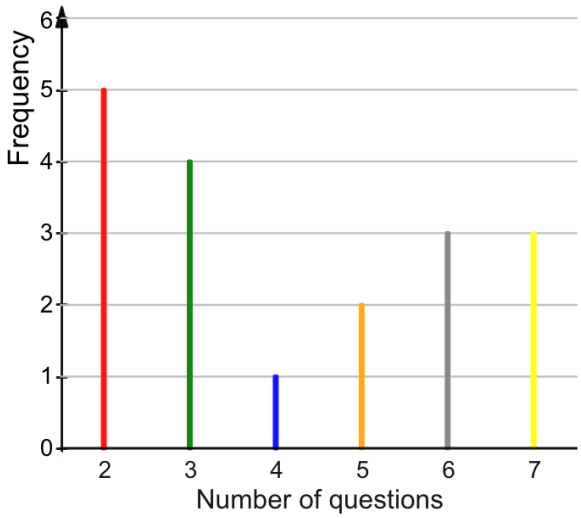
Aïcha records the number of goals her team has scored over the season's matches and represents the data in a line chart.



Find the number of matches recorded.

Worked Example

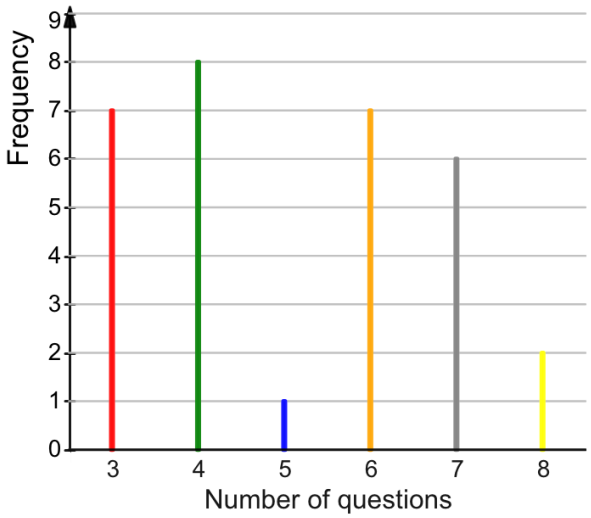
Ruby records the number of questions she answered on DF per day during a holiday and represents the data in a line chart.



Find the difference between the number of days where Ruby answered 3 questions and the number of days where she answered 6 questions.

Your Turn

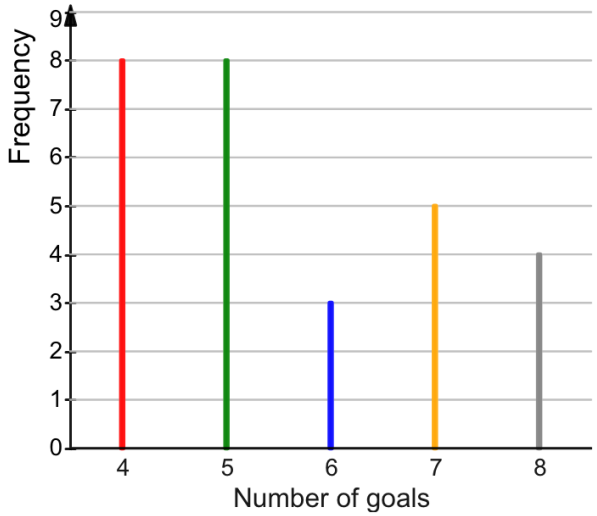
Elsa records the number of questions they answered on DF per day during a holiday and represents the data in a line chart.



Find the difference between the number of days where Elsa answered 6 questions and the number of days where they answered 7 questions.

Worked Example

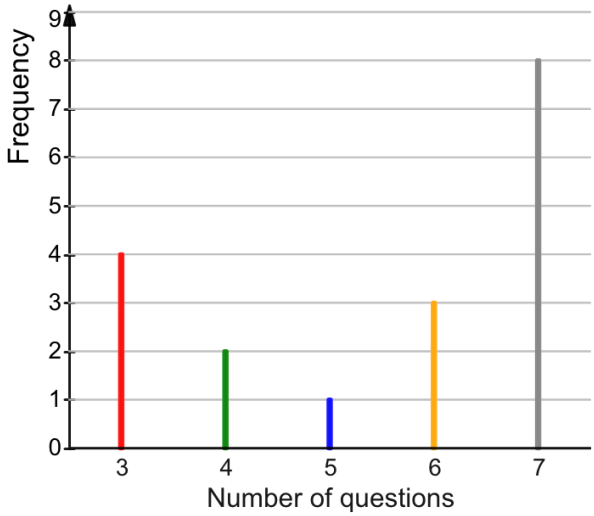
Owen records the number of goals his team has scored over the season's matches and represents the data in a line chart.



Find the total number of goals Owen's team scored.

Your Turn

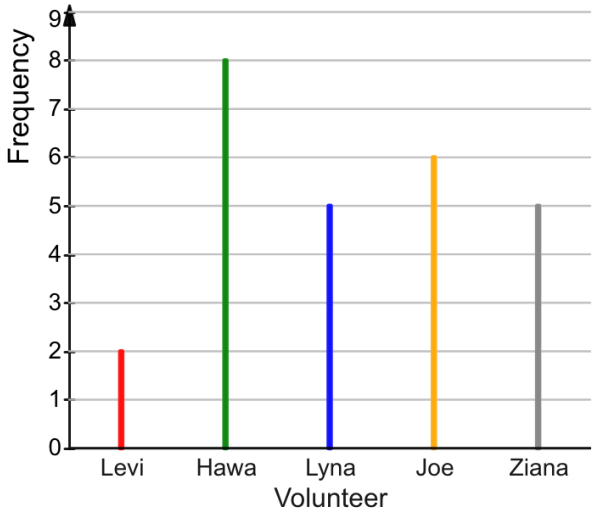
Theo records the number of questions he answered on DF per day during a holiday and represents the data in a line chart.



Find the total number of questions Theo answered.

Worked Example

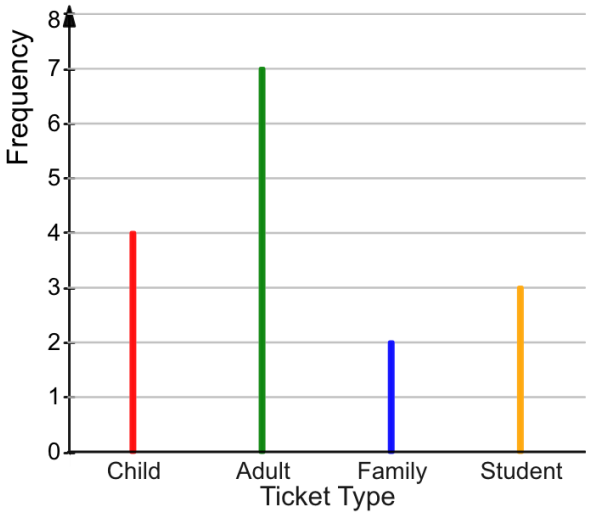
Beth records the number of identical sessions that volunteers complete at a charity event and represents the data on a line chart.



Given that each session runs for 4 hours, find the total number of hours Ziana volunteers for.

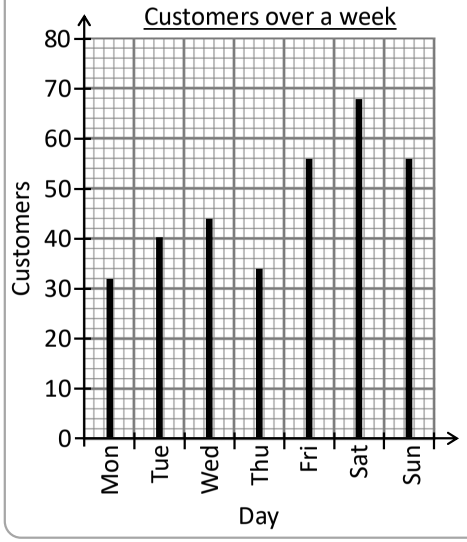
Your Turn

Owen records the number of sales of different ticket types for a concert and represents the data on a line chart.



Given that each ticket costs £ 6, find the total value of the student ticket sales.

① Vertical Line Charts



A shop recorded how many customers it had each day.

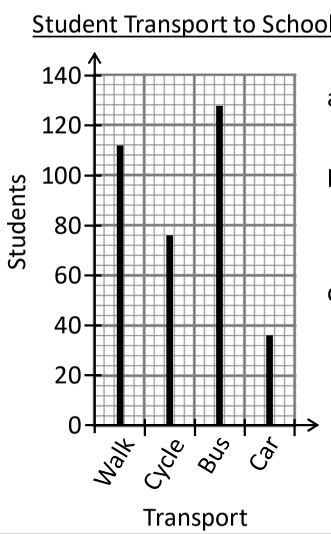
a) Which was the busiest day for the shop?

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

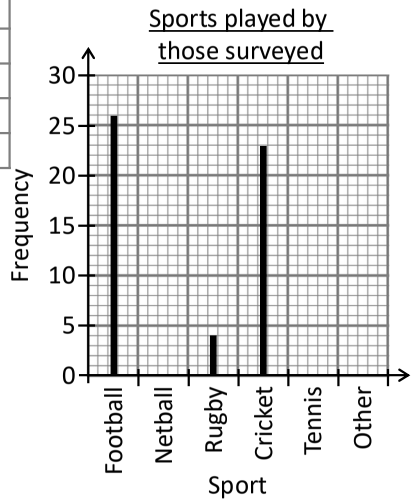
Leigh surveyed 100 people about the sport they played.

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?

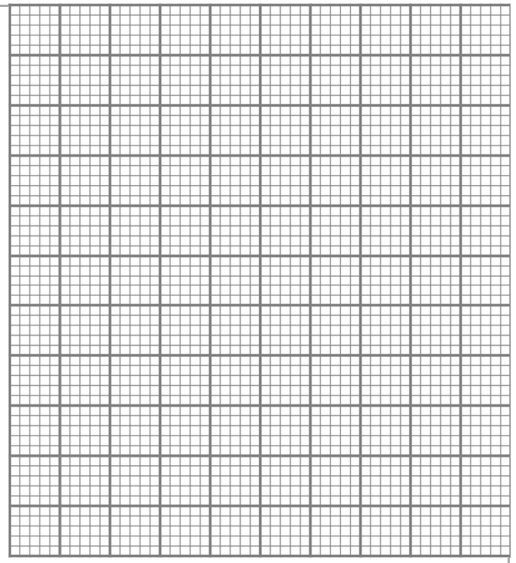


④

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

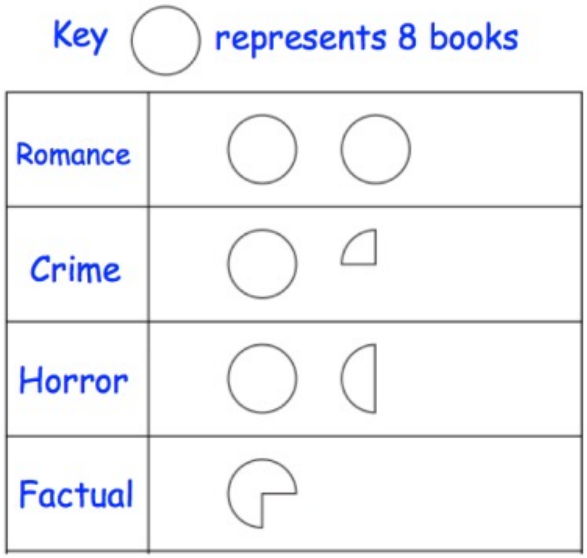
A person asked their friends for their favourite sport.

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:

Norwich

Dublin

Belfast

Aberdeen

Cardiff

Glasgow

Worked Example

Here are the lengths, in centimetres, of 27 pieces of paper.

Length	Frequency
5	
6	
7	
8	

Key:  $= 2$

Find the frequency for 5 centimetres.

Your Turn

Here are the number of times that 16 pupils have been late to school this term.

Number of times	Frequency
3	
4	
5	
6	
7	

Key:  $= 2$

Find the frequency for 4 times.

Worked Example

Here are the masses, in grams, of 78 pencils.

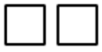
Mass	Frequency
4	
5	
6	
7	
8	

Key: 

Find the most common mass.

Your Turn

Here are the times, in seconds, spent by 24 pupils to answer a question on DFM.

Time	Frequency
3	
4	
5	
6	

Key: 

Find the least common number of pens.

Worked Example

Here is an incomplete pictogram showing the number of times that 20 pupils have been late to school this term.

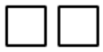
Number of times	Frequency
3	
4	
5	
6	

Key:  $= 2$

Find the number of circles and partial circles needed if 5 pupils were late 4 times.

Your Turn

Here is an incomplete pictogram showing the number of times that 21 pupils have been late to school this term.

Number of times	Frequency
3	
4	
5	
6	

Key:  $= 2$

Find the number of squares and partial squares needed if 4 pupils were late 6 times.

Worked Example

Here are the times, in seconds, spent by some pupils to answer a question on DFM.

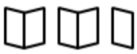
Time	Frequency
5	
6	
7	
8	
9	

Key: 

Find the number of pupils who answered the question.

Your Turn

Here are the number of texts that some pupils sent yesterday.

Number of texts	Frequency
5	
6	
7	
8	
9	

Key: 

Find the number of pupils who were in the survey.

Worked Example

Here is an incomplete pictogram showing the number of times that 7 pupils have been late to school this term.

Number of times	Frequency
5	
6	
7	
8	

Key: 

Find the number of circles and partial circles needed for the incomplete row.

Your Turn

Here is an incomplete pictogram showing the times, in seconds, spent by 24 pupils to answer a question on DFM.

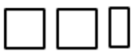
Time	Frequency
4	
5	
6	
7	

Key: 

Find the number of circles and partial circles needed for the incomplete row.

Worked Example

Here are the number of times that 19 pupils have been late to school this term.

Number of times	Frequency
4	
5	
6	
7	

Key:

Find how many more pupils had been late 5 times than 6 times.

Your Turn

Here are the times, in seconds, spent by 24 pupils to answer a question on DFM.

Time	Frequency
3	
4	
5	
6	
7	

Key: 

Find how many more pupils answered in 7 seconds compared to 5 seconds.

Worked Example

Here are the lengths, in centimetres, of some pieces of paper.

Length	Frequency
3	○○○
4	○○○○
5	◗
6	○○
7	○○

Given that 3 pieces of paper were 5 centimetres, complete the key.

Your Turn

Here are the lengths, in centimetres, of some pieces of paper.

Length	Frequency
5	
6	
7	
8	

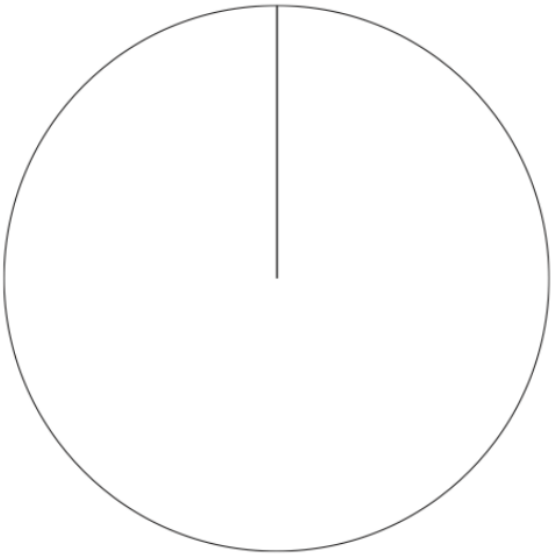
Given that 2 pieces of paper were 7 centimetres, complete the key.

4.4 Pie Charts

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.

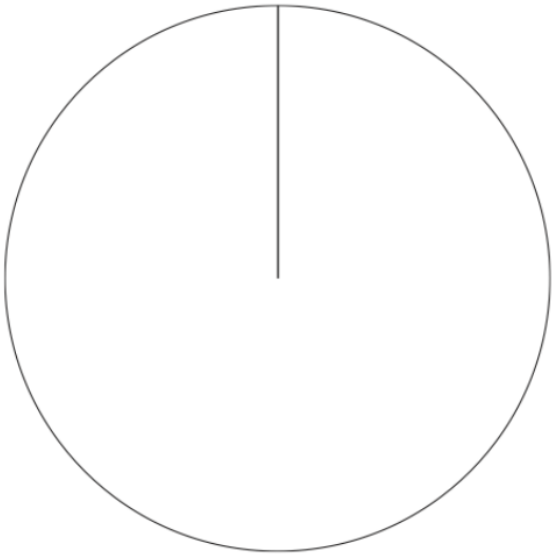
Flavour	Number sold
Vanilla	20
Chocolate	40
Strawberry	24
Honeycomb	24
Mint	12



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	

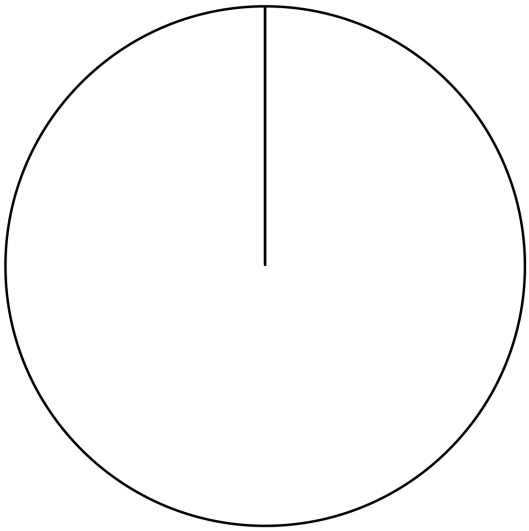
Your Turn

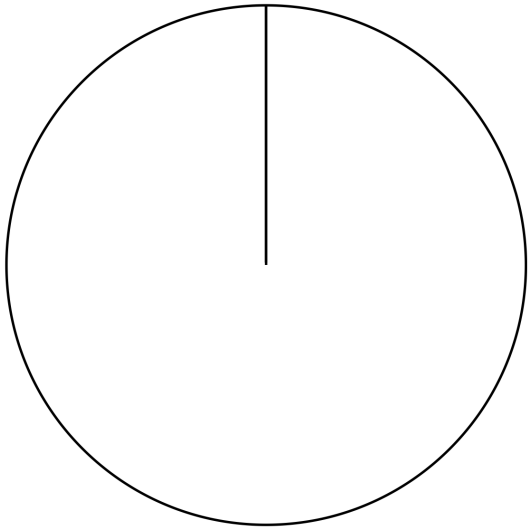
Draw a pie chart for the data.

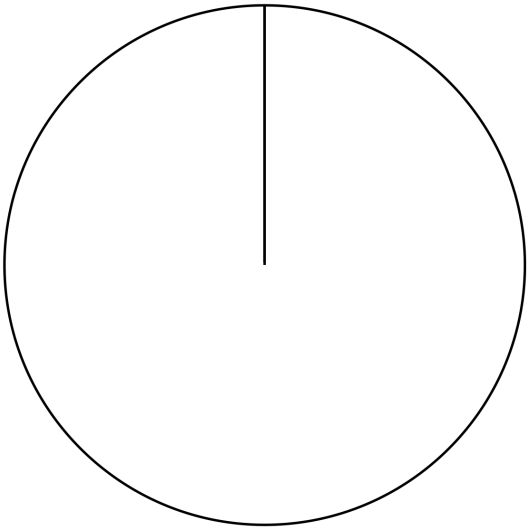
Joanna records how 130 pupils travelled to school on one day.

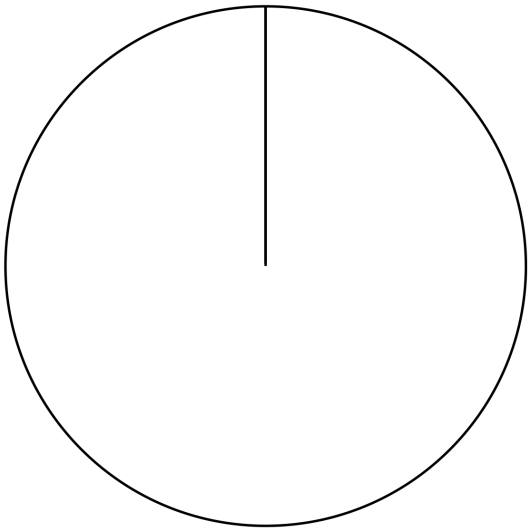
Type of transport	Frequency	Angle (°)
train	32	
walk	26	
bus	35	
cycle	30	
other	7	

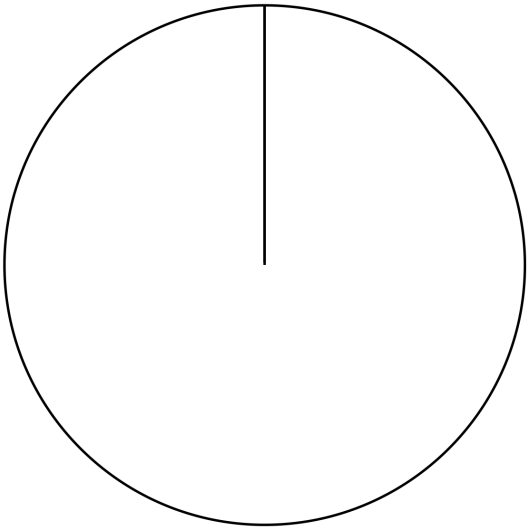
Templates

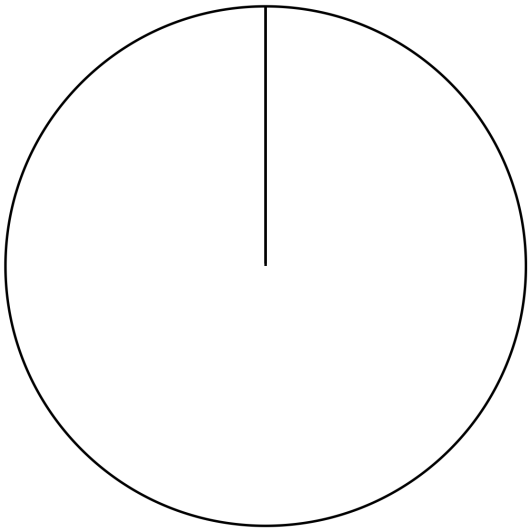




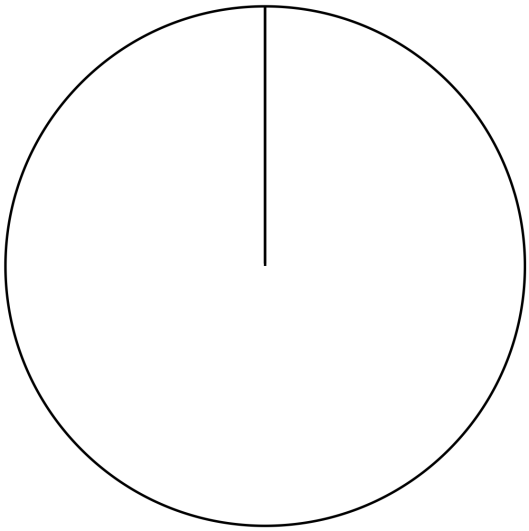


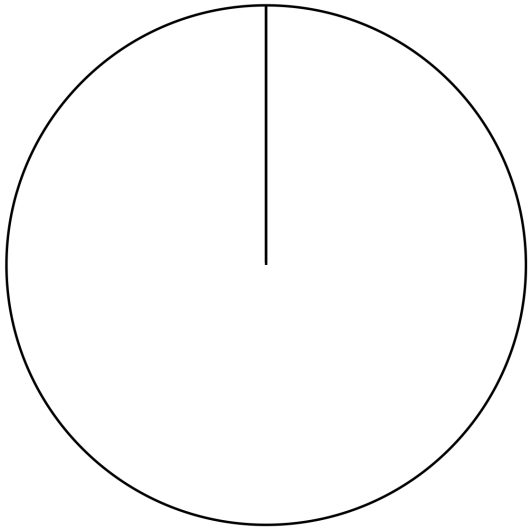


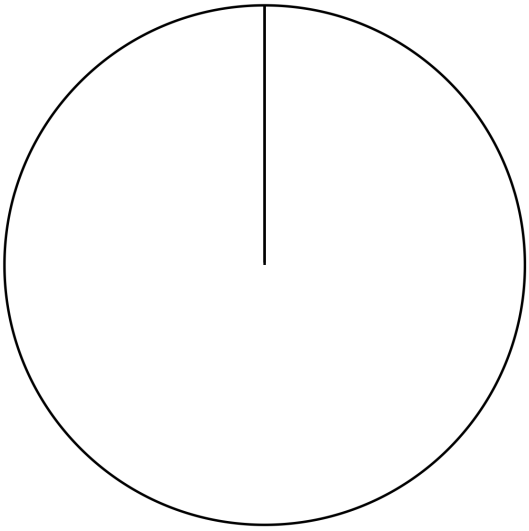


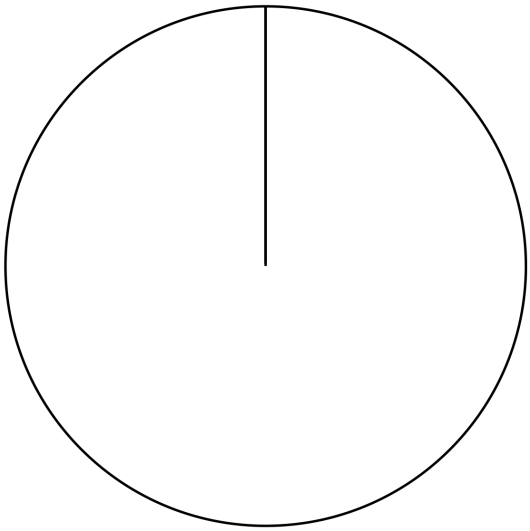


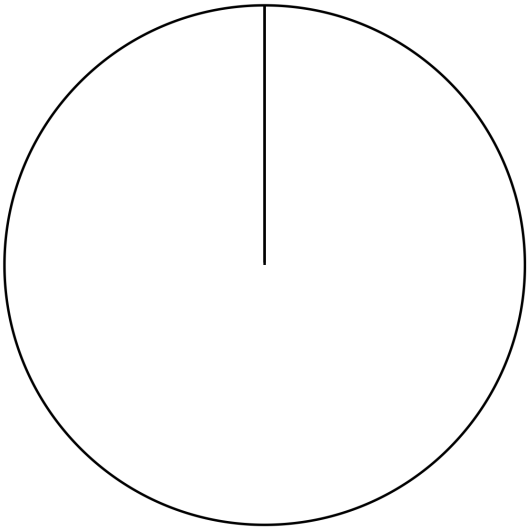
Templates

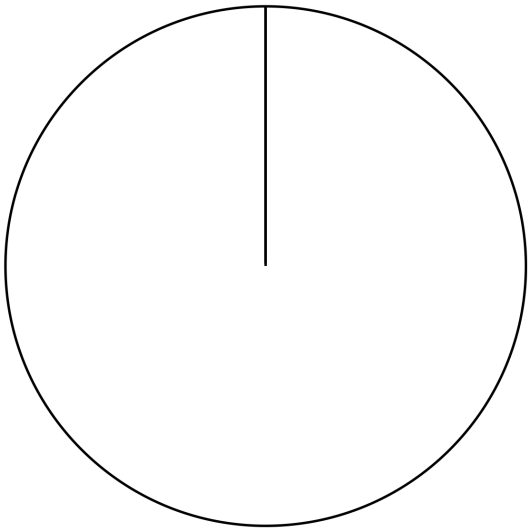






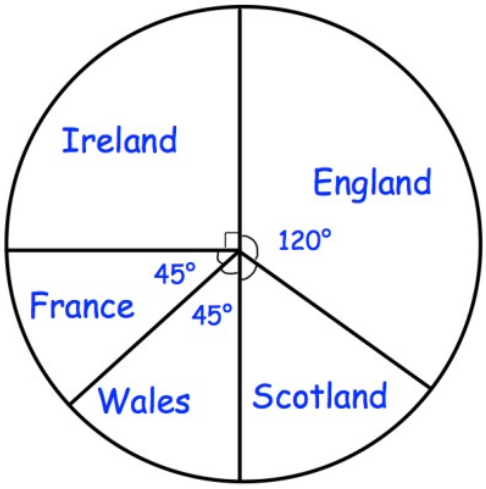






Worked Example

A group of 720 people were asked which rugby team they support.



How many supported:

Ireland

England

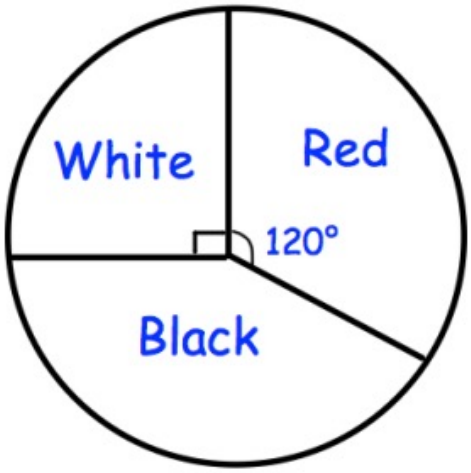
Wales

Scotland

France

Your Turn

There are 1440 counters in a bag. Each is white, red or black.



How many counters are:

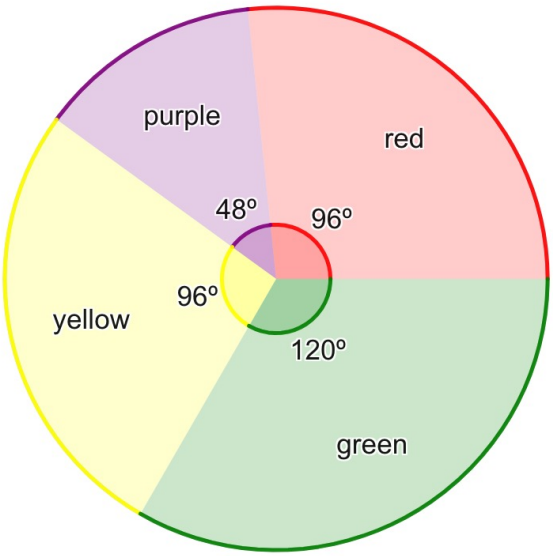
White

Red

Black

Worked Example

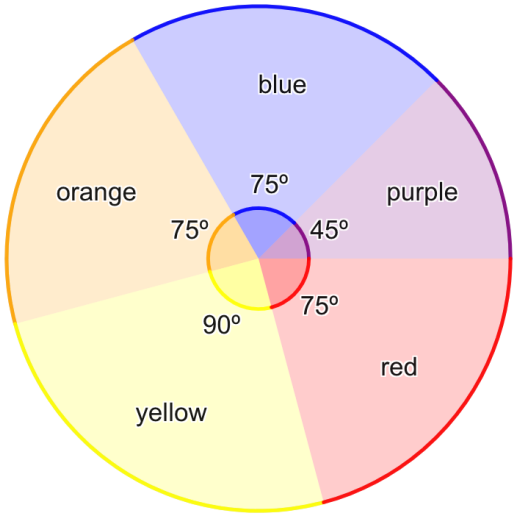
Joel records the favourite colours of 90 people and represents this information on the pie chart below.



Work out how many people purple 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 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

Worked Example	Your Turn
Draw an ordered stem and leaf diagram for this data: 112 121 113 131 153 147 129 121 118 146 121 153 145 121	Draw an ordered stem and leaf diagram for this data: 142 135 156 139 140 151 147 138 142 155 142 148 149 141
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

Back -2- Back Stem & Leaf Diagrams

①

Two classes took a Geography test.
Complete an ordered, back to back stem & leaf diagram for their results.

Class 9YX

12	31	24	31
35	24	32	1
29	35	12	43
9	43	36	23
38	18	30	

Class 9YX vs Class 9YZ

							0								
							1								
							2								
							3								
							4								

Class 9YZ

12	37	15	9
27	9	8	8
9	42	10	13
8	13	26	35
30	9	28	

a) Find the **median score** for each class.

b) What does the **shape** of the stem & leaf diagram tell us about the results?

Back -2- Back Stem & Leaf Diagrams

②

Two shoe shops are competitors.
Complete an ordered, back to back stem & leaf diagram for their sales on a Saturday.

Skoo Shoe Ltd

46	75	32	38
75	49	64	36
32	40	46	49
68	46	68	34
48	64	25	49
25	49	52	55
48	52	55	32
39	49	40	54

Skoo Shoe Ltd vs Kelly's Kicks

											2												
											3												
											4												
											5												
											6												
											7												

Kelly's Kicks

25	20	72	39
55	74	22	74
78	22	55	25
20	42	62	68
74	31	20	78
25	78	55	25
33	37	79	65
78	62	20	33
63	64		

a) Calculate the **median sale** for both shops.

b) Describe the **shape** of both sides of the diagram. Which shop do you think had a higher revenue?

4.6 Two-Way Tables

Worked Example

50 pupils studying sciences were asked which science subject they liked the best. Some information about the results is shown in the two-way table. Complete the two-way table.

	Physics	Chemistry	Biology	Total
Boy		4	9	
Girl	1	1		15
Total	23		22	50

Your Turn

90 pupils studying sciences were asked which science subject they liked the best. Some information about the results is shown in the two-way table. Complete the two-way table.

	Physics	Chemistry	Biology	Total
Boy	18	24	10	52
Girl	21	9		
Total			18	90

Worked Example

110 students each attended one revision lesson at the weekend.
Each student went to Geography, English or Maths. The two-way table below shows the attendance of each revision lesson.

	Geography	English	Maths	Total
Saturday	13	14	24	51
Sunday	13	22	24	59
Total	26	36	48	110

One of the students is picked at random. Find the probability that this student attended English.

Your Turn

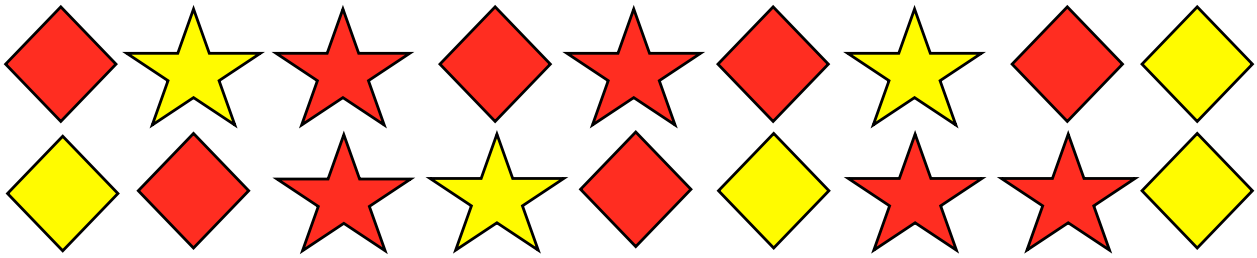
120 students each attended one revision lesson at the weekend.
Each student went to Geography, Computing or Science.
The two-way table below shows the attendance of each revision lesson.

	Geography	Computing	Science	Total
Saturday	17	21	28	66
Sunday	17	13	24	54
Total	34	34	52	120

One of the students is picked at random. Find the probability that this student attended Science.

Fluency Practice

Question 1: Complete the two way table to show the information about the shapes below.



	Rhombus	Star	Total
Red			
Yellow			
Total			

Question 2: 50 children were asked if they wanted to go bowling or to the cinema.

17 girls and 11 boys wanted to go bowling.
12 boys wanted to go to the cinema.

(a) Use this information to complete the two-way table below.

	Bowling	Cinema	Total
Boys			
Girls			
Total			

(b) How many children, in total, want to go to the cinema?

Fluency Practice

Question 3: Complete the following two way tables:

(a)

	Car	Bus	Walk	Total
Year 9	10	8		24
Year 10		7	5	
Total	16			42

(b)

	English	Art	Total
Pass	25		
Fail		12	13
Total		19	

(c)

	Rugby	Football	Hockey	Total
Class 9A	7		6	24
Class 9B		3		
Total	12			40

(d)

	Child	Adult	Total
Male	52		86
Female		43	
Total			178

Question 4: This two-way table shows information about the students in years 8, 9 and 10.

	Year 8	Year 9	Year 10
Boys	45	38	51
Girls	32	52	28

(a) Find the total number of students in year 8.
(b) Find the total number of girls in years 8, 9 and 10.
(c) What fraction of the students are in year 10?
(d) What fraction of year 9 students are girls?

Question 5: This two-way table shows the number of goals scored in each match by three football teams throughout January, February and March.

	Rovers	City	United
0 goals	8	3	5
1 goal	3	8	9
2 or more	7	9	4

(a) Find the number of matches that Rovers played.
(b) Find the number of matches where 1 goal was scored by these teams.
(c) In what percentage of their matches did City score no goals?
(d) Find the fraction of United's matches where they scored 1 or more goals.

Fluency Practice

Question 1: Paul has a deck of 50 cards, each with a shape on it.
The shapes are either red or black.

	Square	Rectangle	Kite
Red	17	6	1
Black	4	9	13

Paul picks a card at random.

(a) What is the probability that the card has a black kite on it?
(b) What is the probability that the card has a red shape on it?
(c) What is the probability that the card has a square on it?
(d) What is the probability that the card has a shape with at least 2 lines of symmetry?

Question 2: 60 people visited a swimming pool one evening.
13 out of the 19 people who wore goggles were adults.
There were 15 children.

(a) Complete a two-way table for this information.
(b) How many adults did not were goggles?
(c) What fraction of the children wore goggles?

Question 3: 100 families booked a holiday in July or in August, at a travel agents.
Some of the families booked to go to France.
Some booked to go to Spain.
The rest of the families booked a holiday to Portugal.

59 families booked to go on holiday in August.
19 of the 35 families going to France booked to go in July.
30 families booked to go to Portugal.
20 families booked to go to Spain in August.

(a) Create a two-way table for this information.
(b) How many families booked to go to Portugal in July?

Question 4: There are 120 students in Year 11 at a school.
Each student studies one language, either French, Spanish, German or Welsh.
21 of the 40 students studying Welsh are male.
18 males and 9 females study French.
12 of the 17 students studying Spanish are female.
Twice as many females study German than males.

How many students in Year 11 are female?

Fluency Practice

Question 5: A teacher surveys 64 children on how they travelled to school.
20 of the students were in Year 7.
The teacher surveyed 30% more students in Year 9 than in Year 7.
The rest of the students surveyed were in Year 11.
75% of the students in Year 7 walked to school.
8 more students in Year 9 walked to school than did not walk.
Out of students surveyed, more Year 11 students walked to school than Year 9 students.

One of these students is picked at random

Write down the probability that the student chosen will walk to school.

Question 6: Isla has a box of counters.
The table shows information about the shape and colours of the counters.

		Shape		
		Circle	Triangle	Square
Colour	Blue	6	2	5
	Red	8	9	11

Isla picks a counter at random, looked at it and then returned it to the box.

(a) Given it is a circular counter, what is the probability that it was red?

David picks a counter at random, looked at it and then returned it to the box.

(b) Given it is a blue counter, what is the probability that it was triangular?

Emily adds a number of red square counters to the box.
The probability of Emily picking a red square at random is now $\frac{2}{3}$

(c) How many red square counters did Emily add to the box?

Worked Example

120 students in total.
There are 12 more boys than girls altogether.
The ratio Maths : English = 2 : 3
Half as many girls have Maths as have English.

	Maths	English	Total
Boys			
Girls			
Total			

Your Turn

120 students in total.
There are 18 more boys than girls altogether.
The ratio Maths : English = 3 : 2
Half as many girls have Maths as have English.

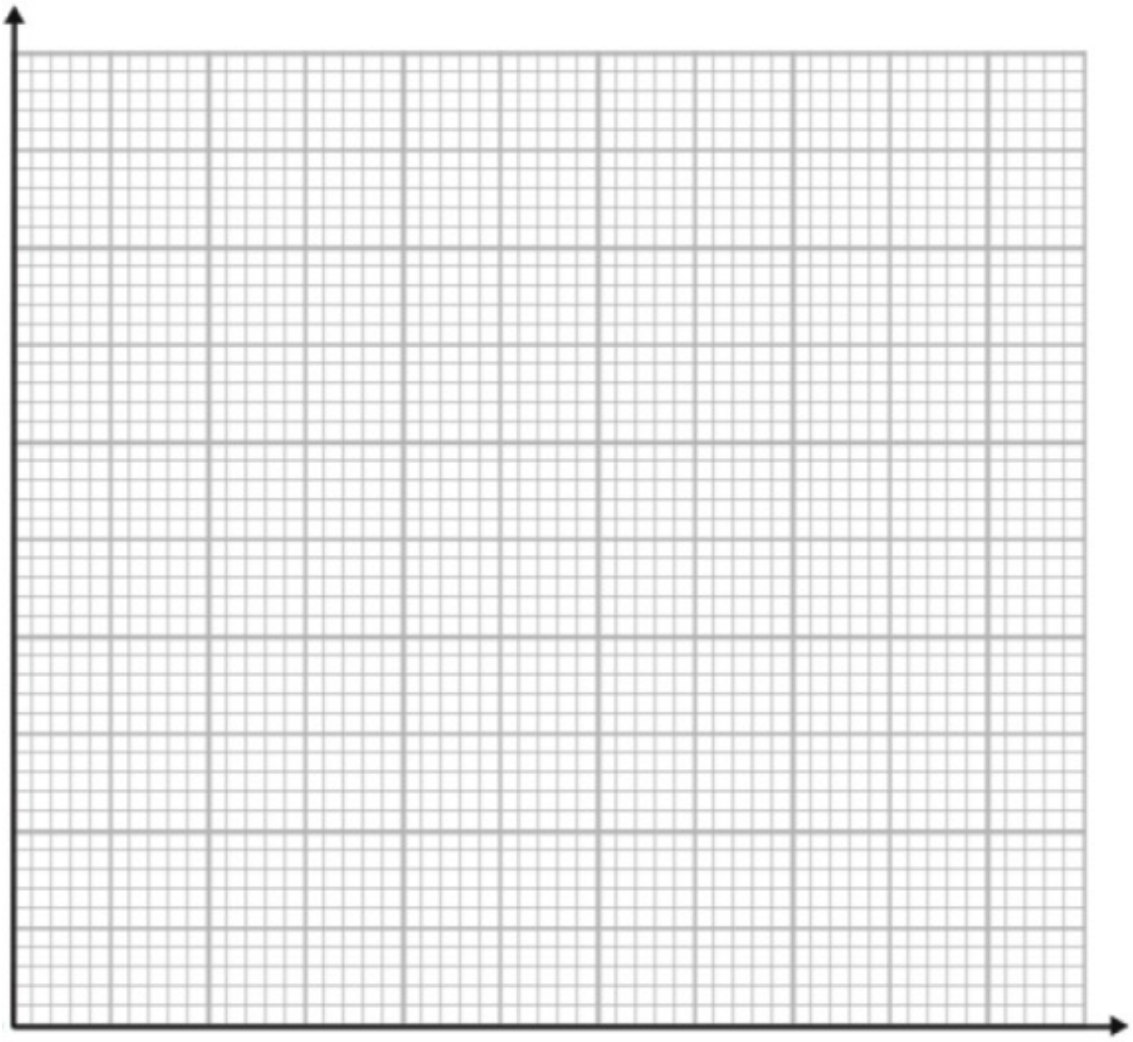
	Maths	English	Total
Boys			
Girls			
Total			

4.7 Line Graphs and Time Series

Worked Example

The table shows the number of customers to a shop over several days. Draw a line graph for the data.

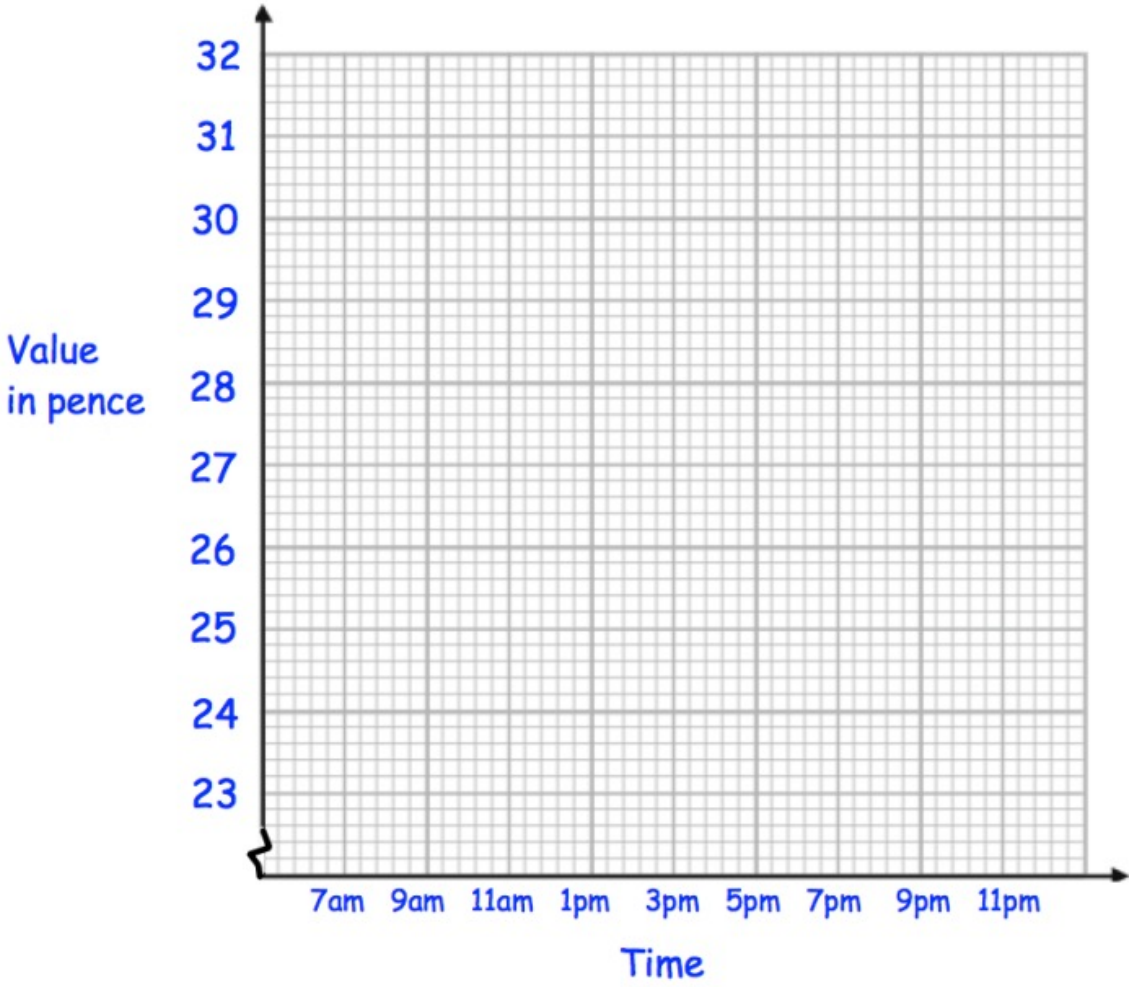
Day	Customers
Monday	42
Tuesday	47
Wednesday	3
Thursday	36
Friday	40
Saturday	31



Your Turn

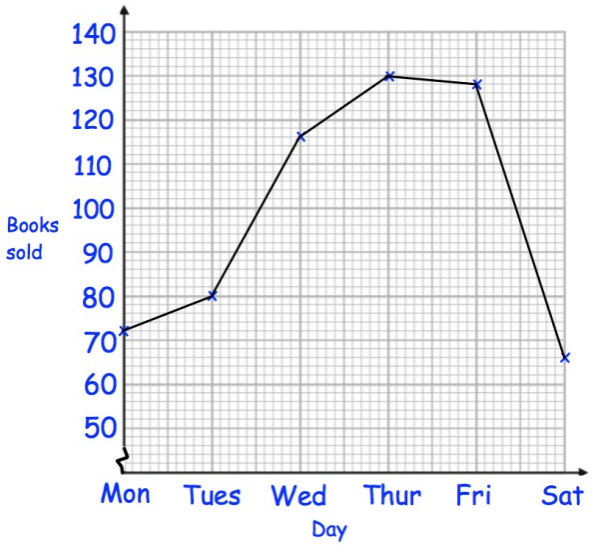
The table shows the value of a share in a mobile phone company over one day. Draw a line graph for the data.

Time	Value
9am	30.2p
11am	31.4p
1pm	29.6p
3pm	25.8p
5pm	24.2p
7pm	25.6p



Worked Example

The line graph shows the number of books sold in a charity shop over one week.

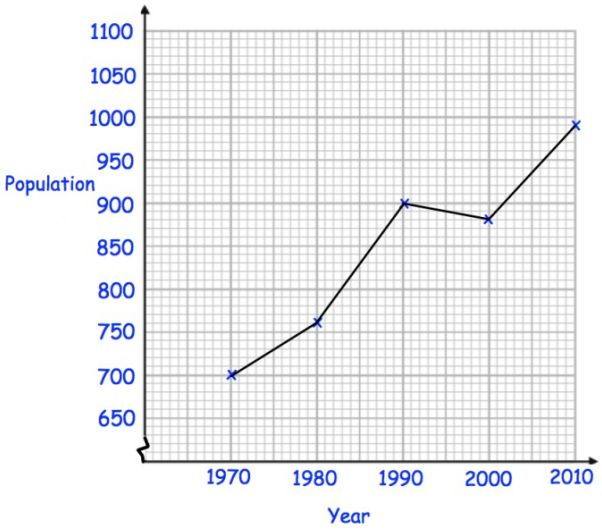


When did the charity shop sell:

a) The most books
b) The least books
c) How many books were sold on Friday?

Your Turn

The line graph shows the population of a village over time.



When was the population:

a) Highest?
b) Lowest?
c) What was the population in 2000?

Fluency Practice

Question 1: Draw a line graph for each of the following tables

(a)

Year	Population
1990	40
1995	44
2000	50
2005	62
2010	88
2015	90

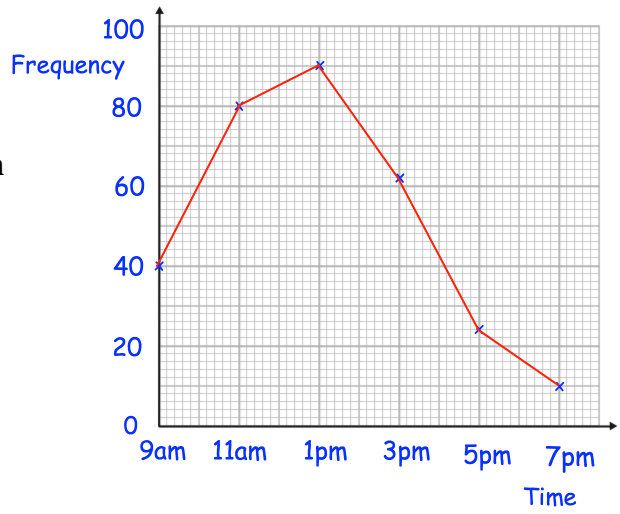
(b)

Time	Price
9am	30p
10am	24p
11am	25p
12 noon	27p
1pm	37p
2pm	38p

(c)

Month	Height, cm
1	3
2	5
3	10
4	20
5	35
6	36

Question 2: Sally recorded the number of cars in a car park every two hours.
She begun at 9am and finished at 7pm.
The line graph shows her results.



(a) When were the most cars in the car park?

(b) How many cars were in the car park at 11am

(c) At what time were there 24 cars in the car park?

(d) Estimate the number of cars in the car park at 10am.

(e) How many less cars were in the car park at 3pm than 1pm?

Fluency Practice

Question 3: The line graph below shows the cost of a coffee in a shop over 30 years.

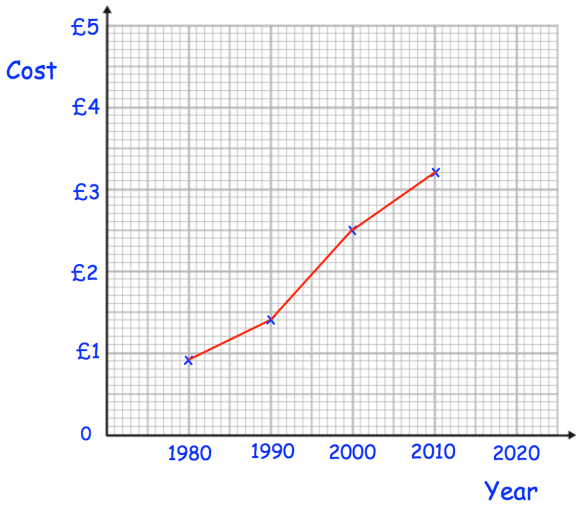
(a) In which year was the price £2.50?

(b) How much was the price of a coffee in 1990?

(c) Estimate the price of a coffee in 2005.

Carlos says that the price of a coffee will be £3.60 by 2020.

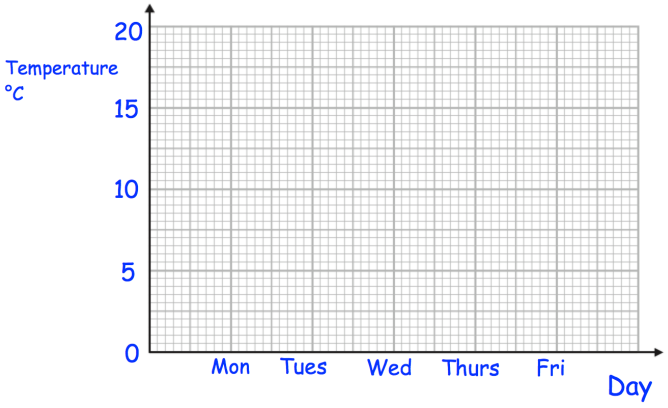
(d) Do you agree with Carlos?
Explain your answer.



Question 4: The table below shows the average temperature in Belfast and Plymouth.

(a) Draw line graphs on the same axes to show the temperatures in Belfast and Plymouth.

	Belfast	Plymouth
Monday	14°C	17°C
Tuesday	16°C	18°C
Wednesday	15°C	13°C
Thursday	10°C	12°C
Friday	9°C	10°C

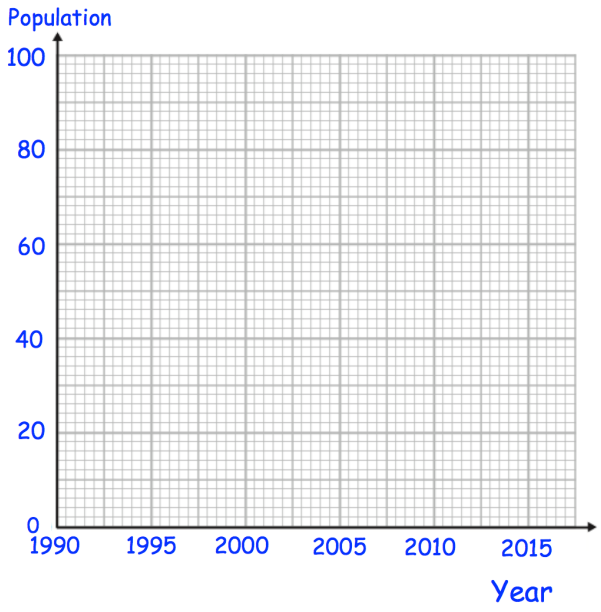


(b) On which day did Belfast have a higher temperature than Plymouth?

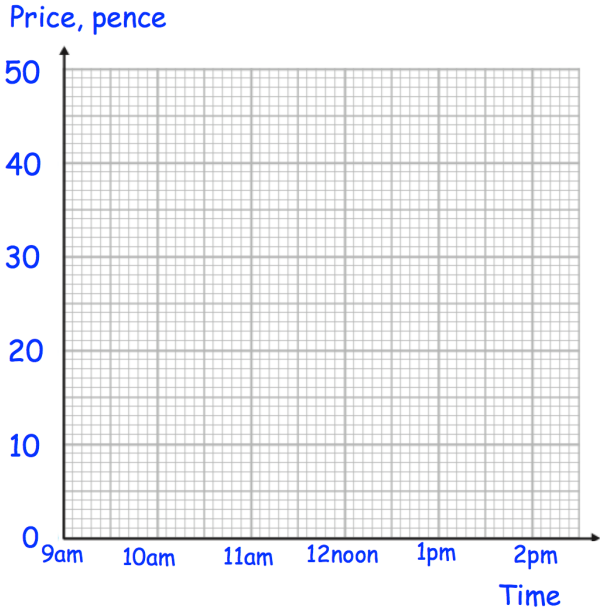
(c) Between which two consecutive days did the temperature in Belfast change the most?

Templates

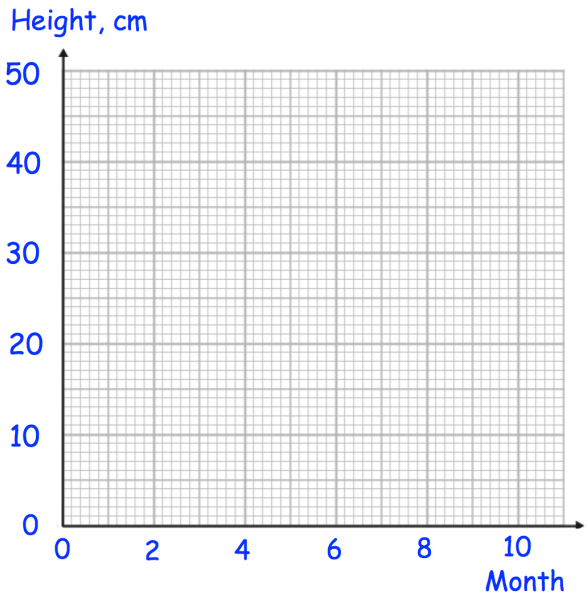
Question 1(a)



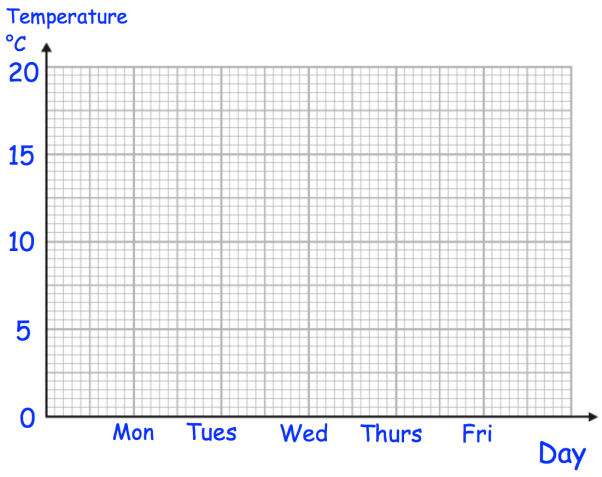
Question 1(b)



Question 1(c)



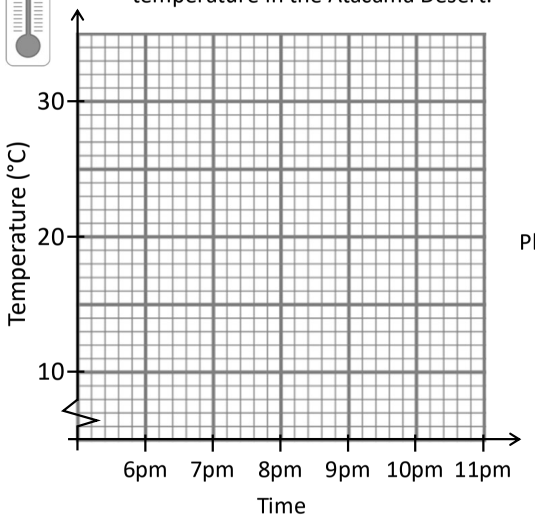
Question 4



Time Series / Line Graphs

A weather station recorded the temperature in the Atacama Desert.

Time	Temp. (°C)
6 pm	30
7 pm	28
8 pm	19
9 pm	14
10 pm	11
11 pm	8



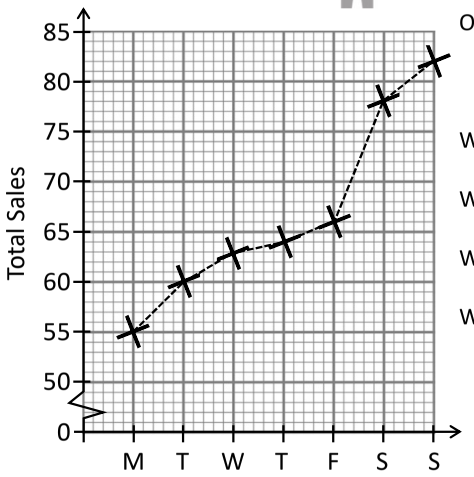
Plot a line graph with this data.

What trend does the line graph show? Why?

Will this trend continue?

Estimate the temperature at 20:30

A clothes shop records **total sales** over one week.



How many sales were made on Tuesday?

On what day were…
…the most sales made?
…the least sales made?

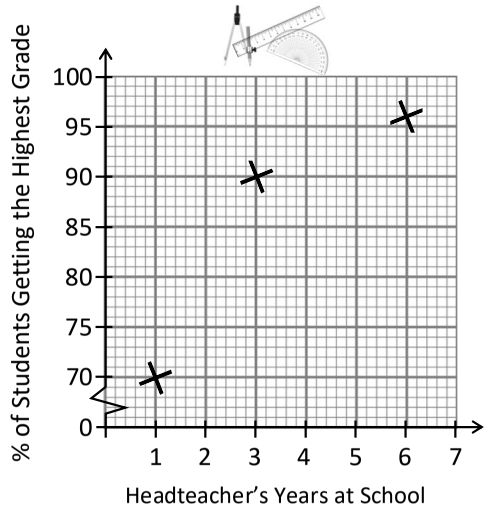
What trend does the line graph have?

Why **must** it have this trend?

Why is the y-axis truncated?

Why do you think this line is dashed and not solid?

A headteacher creates a line graph for the results during their 6 years at a school.



Estimate the amount of students that got the highest grade…
…after 2 years.
…after 5 years.

"In the next two years, 100% of students will get the highest grade."

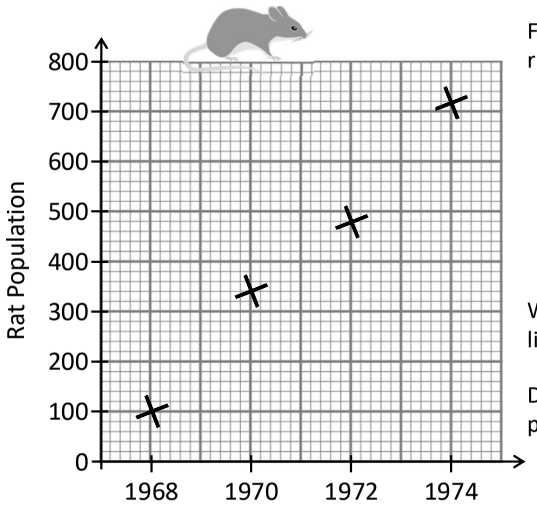
"More students are getting the highest grade."

"Results have always been improving."

Do you agree with the headteacher's statements?

Is the graph misleading?

In 1967 some rats were accidently introduced to small McGuffin Island. Every 2 years a scientist came to the island and estimated the rat population.



Find an estimate for the rat population in…

…1969

…1971

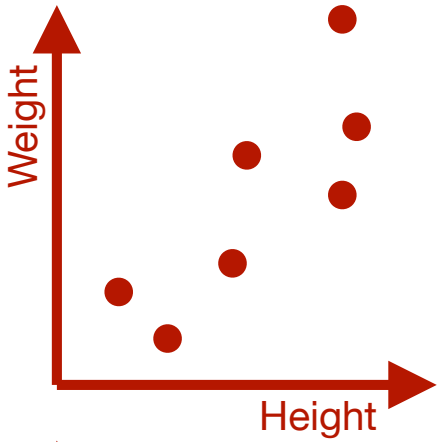
…1973

What trend does the line graph have?

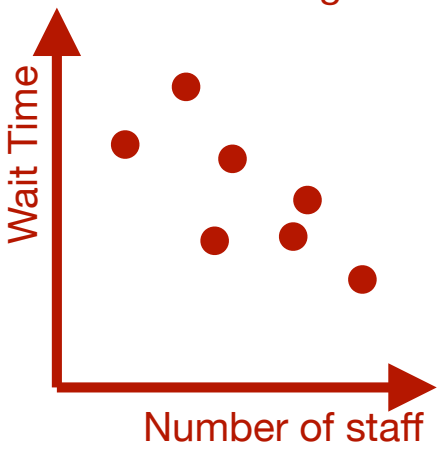
Do we expect the population to keep increasing?

4.8 Scatter Diagrams

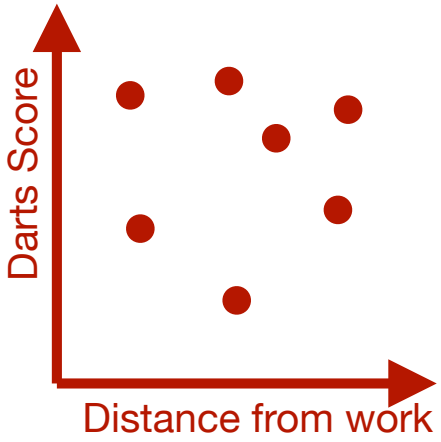
Scatter Graphs can show a relationship between two variables.



…such as people's height and weight.



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



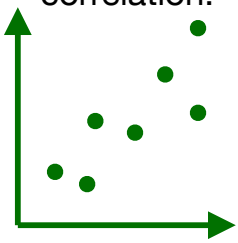
…or the distance people live from work and their best score in darts.

Correlation

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

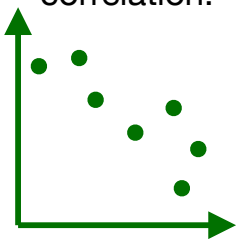
There are different types of correlation:

Positive correlation:



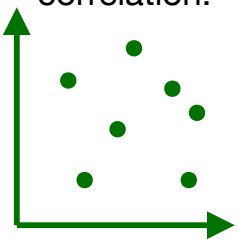
As one value goes up, so does the other.

Negative correlation:



As one value goes up, the other goes down.

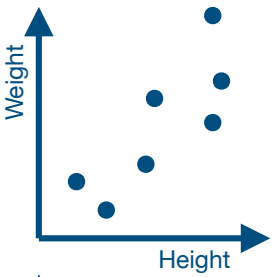
No correlation:



There is no obvious relationship.

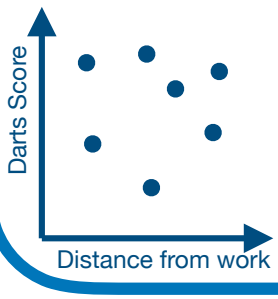
Sometimes you might be asked to explain the correlation in context.

This means describing what is actually happening. eg:



"Taller people are usually heavier."

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

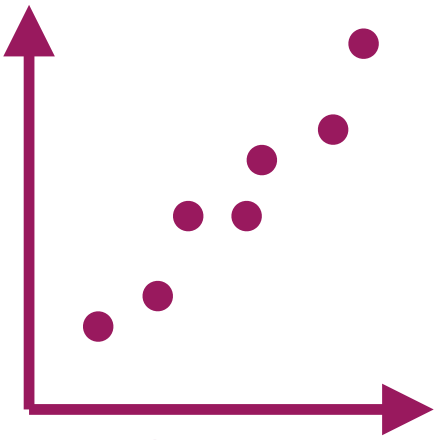


"There is no relationship between how far people live from work and their darts ability."

Correlation Strength

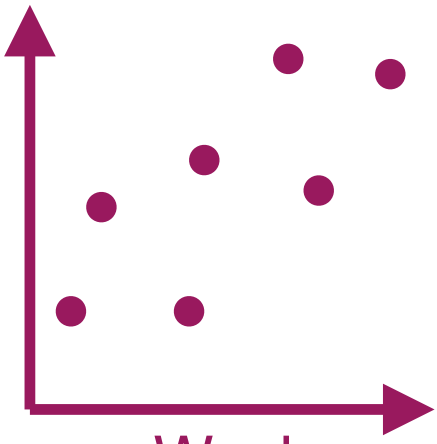
Correlation can be strong or weak.

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.

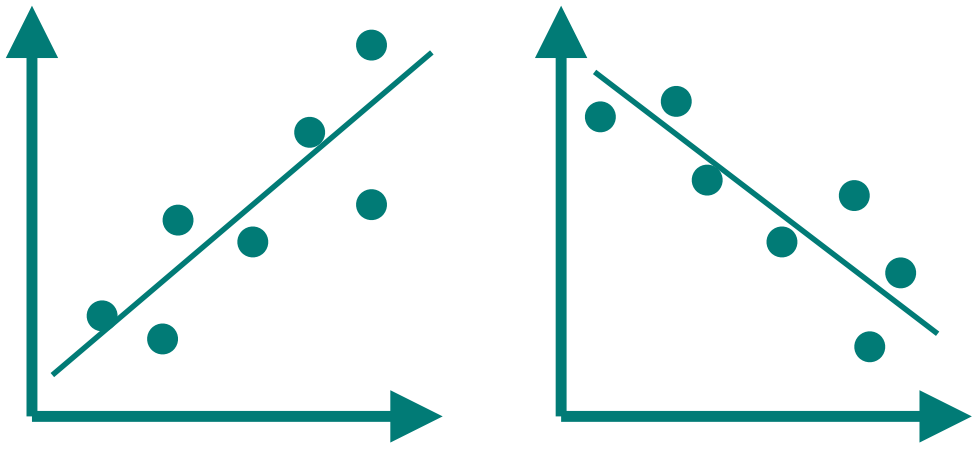


Weak correlation

Line of Best Fit

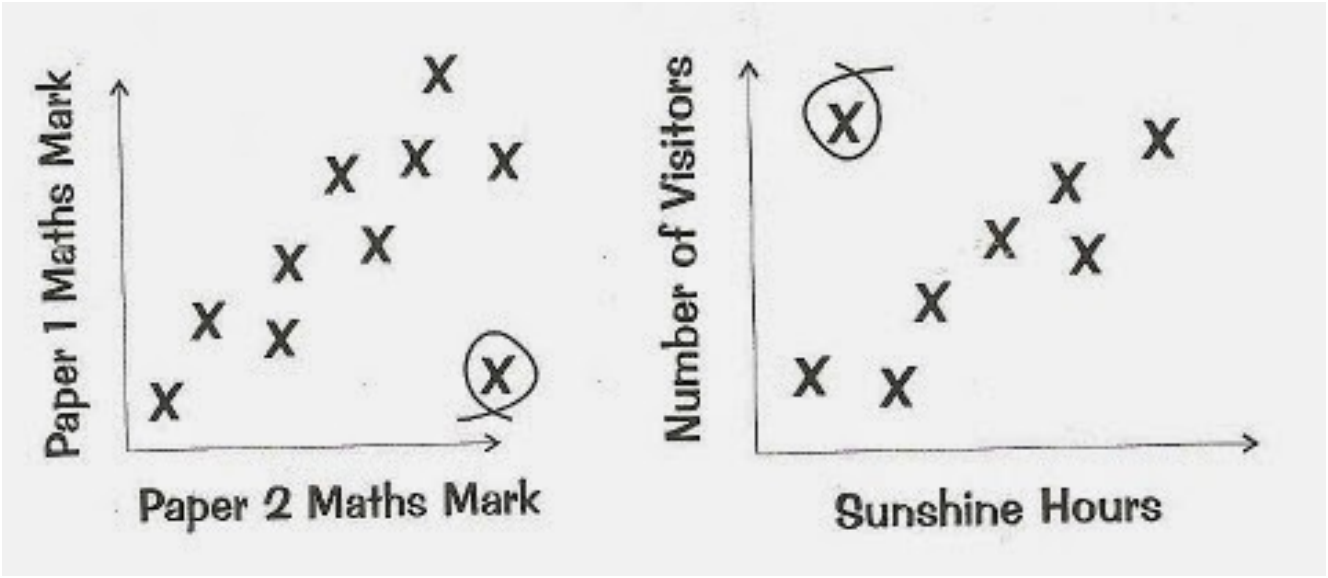
We can show the correlation more clearly by drawing a Line of Best Fit.

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



Outliers

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

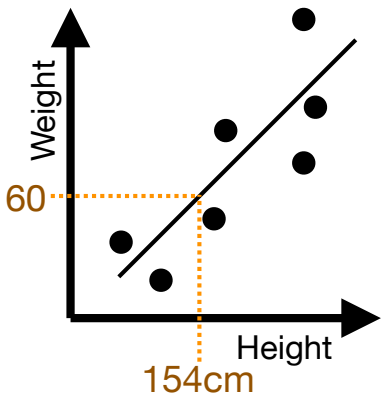


Drawing and Interpreting Scatter Graphs

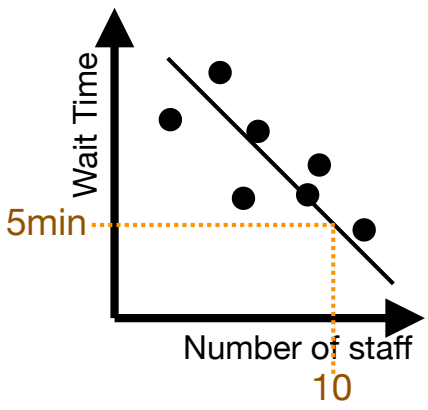
We can use the Line of Best Fit to make predictions of other results.

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.

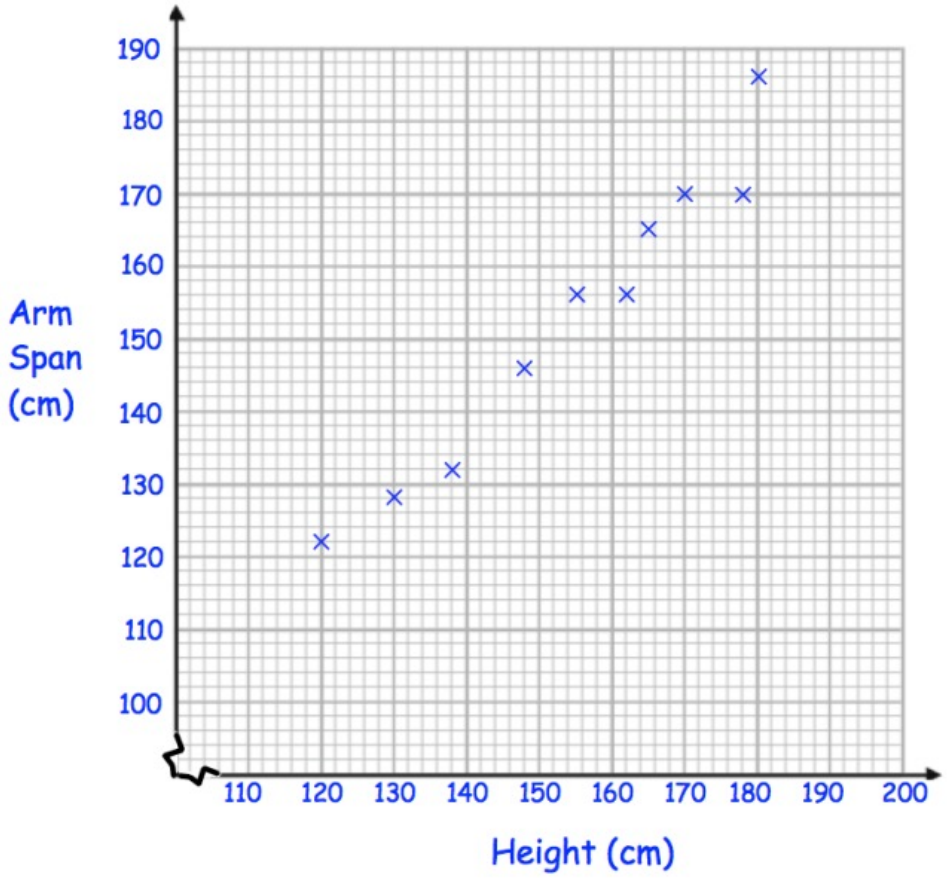


- When we use our line of best fit to estimate a value **inside** the range of our data, this is known as **interpolation**.

- 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.

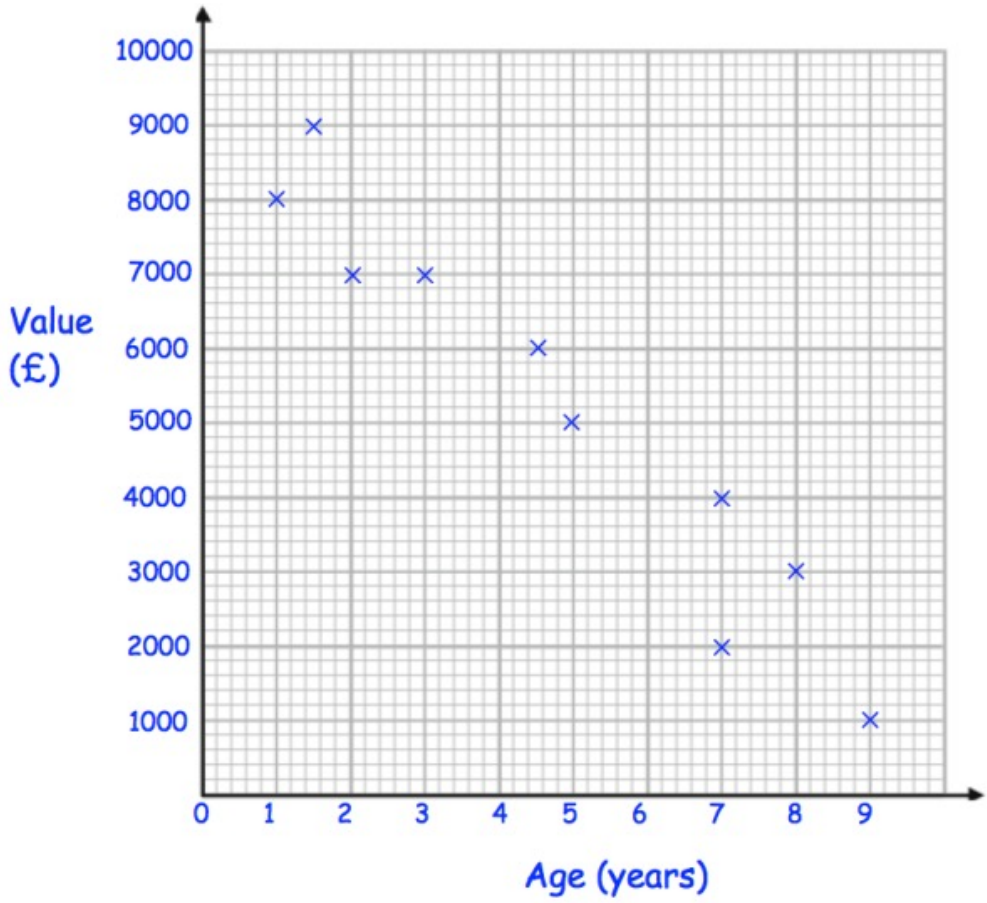


a) Describe the correlation.
b) Another student is $174\ cm$ tall and has an arm span of $180\ cm$. Plot this on the graph.
c) Another student is $142\ cm$ tall. Estimate the arm span of this student.

Dr Frost 244d, 244a and 245c

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.

Fluency Practice

Question 1: Plot the following information as scatter graphs

(a)

Maths score	9	13	6	18	11	4	15	10
Physics score	10	13	5	20	8	5	12	14

(b)

Age, years	4	7	2	4	1	9	3	6
Cost, £	6000	3000	7500	5000	8000	1500	6000	4000

(c)

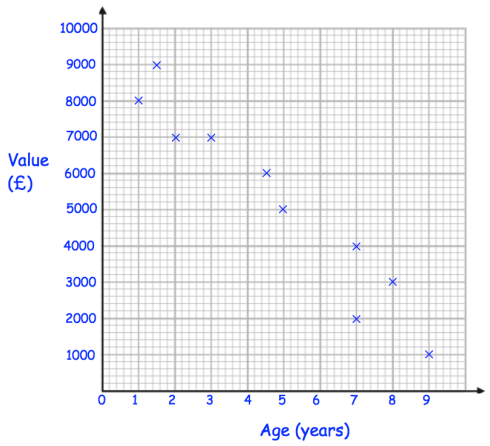
Height, cm	157	160	148	160	177	156	166	170
Weight, kg	53	60	44	53	54	60	54	70

(d)

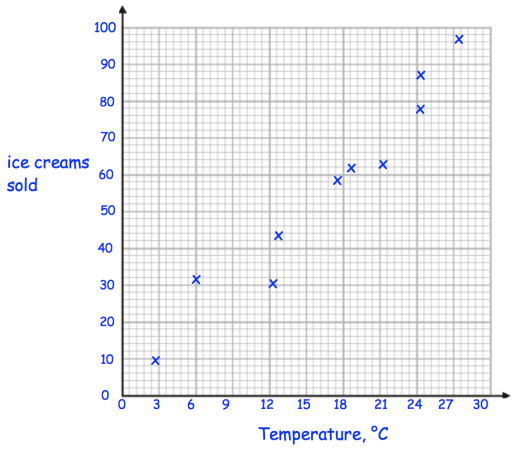
Distance, miles	2.5	0.8	1.2	4.1	2.8	3.3	3.7	1.5
Cost	£3.20	£1.40	£1.80	£4.40	£3.00	£3.60	£4.80	£2.40

Question 2: What type of correlation does each scatter graph show below

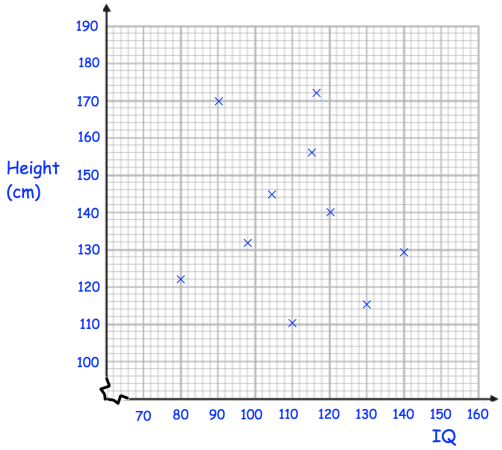
(a)



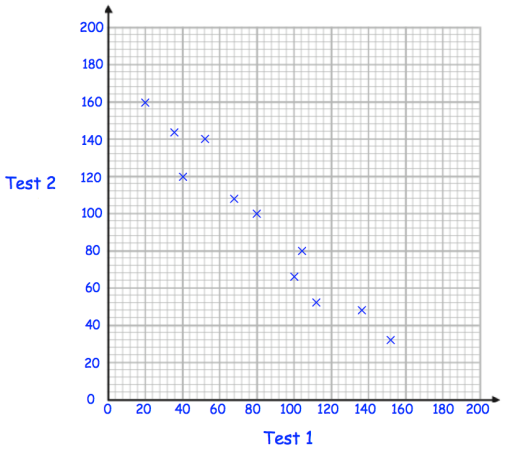
(b)



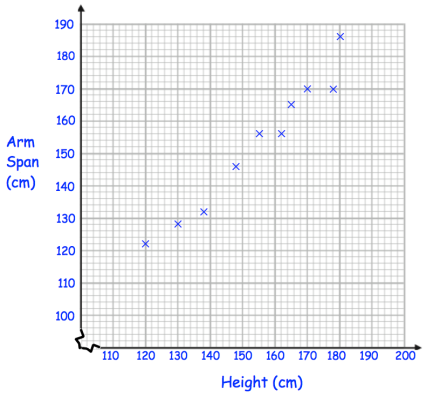
(c)



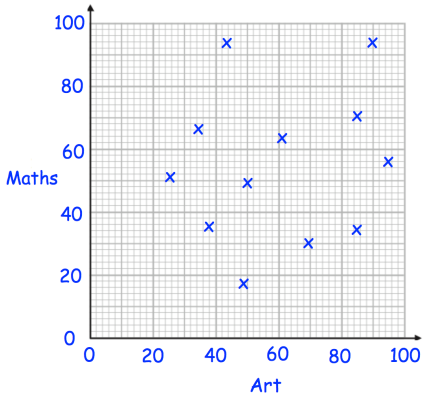
(d)



(e)



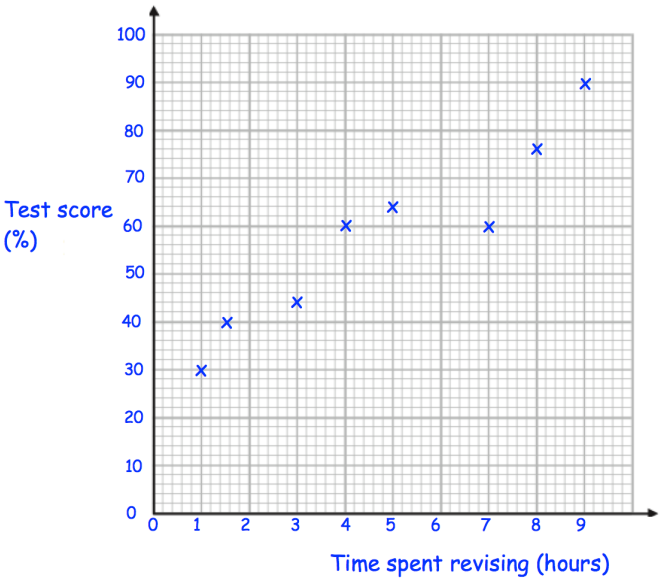
(f)



Question 3: Describe the relationships shown in each scatter graph in Question 2.

Apply

Question 1: The scatter graph below shows information about the number of hours spent revising for a test and the test result for a group of 8 students.



(a) Daisy spent 7 hours revising for the test. What is Daisy's test score?

(b) Harry's test score was 30%. How many hours did Harry spend revising?

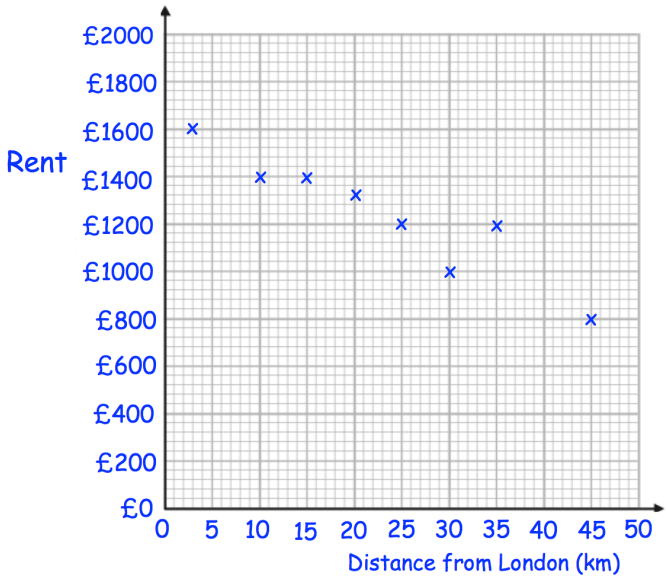
(c) Draw a line of best fit.

(d) Another student spent 6 hours revising for the test.
Find an estimate of their test score.

(e) Explain why it might not be sensible to use the scatter graph to estimate the score for a student that spent 15 hours revising.

Fluency Practice

Question 2: The scatter graph shows information about the cost of renting apartments and their distance from London.



(a) Describe the relationship shown in the scatter graph.

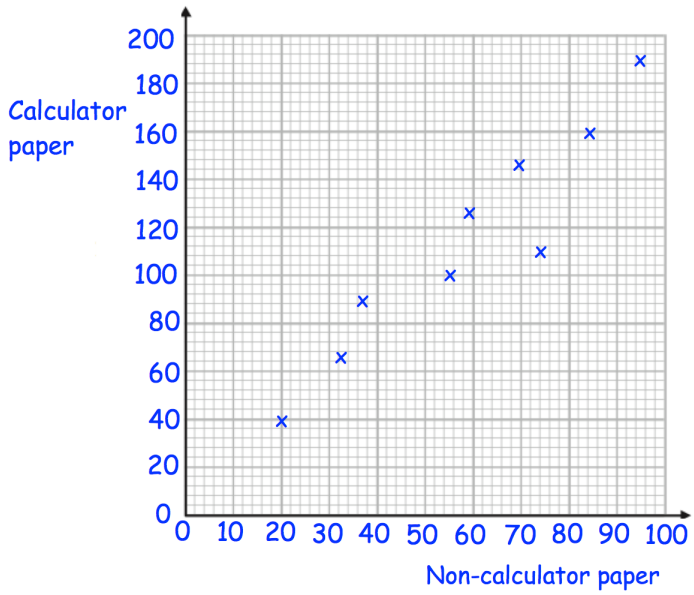
(b) Draw a line of best fit on the diagram.

(c) Estimate the cost of renting an apartment 40km from London.

(d) Victor has £1100 to spend on rent. Estimate how close he could live to London.

(e) Explain why it might not be sensible to use the scatter graph to estimate the price of rent for a property that is 250km from London.

Question 3: The students in a class sit a non-calculator and a calculator maths paper.



Fluency Practice

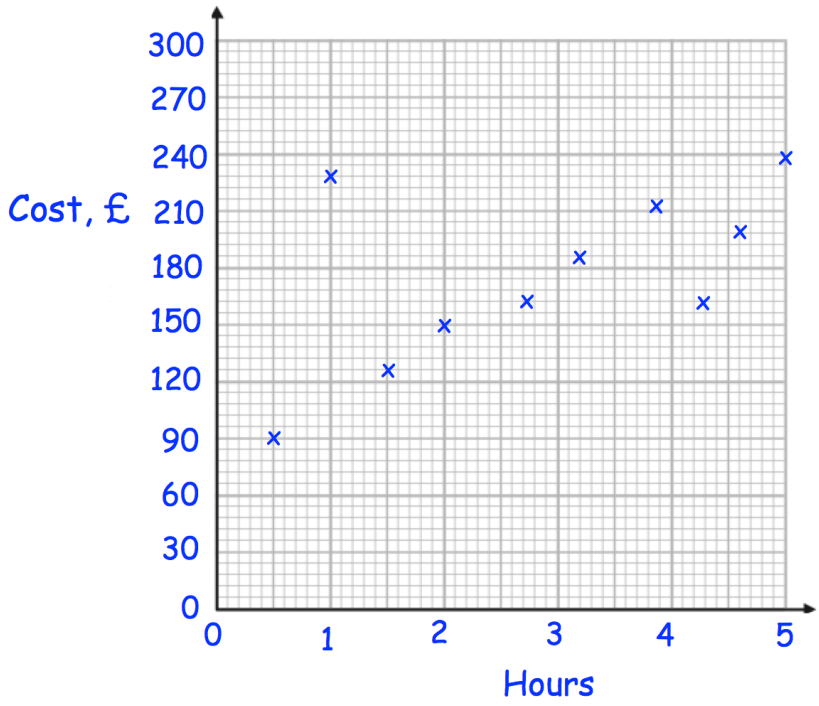
(a) What type of correlation does the scatter graph show?

(b) Draw a line of best fit.

(c) Philip was absent for the calculator paper, but he scored 80 in the non-calculator paper.
Use your line of best fit to predict his calculator paper score.

(d) Neil was absent for the non-calculator paper, but he scored 60 in the calculator paper.
Use your line of best fit to predict his non-calculator paper score.

Question 4: Mr Hughes is a plumber.
The scatter graph shows the cost and the length of his last 10 jobs.



(a) Draw a line of best fit

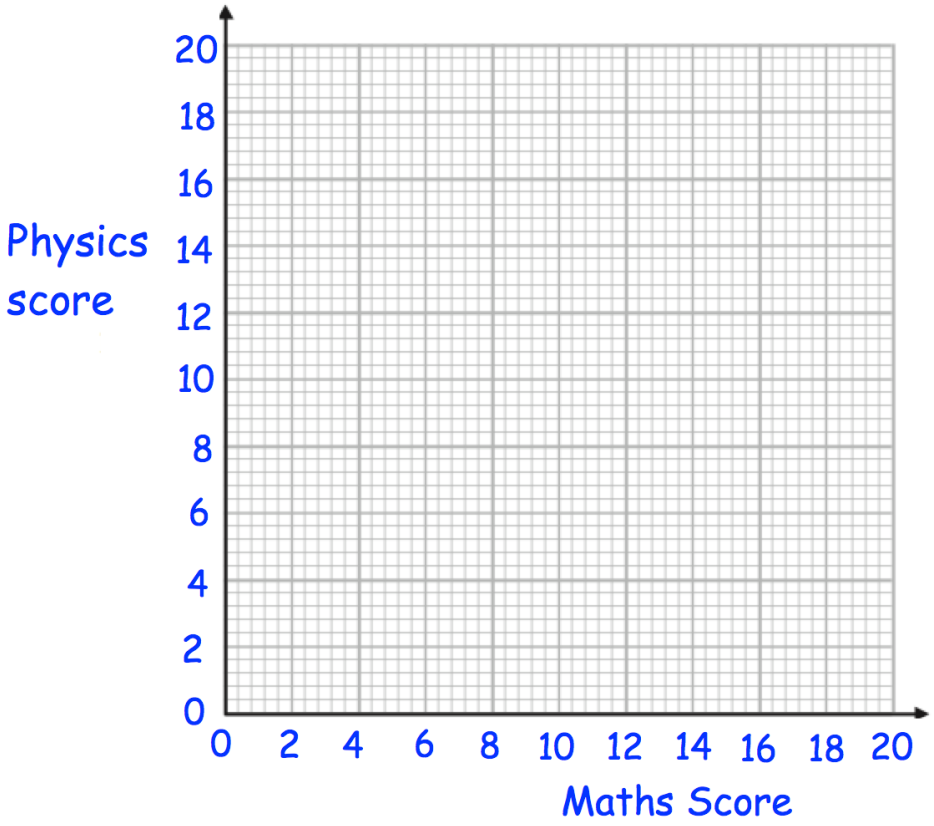
(b) For one job Mr Hughes needed to replace an expensive part that he fitted quickly.
How long did that job last?

(c) Estimate the cost of a job lasting 3.5 hours.

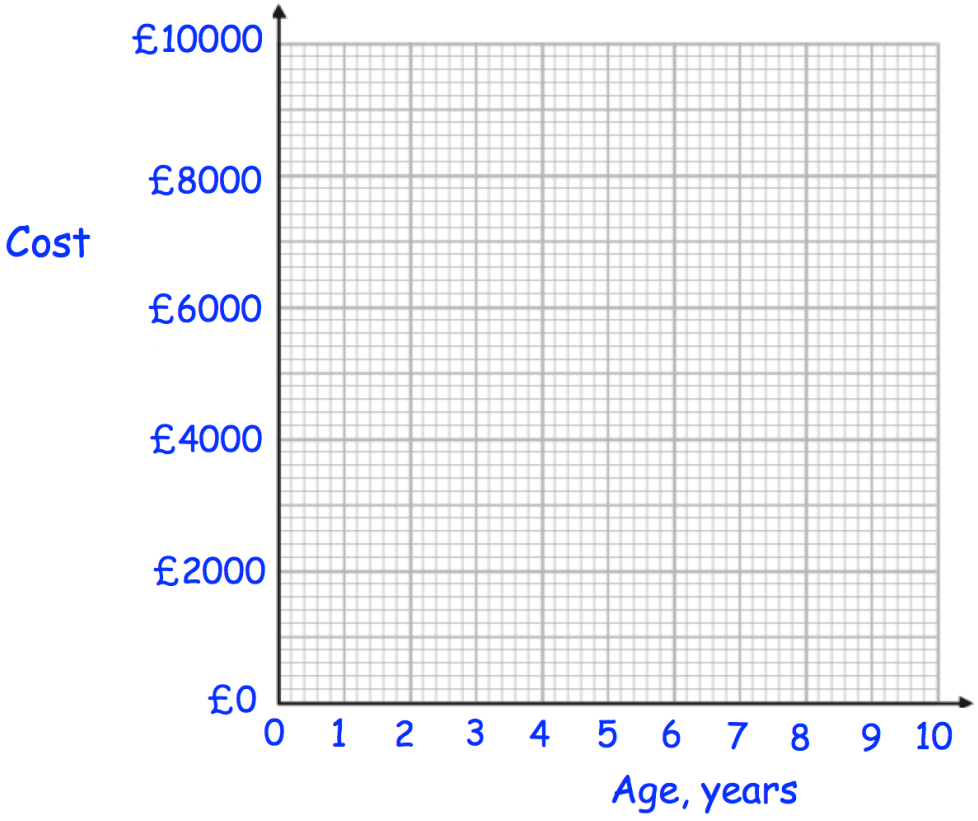
(d) A job costs £120, estimate the length of the job.

Templates

Question 1(a)

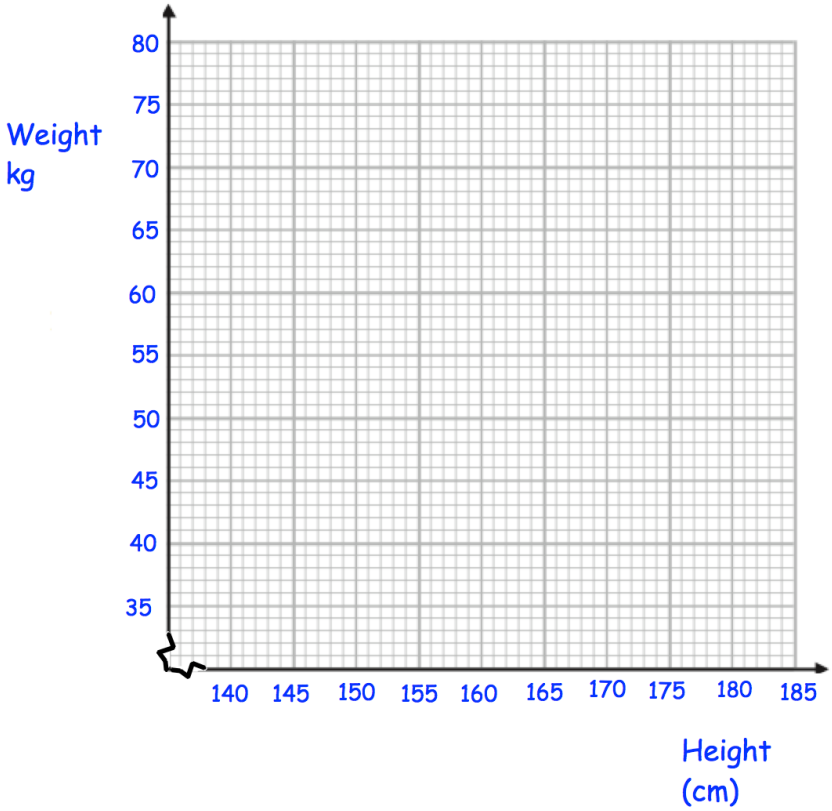


Question 1(b)

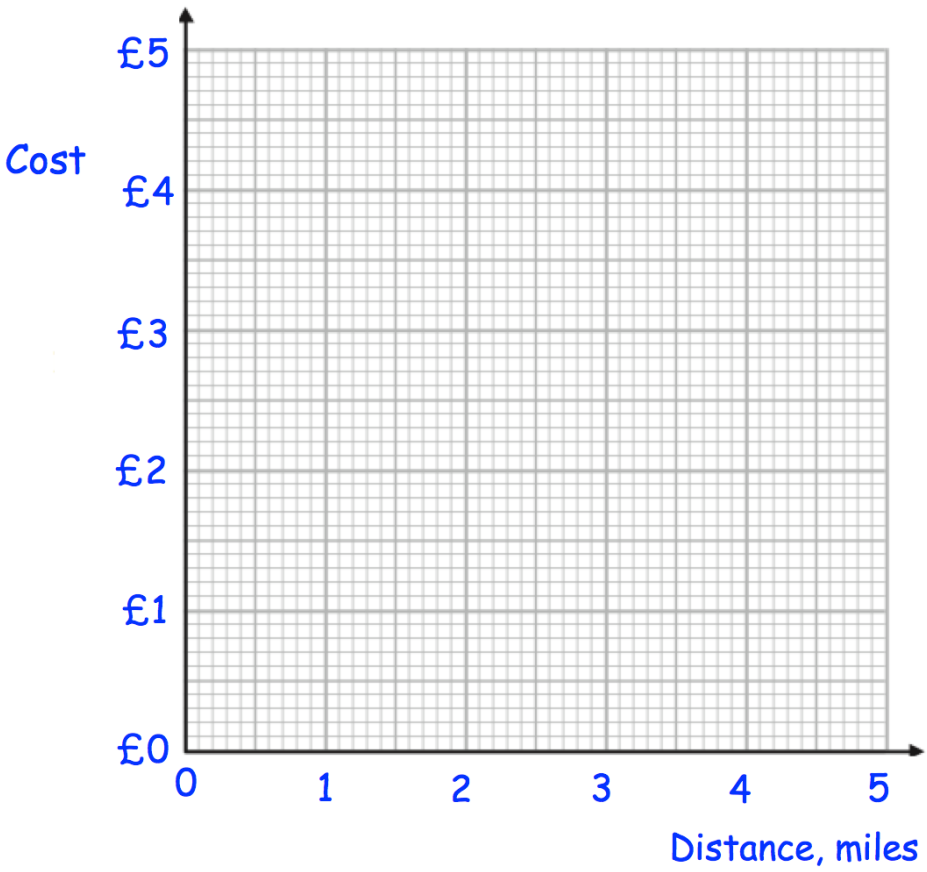


Templates

Question 1(c)

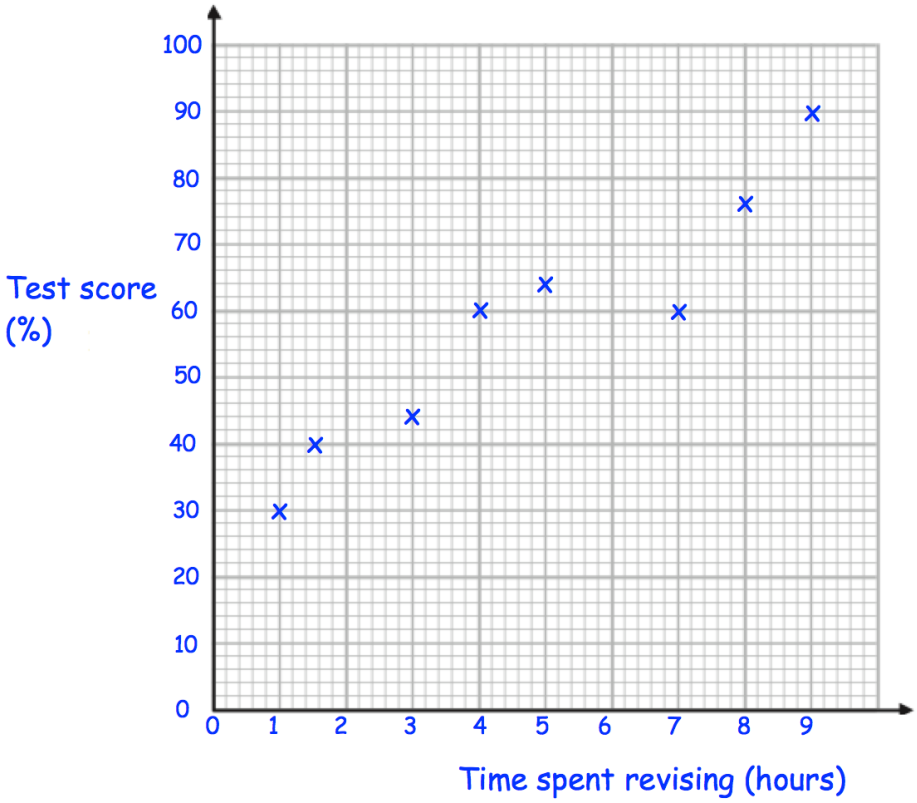


Question 1(d)

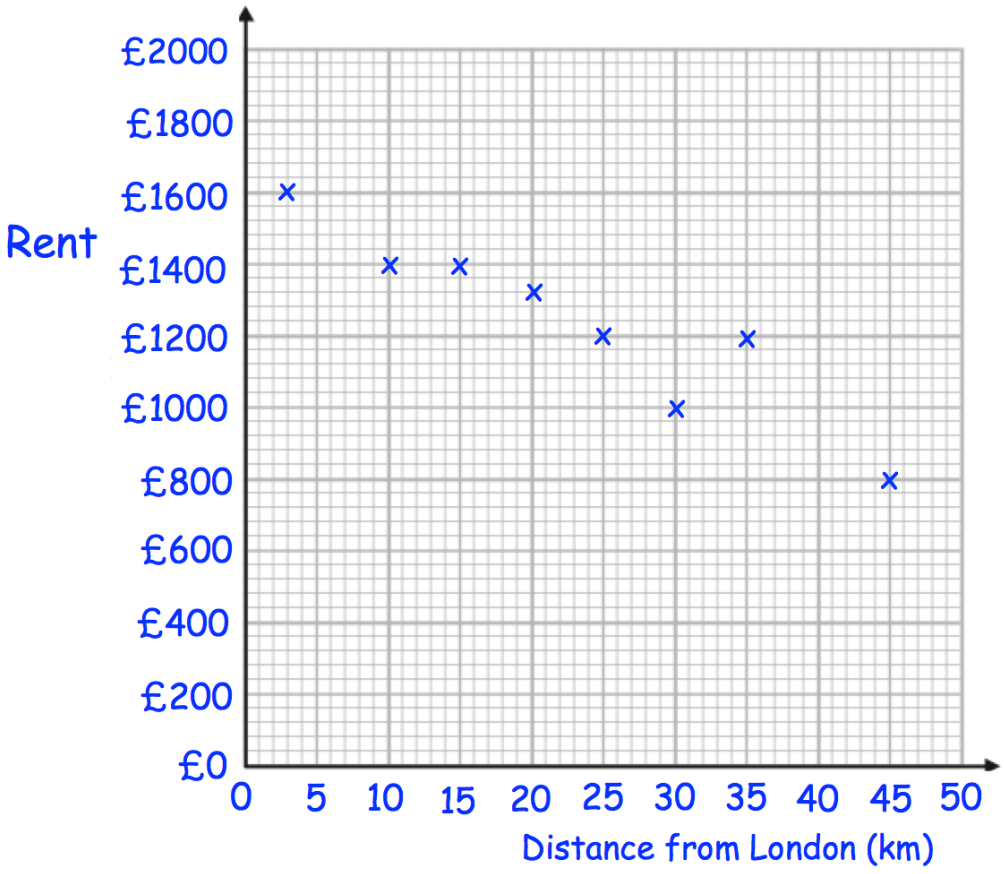


Templates

Apply 1

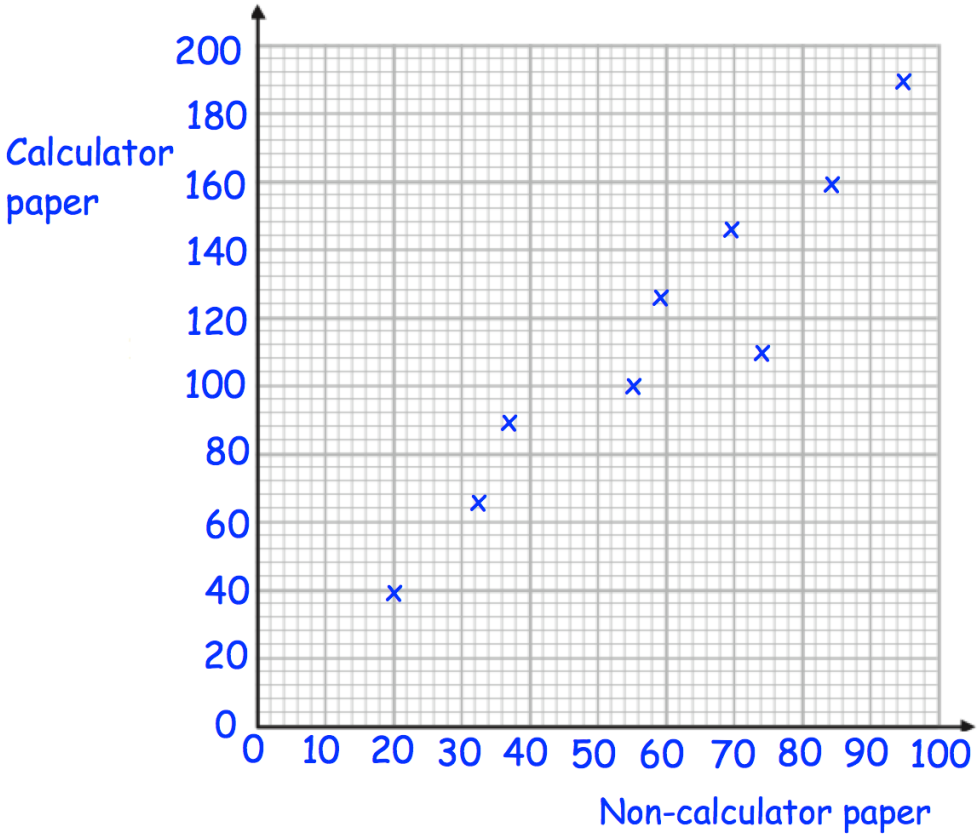


Apply 2

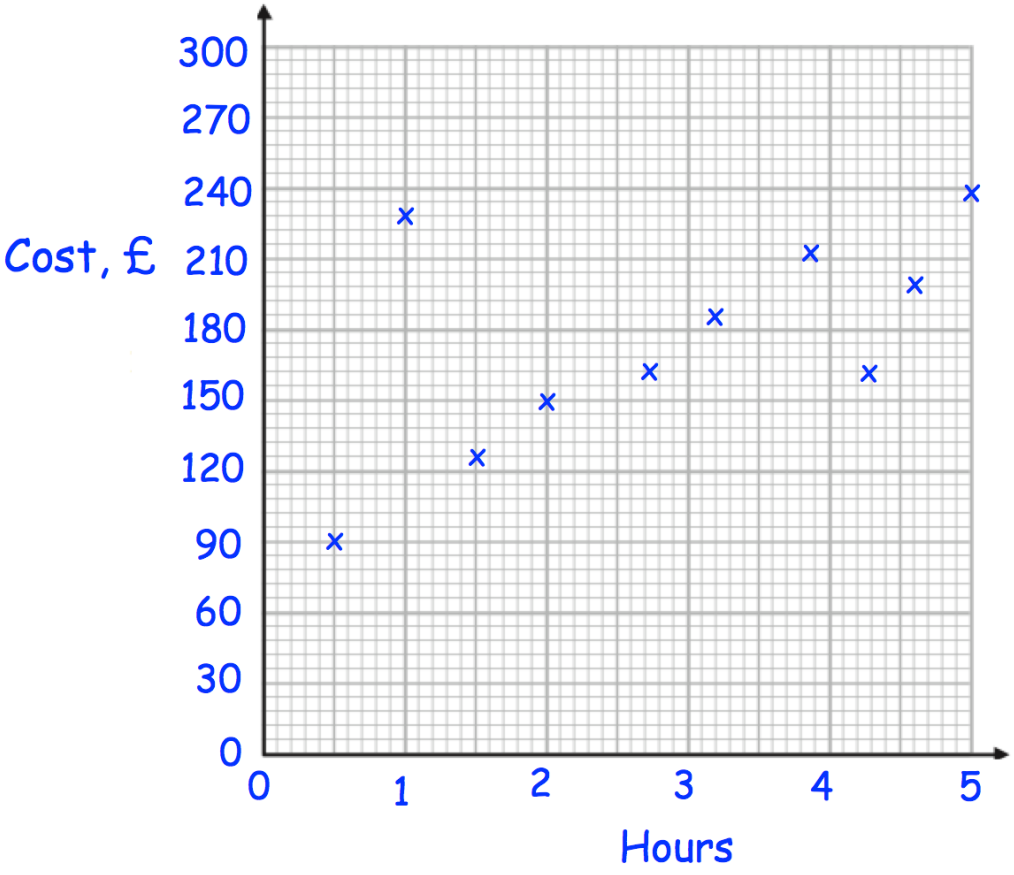


Templates

Apply 3

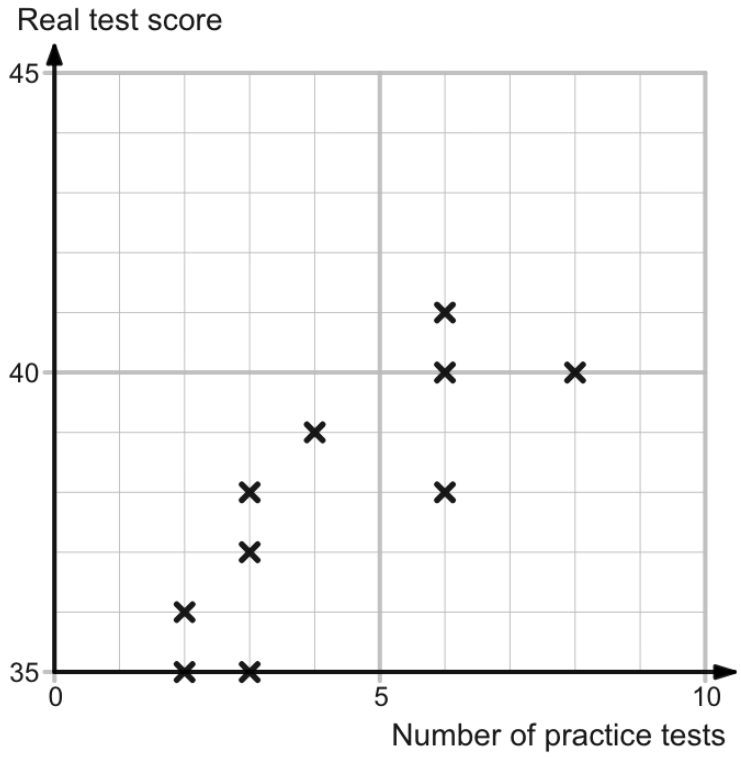


Apply 4



Worked Example

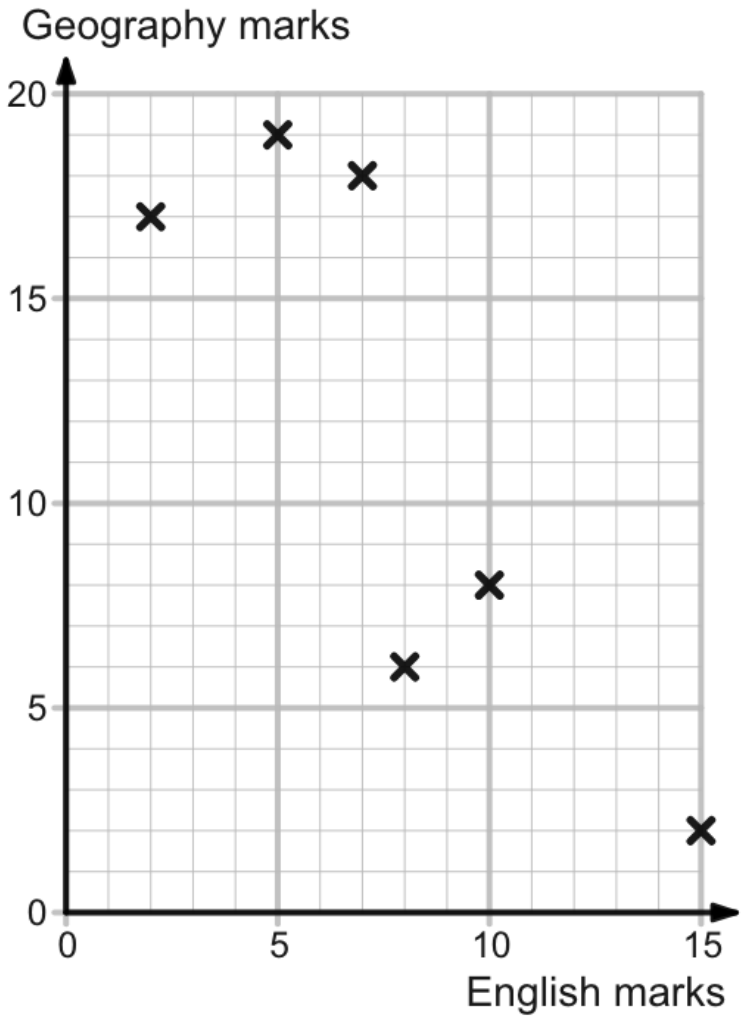
A group of 10 people sat their driving theory test.
Their driving instructor recorded how many practice tests they did and their score in the real test. The information is shown on the scatter diagram below.



Calculate the mean real test score for the 5 students with the smallest number of practice tests.
Give your answer correct to 1 decimal place where appropriate.

Your Turn

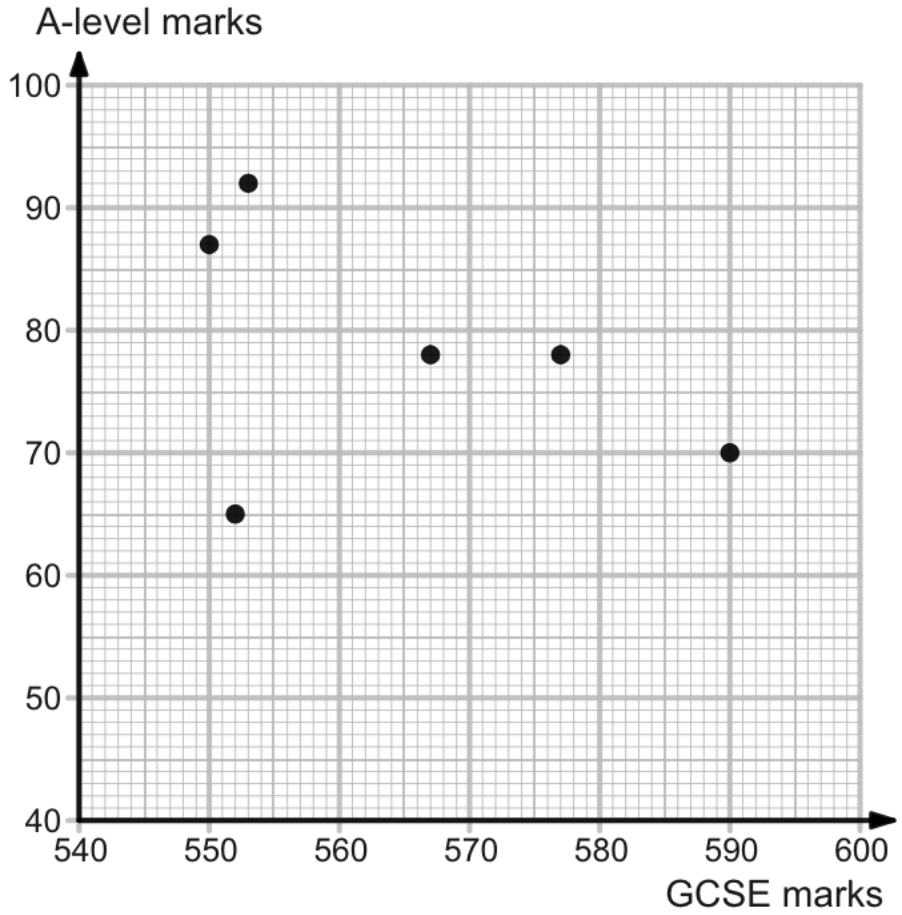
6 pupils each took an English test and a Geography test.
The marks of these pupils are shown on the scatter diagram below.



Calculate the mean Geography score for all 6 students.
Give your answer correct to 1 decimal place where appropriate.

Worked Example

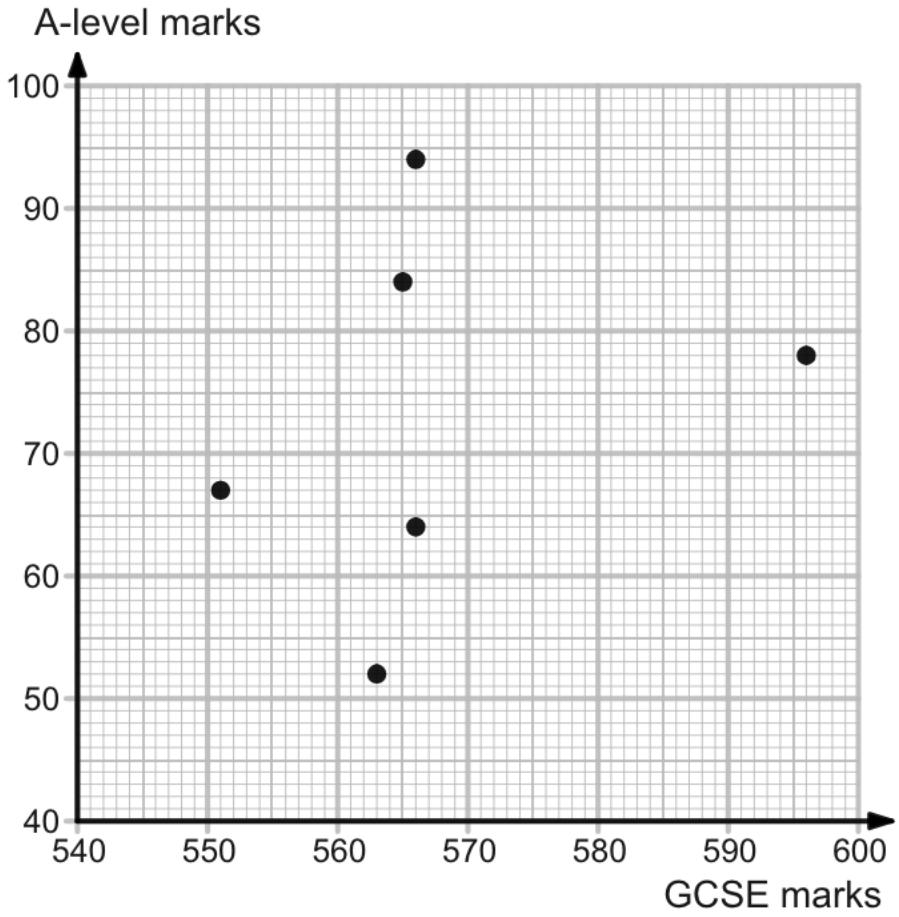
Mehar was investigating the relationship between the marks gained by students in their GCSE Physics exam and the marks gained by the same students in an A-level Physics exam. Mehar drew a scatter diagram to represent the results for 6 students.



Calculate the double mean point of the data. Give your answer correct to one decimal place.

Your Turn

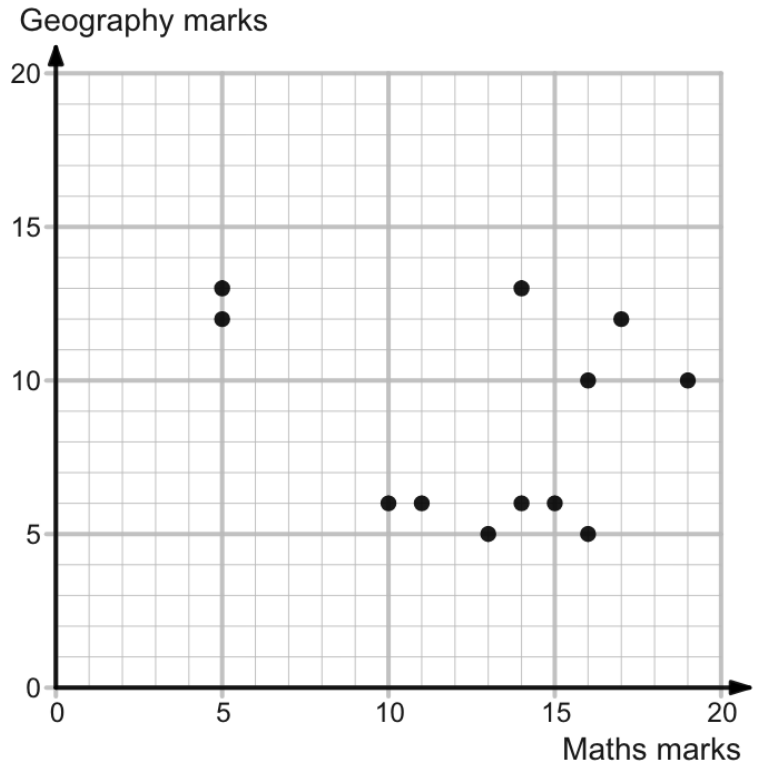
Noah was investigating the relationship between the marks gained by students in their GCSE Chemistry exam and the marks gained by the same students in an A-level Chemistry exam.
Noah drew a scatter diagram to represent the results for 6 students.



Calculate the double mean point of the data. Give your answer correct to one decimal place.

Worked Example

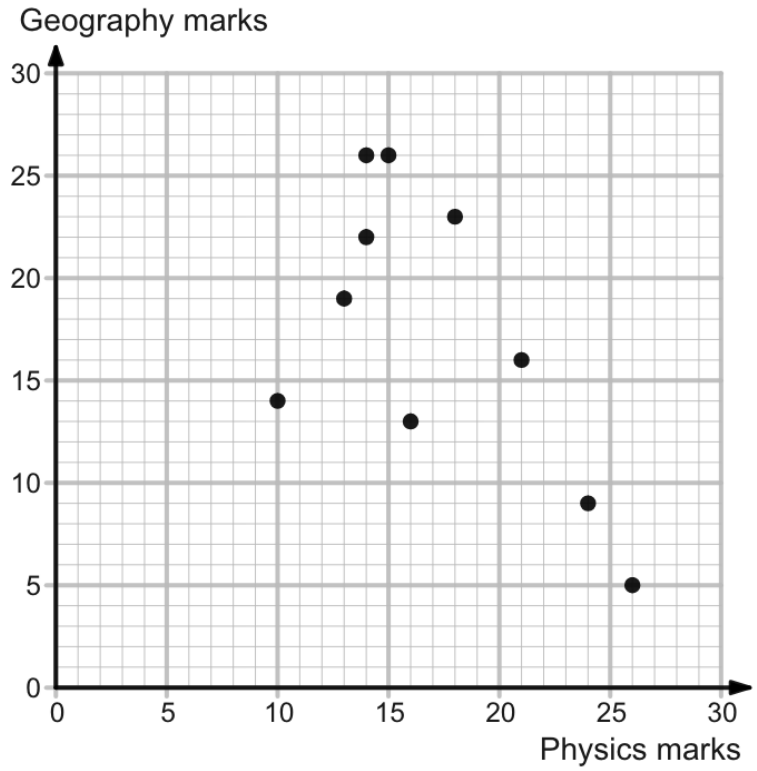
12 pupils each took a Maths test and a Geography test. The results of these pupils are shown on the scatter diagram below.



Calculate the percentage of students whose Geography result was higher than their Maths result. Give your answer correct to one decimal place.

Your Turn

10 pupils each took a Physics test and a Geography test. The results of these pupils are shown on the scatter diagram below.



Calculate the percentage of students whose Geography result was higher than their Physics result.