Had a look ☐ Nearly there ☐ Nailed it! ☐

Hot Topic

Calculator and number skills

These calculator keys are really useful:

x^2	Square a number.
x^3	Cube a number.
x^{-1}	Find the reciprocal of a number.
Ans	Use your previous answer in a calculation.
(−)	Enter a negative number.
$\sqrt{\square}$	Find the square root of a number.
$\sqrt[3]{\square}$	Find the cube root of a number. You might need to press the shift key first.
S⇔D	Change the answer from a fraction or surd to a decimal. Not all calculators have this key.

Order of operations

You need to use the correct **priority of operations when doing a calculation.**

Brackets
Indices
Division
Multiplication
Addition
Subtraction

$(10 - 7) + 4 \times 3^2$
$= 3 + 4 \times 3^2$
$= 3 + 4 \times 9$
$= 3 + 36$
$= 39$

Reciprocals

The reciprocal of a number is 1 divided by that number. You can find it by writing the number as a fraction then turning it upside down.

$7 = \frac{7}{1} \rightarrow \frac{1}{7}$ The reciprocal of 7 is $\frac{1}{7}$

$\frac{3}{4} \rightarrow \frac{4}{3}$ The reciprocal of $\frac{3}{4}$ is $\frac{4}{3}$

You can use the x^{-1} key on your calculator to find reciprocals.

Worked example

Target grade 4

(a) Work out the value of $\frac{\sqrt{8.3}}{12.5 - 7.3}$

Give your answer as a decimal.
Write down all the figures on your calculator display. **(2 marks)**

$\frac{\sqrt{8.3}}{12.5 - 7.3} = \frac{2.88097}{5.2} = 0.554033088$

(b) Find the reciprocal of 12.5. Give your answer as a decimal. **(1 mark)**

$1 \div 12.5 = 0.08$

Read the question carefully. You have to give the answer as a **decimal**, so you might need to use the S⇔D button on your calculator.

Examiners' report

If you have to work out a calculation like this in your exam, you should work out the numerator (top) and denominator (bottom) **separately**, and **write them both down**. Then divide to work out the final answer. Read the question carefully. You have to write down **all the figures** from your calculator display.

Check it!
Check your answer by working out the whole calculation in one go using the key.

Real students have struggled with questions like this in recent exams – **be prepared!**

Now try this

Try doing these **without a calculator**. Make sure you use the correct priority of operations.

Target grade 1

1 Work out
(a) $10 - 3 \times 2$ **(1 mark)**
(b) $84 \div (6 + 6)$ **(1 mark)**
(c) $8 + 3^2$ **(1 mark)**
(d) $(9 - 4)^3$ **(1 mark)**

Target grade 2

2 Work out
(a) $\sqrt{244 + 717}$ **(1 mark)**
(b) $\sqrt[3]{3.1 - 0.356}$ **(1 mark)**

Worked solution video

Use a calculator and give your answers as decimal numbers. You might need to use the S⇔D key to convert a fraction answer to a decimal.

Had a look ☐ Nearly there ☐ Nailed it! ☐

Problem-solving practice 1

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- Sketch a diagram to see what is going on.
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- Plan your strategy before you start.
- Write down any formulae you might be able to use.
- Use x or n to represent an unknown value.

AO2

AO3

Now try this

1 Wilfred has these coins.

Nisha has these coins.

Wilfred gives Nisha one coin. Wilfred now has twice as much money as Nisha.
What value is the coin Wilfred gives to Nisha? **(4 marks)**

Target grade 1

Place value page 1

In money questions you should decide whether you are going to work in pounds or pence. Don't mix up your units.

Remember that if Wilfred gives a coin to Nisha his amount of money is **reduced** by that value and hers is **increased** by the same amount.

TOP TIP

With a question like this it's easy to check your answer. Write down the new amounts of money Wilfred and Nisha have and check that Wilfred's total is twice Nisha's.

2 Liam is planning a trip for a group of 20 children and 5 adults.
They can go to either the theatre or the zoo.
If they go to the theatre, they will go by train.
If they go to the zoo, they will go by coach.
Liam has information about the costs.

Theatre ticket prices	**Return train fares**
Stalls: £22	Adults: £11.50
Circle: £15	Child: £5.75

Zoo admission	**Coach hire**
Adult: £18	20 Seats: £190
Child: £12	30 Seats: £240
	40 Seats: £300

What is the lowest possible total cost of the trip? You must show all your working.
(5 marks)

Target grade 2

Calculator and number skills page 16

Work out the total cost of each trip.
Remember to choose the cheapest ticket price for the theatre tickets, and write down all your working. You have to say which trip is the cheapest to complete your answer.

TOP TIP

Plan how you will lay out your answer. You need to show **what** you are working out at each stage, so write short headings to go with your workings. You could use these headings:

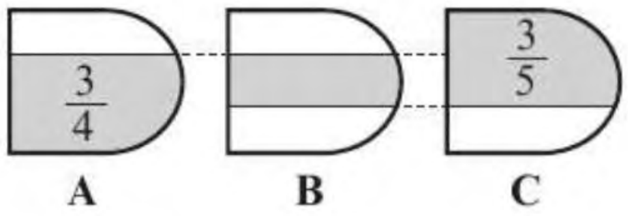
Cost of theatre trip
Cost of zoo trip
Conclusion

Had a look ☐ Nearly there ☐ Nailed it! ☐

Problem-solving practice 2

Now try this

3 The diagram shows three identical shapes.
$\frac{3}{4}$ of shape A is shaded and $\frac{3}{5}$ of shape C is shaded.



What fraction of shape B is shaded? **(3 marks)**

Target grade 3

Fractions page 13

If the whole of each shape is 1, then you can start by working out the fractions that represent the **white** areas on shapes A and C. You can then subtract these from 1 to find the shaded area on shape B.

TOP TIP

You have to **show your strategy**. This means you need to show all your working so it is clear how you have tackled the problem.

4 Susan has 2 dogs.
Each dog is fed $\frac{3}{8}$ kg of dog food each day.
Susan buys dog food in bags.
Each bag weighs 14 kg.
For how many days can Susan feed the 2 dogs from 1 bag of dog food?
You must show **all** your working. **(3 marks)**

Target grade 4

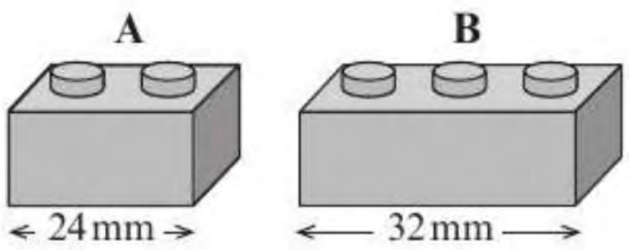
Fractions page 13

There are lots of steps in this question so make sure you keep track of your working.

TOP TIP

If your working is very untidy or hard to follow, then re-write it clearly and cross out your original working.

5 The diagram shows two types of plastic building block.



Block A is 24 mm long.
Block B is 32 mm long.
Jeremy joins some type A blocks together to make a straight row.
He then joins some type B blocks together to make a straight row of the same length.
Write down the shortest possible length of this row. **(4 marks)**

Worked solution video

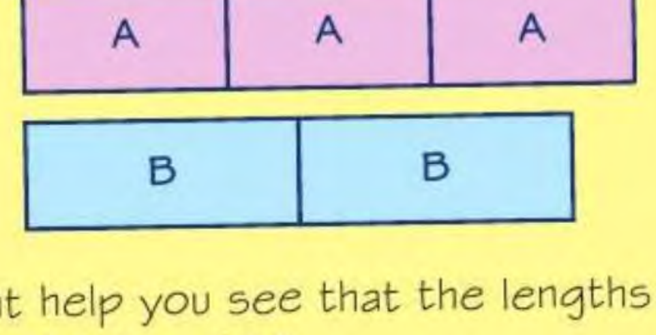
Target grade 4

HCF and LCM page 12

You have to use a **whole number** of building blocks in each row, so the length of each row has to be a multiple of the length of one block. The answer will be the smallest number that is a multiple of 24 and a multiple of 32. This is the **lowest common multiple** of 24 and 32. You can't get all the marks just by writing down the answer. You need to show, clearly and neatly, how you got your answer.

TOP TIP

If you're not sure how to start you could draw a sketch or a scale drawing:



This might help you see that the lengths are multiples of 24 and 32.

Had a look ☐ Nearly there ☐ Nailed it! ☐

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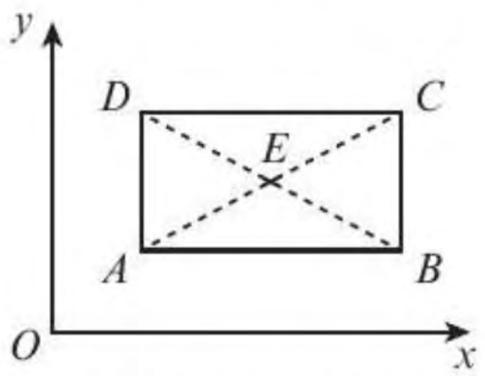
AO2

AO3

Now try this

1 In the diagram, $ABCD$ is a rectangle.



The length AB is twice the length AD.
E is the mid-point of the diagonals of the rectangle.
The coordinates of E are (30, 20).
Work out one set of possible coordinates for points A, B, C and D. **(4 marks)**

Target grade 3

Coordinates page 36

There are lots of different correct answers to this question. Start by picking coordinates for A. In order for the width of the rectangle to be twice its height, the horizontal distance from A to E must be twice the vertical distance from A to E.

TOP TIP

Choose simple numbers to make your calculations easier. The coordinates of the mid-point are multiples of 10, so try using multiples of 10 for the coordinates of the vertices.

2 Dexter uses this formula to work out how long to cook a chicken.

Cooking time in minutes	=	chicken's weight in kg	× 45 + 30

He works out that his chicken will take exactly 1 hour 33 minutes to cook.
Work out the weight of Dexter's chicken. **(3 marks)**

Target grade 3

Rearranging formulae page 50

The units in the formula are minutes, so write 1 hour 33 minutes as a time in minutes.
To find the weight of Dexter's chicken, substitute any values you know into the formula, and then solve the equation to find the missing value.

TOP TIP

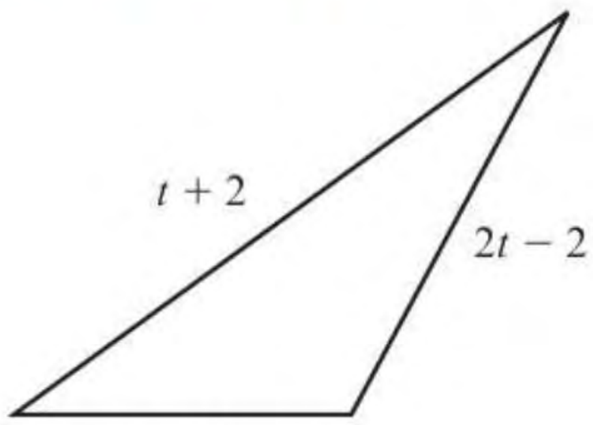
You can represent the chicken's weight in kg as a single letter, for example w, in order to simplify your equation.

Had a look ☐ Nearly there ☐ Nailed it! ☐

Problem-solving practice 2

Now try this

3



The perimeter of this triangle is 13 cm.
All lengths on the diagram are in cm.
Work out the value of ***t***. **(4 marks)**

Target grade 3

Linear equations 2 page 31
Using algebra page 51

Use the information in the question to write an equation. Solve your equation to work out the value of *t*.

TOP TIP

Remember to simplify your equation by collecting like terms before solving.

4 Here are the first four terms of an arithmetic sequence:
9, 15, 21, 27, …
Explain why the number 65 cannot be a term of this sequence. **(3 marks)**

Worked solution video

Target grade 4

Sequences 2 page 35

Work out the *n*th term of the sequence.
Then work out consecutive terms of the sequence on either side of 65.

TOP TIP

You can use any successful strategy to answer a question, as long as you show your method.
You could set the *n*th term equal to 65 and solve an equation to show that *n* is not an integer.

5 A train travels a distance of *y* km in 3 minutes.
Show that the average speed of the train is $20y$ km/h. **(3 marks)**

Target grade 4

Formulae page 26 Speed page 64

You could convert minutes to hours then use the formula for average speed. Or you could find an expression for the distance travelled in 1 minute then multiply by 60.

TOP TIP

Try changing *y* into a number and calculating the average speed. It will give you an idea of how the formula works.

6 A straight line has a gradient of 8 and passes through the point (5, 10).
(a) Determine whether the point (10, 50) lies on the line.
You must show your working. **(3 marks)**
(b) Is your answer to part (a) reliable? Explain your answer. **(1 mark)**

Target grade 5

Straight-line graphs 2 page 39

You could tackle this question using algebra, or by drawing a diagram to scale. Whichever method you use, make sure you write a conclusion.

TOP TIP

If you have to comment on **reliability** then think about the method you used. If you used a diagram your answer might be less reliable than if you used algebra.

Had a look ☐ Nearly there ☐ Nailed it! ☐

Problem-solving practice 1

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AO2

AO3

Now try this

1 A bag contains green, red and blue counters.
20% of the counters are green.
There are three times as many red counters as blue counters.
There are 9 blue counters in the bag.
How many counters are there in the bag in total? **(4 marks)**

Target grade 2

Percentages page 55

There is more than one way to approach this question. One way is to start by working out how many red and blue counters there are in total. This represents 80% of all the counters in the bag.

TOP TIP

You can sometimes solve percentage problems by working out what 1% represents and then multiplying by 100.

2 Suresh wants to buy a new pair of trainers.
There are three shops that sell the trainers he wants.

Sportcentre Trainers	Footwear First Trainers	Action Sport Trainers
£10 plus 10 payments of £3.50	$\frac{1}{4}$ off usual price of £80	£40 plus VAT at 20%

Which shop is selling the trainers the cheapest?
You must show working to justify your answer. **(5 marks)**

Target grade 3

Fractions, decimals and percentages page 56

Percentage change 1 page 57

There are lots of steps in this question so make sure you keep track of your working. You need to calculate the price at each shop, then write down which shop is cheapest.

TOP TIP

Divide the answer space into three columns. Then the examiner can see which shop each bit of working is for.

Had a look ☐ Nearly there ☐ Nailed it! ☐

Problem-solving practice 2

3 At a sixth form college, the ratio of male to female students is 7 : 6
There are 144 female students at the college. How many students are there in total? **(2 marks)**

Ratio 2 page 60 Target grade 4

Use the information in the question to work out what each part of the ratio represents. There are 7 + 6 = 13 parts in the ratio, so multiply your answer by 13 to work out the total number of students.

TOP TIP

Check your answer by dividing it in the ratio 7 : 6

4 Joshua invested £2000 in a savings account for two years. The account pays 2% per annum compound interest.
At the end of the first year he put an extra £1500 into the account.
How much money will Joshua have at the end of the two years? **(4 marks)**

Growth and decay page 63 Target grade 5

Work out the interest Joshua earns on £2000, then add the extra £1500. This is the new starting amount for the second year. So in the second year, Joshua earns interest on this new amount.

TOP TIP

At each step of your working, make a note of what you have worked out. Your notes here could be:

- Interest earned in year 1
- Total starting amount for year 2
- Interest earned in year 2
- Total amount at end of year 2

5 This item appeared in a newspaper.

Cow produces 3% more milk

A farmer found that when his cow listened to classical music the milk it produced increased by 3%.
This increase of 3% represented 0.72 litres of milk.

Calculate the amount of milk produced by the cow when it listened to classical music. **(4 marks)**

Proportion page 67 Target grade 5

When the cow listened to classical music, it produced 103% of the milk it produced originally. You know that 3% represents 0.72 litres.
Use this information to work out what 103% represents.

TOP TIP

You can sometimes solve percentage problems by working out what 1% represents.

Had a look ☐ Nearly there ☐ Nailed it! ☐

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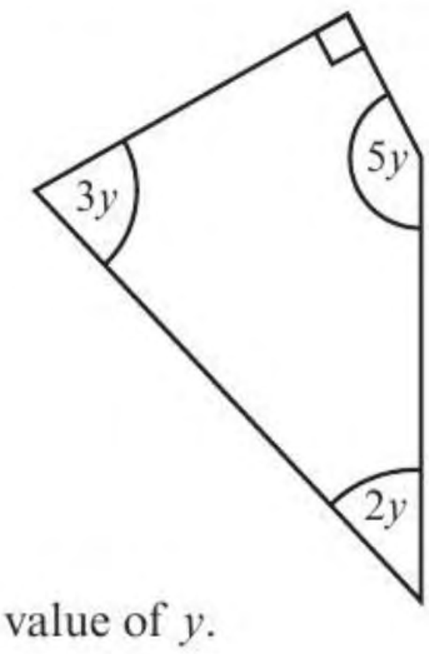
AO2

AO3

Now try this

1 This diagram shows a quadrilateral.



Work out the value of y. **(3 marks)**

Target grade 3

Angles 2 page 74

Using algebra page 51

Start by writing an expression for the sum of the angles in the quadrilateral. Use angle facts to write down what this sum is equal to. This gives you an equation you can solve to find the value of y.

TOP TIP

If you know what unknown angles should add up to, then you can write an equation and solve it to find the value of the unknown.

2 A buoy is 6 km from a ship on a bearing of 290°.
A lighthouse is 8 km east of the ship.
Work out the distance between the buoy and the lighthouse. **(3 marks)**

Target grade 3

Bearings page 102

Scale drawings and maps page 98

You'll need to draw a scale diagram to solve this problem. A good scale to use would be 1 cm = 2 km. Always use a ruler and a sharp pencil to draw any lines and **don't** rub out any construction lines or working.

TOP TIP

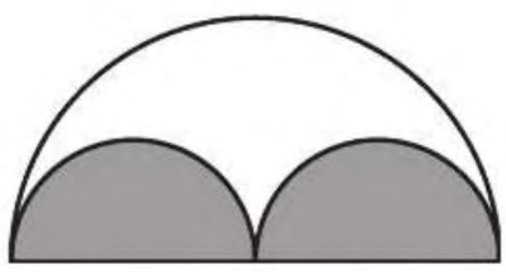
Bearings less than 180° are to the **right** of north.
Bearings between 180° and 360° are to the **left**.
Bearings always have three figures.

Had a look ☐ Nearly there ☐ Nailed it! ☐

Problem-solving practice 2

Now try this

3 The diagram shows a semicircle. It has two identical semicircles drawn inside it.



Show that the shaded area is exactly half of the area of the large semicircle. **(3 marks)**

Target grade 3

Area of a circle page 104

The easiest way to tackle this problem is to choose a value for the diameter of each semicircle. The two small semicircles are identical, so if they both have diameter 2 cm, the large semicircle will have diameter 4 cm. Work out the area of each semicircle using these values, then write a conclusion. Make sure all your working is clear and neat.

TOP TIP

If you aren't given any lengths on a diagram you might be able to:

- use x to represent one of the lengths and write the other lengths in terms of x
- choose some easy numbers yourself for the lengths.

4 A ladder is 6 m long.
The ladder is placed on horizontal ground, resting against a vertical wall.
The instructions for using the ladder say that the bottom of the ladder must not be closer than 1.5 m to the bottom of the wall.
How far up the wall can the ladder reach if the instructions are followed? **(3 marks)**

Target grade 4

Pythagoras' theorem page 90

You should definitely draw a sketch to show the information in the question.

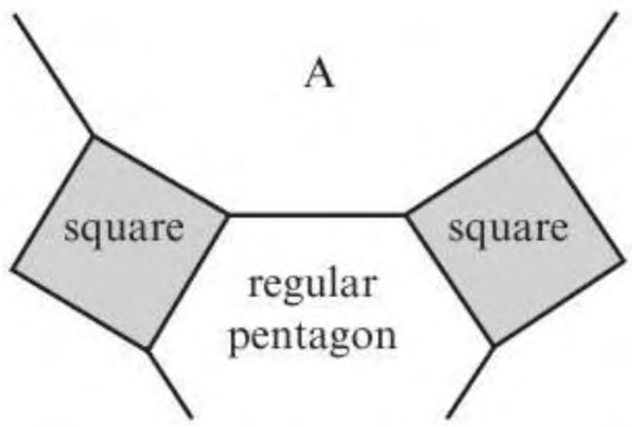
TOP TIP

Be careful when you are working out the length of a **short** side using Pythagoras' theorem.

Remember: $\text{short}^2 + \text{short}^2 = \text{long}^2$

$\text{short}^2 = \text{long}^2 - \text{short}^2$

5



The diagram shows two squares, part of a regular pentagon and part of a regular n-sided polygon, A.
Calculate the value of n. Show your working clearly. **(5 marks)**

Target grade 4

Angles in polygons page 76

Follow these steps:

1. Work out the interior angles of a regular pentagon and a square.
2. Use the fact that the angles around a point add up to 360° to find the interior angle of A.
3. Subtract this from 180° to find the exterior angle of A.
4. Divide 360° by this to work out n.

TOP TIP

If there are a lot of steps in a question it's a good idea to **plan** your answer before you start.

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AO2

AO3

Now try this

1 The table shows information about the numbers of Year 7 pupils absent from Keith's school last week.

	Boys	Girls
Monday	8	10
Tuesday	11	9
Wednesday	12	12
Thursday	14	13
Friday	13	11

Keith wants to compare the data.

Draw a suitable diagram or chart. **(4 marks)**

Target grade 1

Bar charts page 117

Line graphs page 123

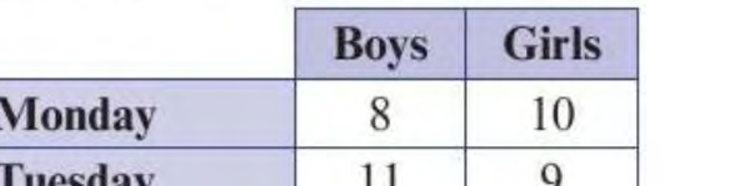
In this question **you** have to choose what type of diagram or chart to use. It is best to use a bar chart or a line graph.

TOP TIP

- Label **both** axes correctly.
- Draw a key for boys and girls, or make sure it is clear which bars (or lines) are for boys and which are for girls.

2 Abi has five cards.

Each card has a number written on it.



The mean of the five numbers is 6.

One of the numbers is hidden.

Work out the hidden number. **(2 marks)**

Target grade 2

Averages and range page 120

You could try some different values for the hidden number and work out the mean each time. But you can save time by using the rule in the Top tip. There are five numbers and the mean is 6, so the sum of the numbers must be $5 \times 6 = 30$.

TOP TIP

$$\text{Mean} \times \text{Number of data values} = \text{Sum of data values}$$

Had a look ☐ Nearly there ☐ Nailed it! ☐

Problem-solving practice 2

Now try this

3 Some students in a class weighed themselves. Here are their results.

Boys' weights in kg

70 65 45 52 63 72 63

Girls' weights in kg

65 45 47 61 44 67 55 56 63

Compare fully the weights of these students. **(6 marks)**

Target grade 3

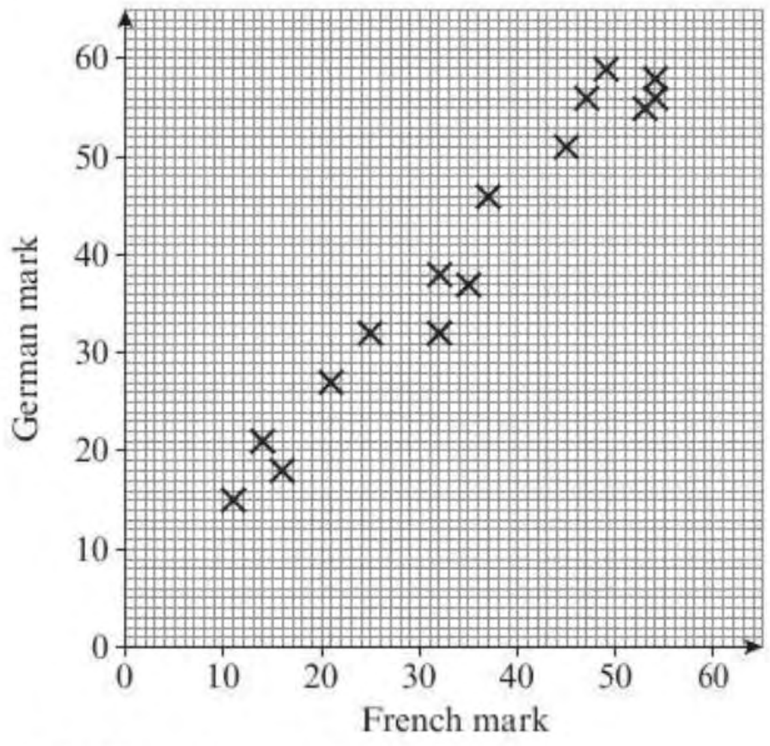
Averages and range page 120

There are **6 marks** for this question.
To give a full answer you need to **compare** the data. So (1) calculate averages like the mean or median and a measure of spread like the range, and (2) write a sentence for each of these, comparing the boys and the girls.

TOP TIP

You need to **calculate** first, then use your calculations to write your **conclusion**. It's safest to write in full sentences for your conclusion.

4 The scatter graph shows the French and German marks of 15 students.



Jade's French mark was 42.
Estimate Jade's German mark. **(2 marks)**

Target grade 4

Scatter graphs page 119

Start by drawing a line of best fit on the scatter graph. Next draw a line up from 42 on the horizontal axis to your line of best fit. Then draw a line across to the vertical axis to estimate Jade's German mark. Make sure you draw the lines you use on your graph to show your working.

TOP TIP

When you are reading information from a graph you should always give your answer to the nearest small square.

5 Amy picks one card at random from group A and one card at random from group B.

She adds together the numbers on the two cards. What is the probability that her total is

(a) 8 (b) 7 (c) an odd number? **(4 marks)**

Target grade 5

Independent events page 133

Counting strategies page 19

You can tackle this in two different ways.

1. Write down all the possible outcomes when two cards are picked.
2. Consider the two picks as two separate independent events, and multiply the probabilities of each.

TOP TIP

In a probability question make sure you have considered all the possible outcomes, and all the successful outcomes.