AQA
Realising potential

GCSE Mathematics – small things make a big difference

Introduction

Taking note of a few small things can make a big difference to the marks of even the best-prepared students.

This PowerPoint highlights where marks are often unnecessarily lost.

It aims to encourage GCSE maths students to invest a small amount of time in ensuring they do not make these same errors.

All of the issues are relevant for Foundation and Higher tier papers.

Overview

The following points are addressed in this PowerPoint. Click on the links to read the different sections.

1. Learning keywords and terminology

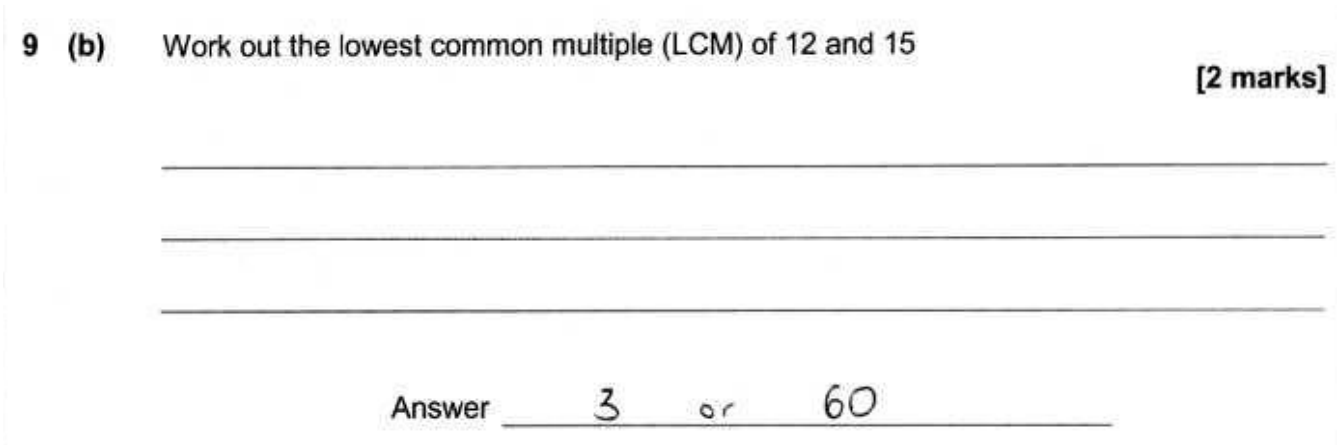
Many students lose marks by not recalling mathematical terminology correctly. These are some of the pairs of words which are often confused with each other:

- factor / multiple
- product / sum
- parallel / perpendicular
- adjacent / alternate
- simple interest / compound interest
- transformation / translation
- congruent / similar

1. Learning keywords and terminology

This student did not know the difference between ‘factor’ and ‘multiple’ so gave both on the answer line.

By not committing to an answer, they did not score any marks.



9 (b) Work out the lowest common multiple (LCM) of 12 and 15

[2 marks]

Answer 3 or 60

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2. Using keywords and terminology correctly

Using keywords and terminology incorrectly lose students marks. Descriptions in words must be precise and concise. Some correct terminology, with their common, incorrect versions are shown below:

- Use **reflection**, rather than 'flip' or 'mirrored'.
- Use **rotation**, rather than 'spin' or 'turn'.
- Use **alternate angles**, rather than 'Z angles'.
- Use **corresponding angles**, rather than 'F angles'.
- Use **alternate segment theorem**, rather than 'alternate theorem'.
- Use **angles in the same segment are equal**, rather than 'bow-tie theorem.
- Use **inter-quartile range** rather than 'upper quartile range' or 'lower quartile range'.

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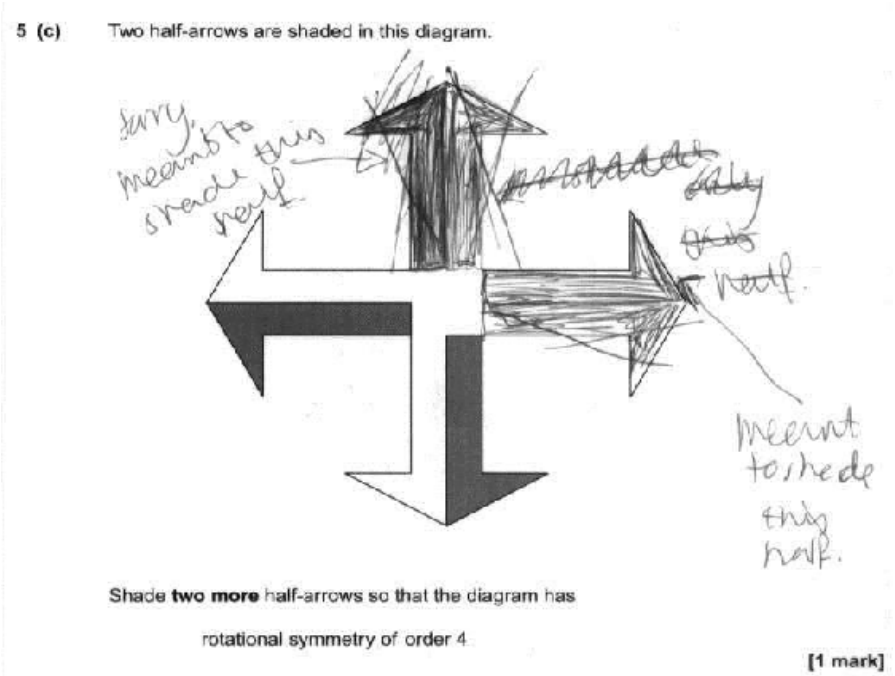
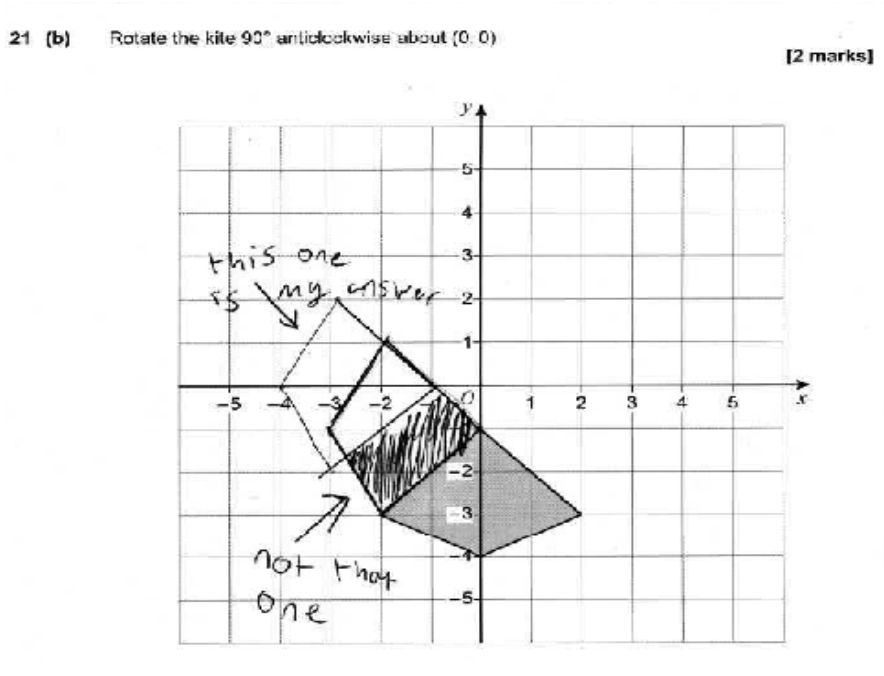
3. Drawing diagrams

When drawing diagrams and graphs, only a sharp HB pencil should be used. Students who make an error when using a pen will have difficulty showing which work they wish to have marked, as these examples show:





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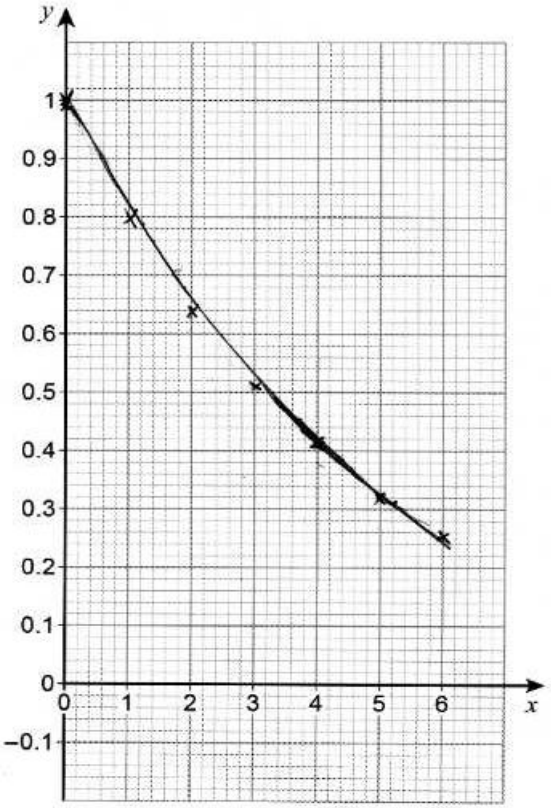
4. Drawing graphs

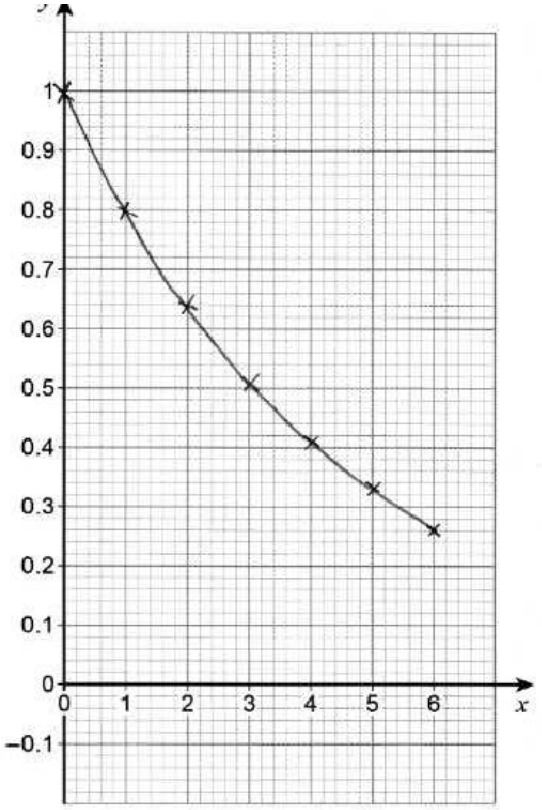
To avoid losing marks when drawing graphs,, students should remember the following:

- Use a sharp HB pencil.
- Plot the points carefully: they must be accurate and lie within a specific tolerance.
- Remember to draw the line or curve.
- Use a single, smooth line that passes through all the points (except lines of best fit, which will not go through all the points).
- Do not 'feather' or sketch a line and do not use a ruler to join the points dot-to-dot.
- Check the points have been correctly calculated and correctly plotted if the curve is not smooth or does not fit on the printed grid.
- Read the scales on graphs carefully – the two axes will often be different.
- Drawing on 1cm grids must still be accurate.
- Cumulative frequency curves must start and finish at the correct points.

4. Drawing graphs

Here are two examples of graph plotting: on the left is a poorly drawn curve which does not score a mark and on the right a fully correct graph.

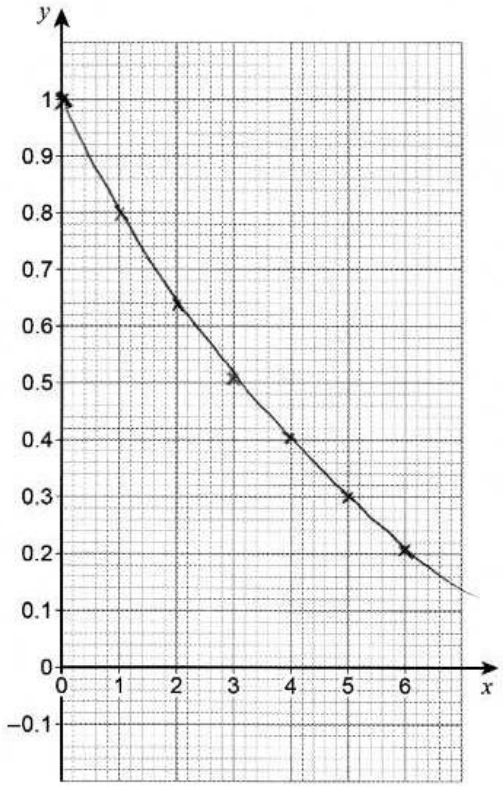




4. Drawing graphs

This student has filled in the table correctly but has not plotted the points accurately and lost two marks.

x	0	1	2	3	4	5	6
y	1	0.8	0.64	0.512	0.4096	0.32768	0.262144



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5. Presentation and setting out of working

Poor quality of presentation and a lack of structured setting out can lead to lost marks. Here are some of the common issues that occur:

- x turns into π or vice versa.
- Miscopying own writing and digits from one line to the next.
- Overwriting an error instead of crossing it out and rewriting alongside.
- 1 and 7 often look too similar.
- 4 and 9 often look too similar.
- $\times$ and + often look too similar.
- Writing is too small.

The setting out of working in multi-step problem solving questions can be particularly poor. Students should be encouraged to use a structured approach where their method can be more easily followed. Using a brief description of what has been found alongside a calculation (e.g. cost of 1 litre of blue paint) is helpful to both students and examiners.

5. Presentation and setting out of working

Writing this small is very difficult to read even when fully magnified

10 (b) From a different city 13 coaches are needed.
Each coach costs £450 to hire.

Work out the total cost of hiring 13 coaches.

[3 marks]

£450 x 3 = £1350

£450 x 10 = £4500

£4500 + £1350 = £5850

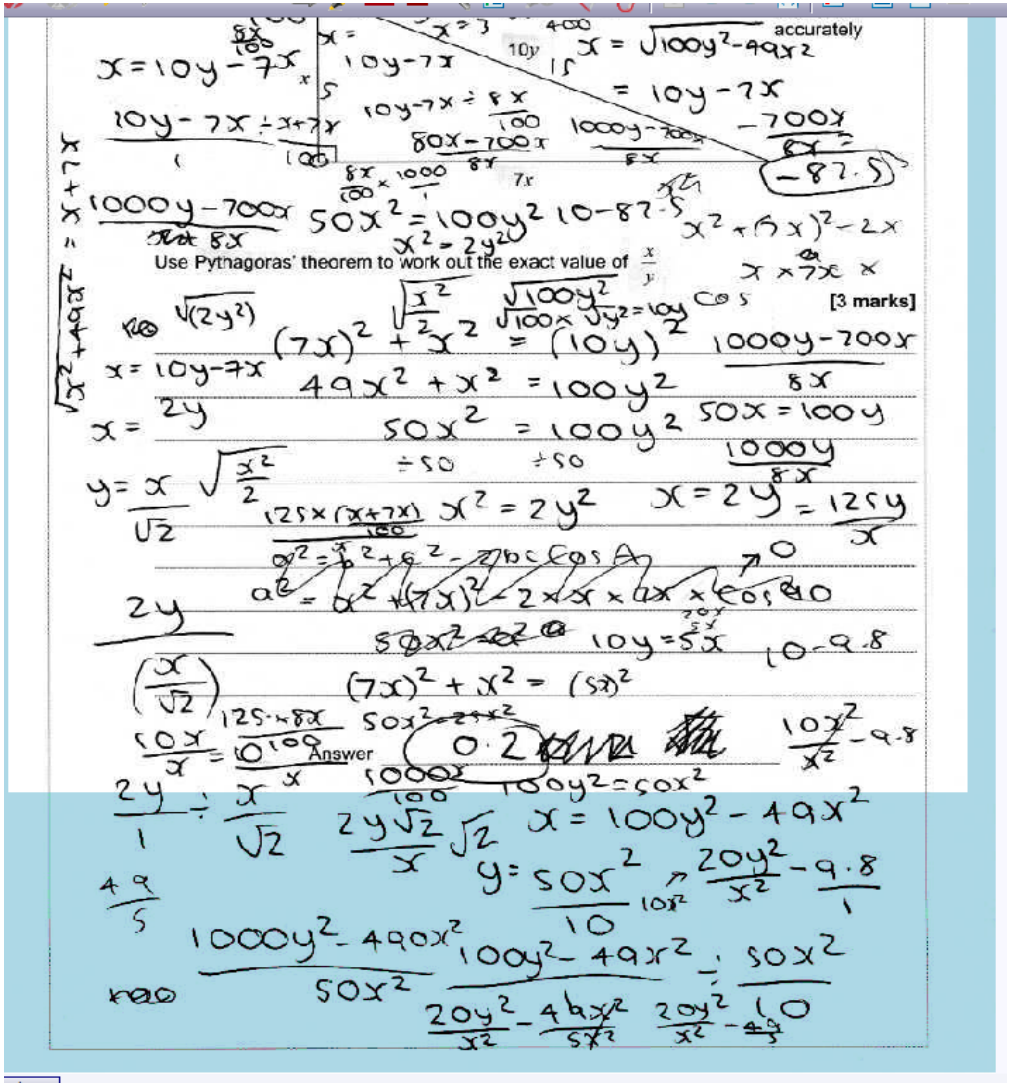
Answer £ 5850

5. Presentation and setting out of working

There is no structure to this response and the several different attempts at answering the question are mixed up.

Some correct working is seen amongst the majority of incorrect working.

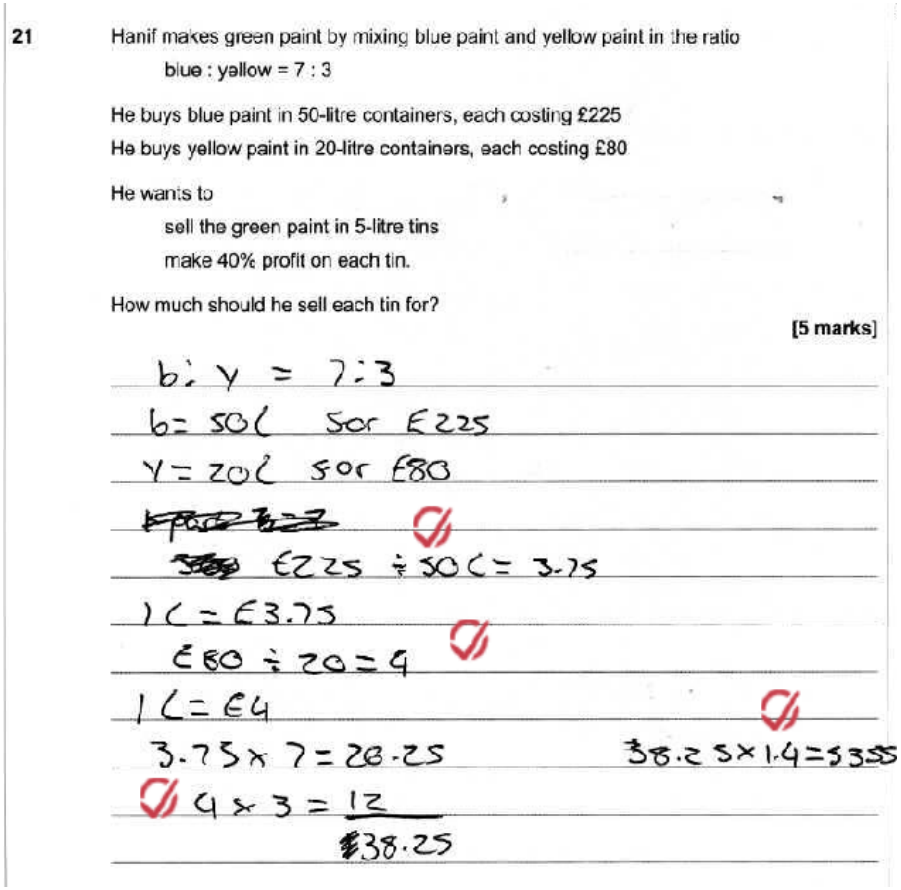
However, the student has not indicated the choice of working to be marked and a response like this, with many attempts, is unlikely to gain any marks.



5. Presentation and setting out of working

This student has shown each step of working out clearly and it is easy to follow the method they have used.

There is an arithmetic error at an early stage and the final division and answer are missing but, because the correct method is shown and is complete, 4 marks out of 5 are awarded.



21 Hanif makes green paint by mixing blue paint and yellow paint in the ratio
blue : yellow = 7 : 3

He buys blue paint in 50-litre containers, each costing £225
He buys yellow paint in 20-litre containers, each costing £80

He wants to
sell the green paint in 5-litre tins
make 40% profit on each tin.

How much should he sell each tin for?

[5 marks]

b : y = 7 : 3
b = 50 s or £225
y = 20 s or £80
~~[illegible]~~
£225 ÷ 50 = 3.75
1 = £3.75
£80 ÷ 20 = 4
1 = £4
3.75 × 7 = 26.25
4 × 3 = 12
£38.25
38.25 × 1.4 = 53.55

5. Presentation and setting out of working

In questions with a comparison, splitting up the answer is an excellent way to set out working.

The method and correct answer for each offer are clearly shown.

No decision is made or indicated, so the question is not fully answered and the final mark is lost.

It is important students check they have answered the question which has been asked.

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10 Mia wants to borrow £6000 and repay it, with interest, after two years.

She sees two offers for loans.

Offer 1	Offer 2
Compound interest	Compound interest
3% per year	First year 1%
	Second year 5%

Mia says,

"I will pay back the same amount because the average of 1% and 5% is 3%"

Is she correct?

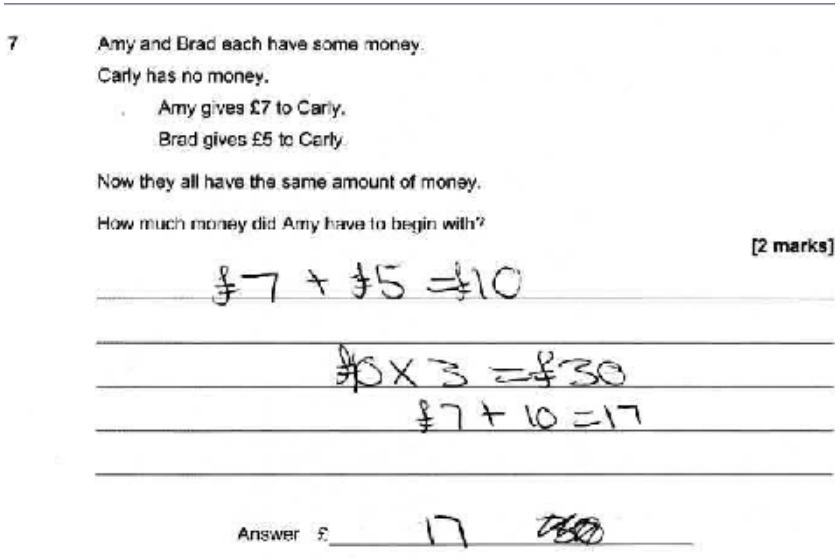
You **must** show your working.

[3 marks]

offer 1	offer 2
£6000 × 1.03² = £6365.4	£6000 × 1.01 = £6060 £6060 × 1.05 = £6363

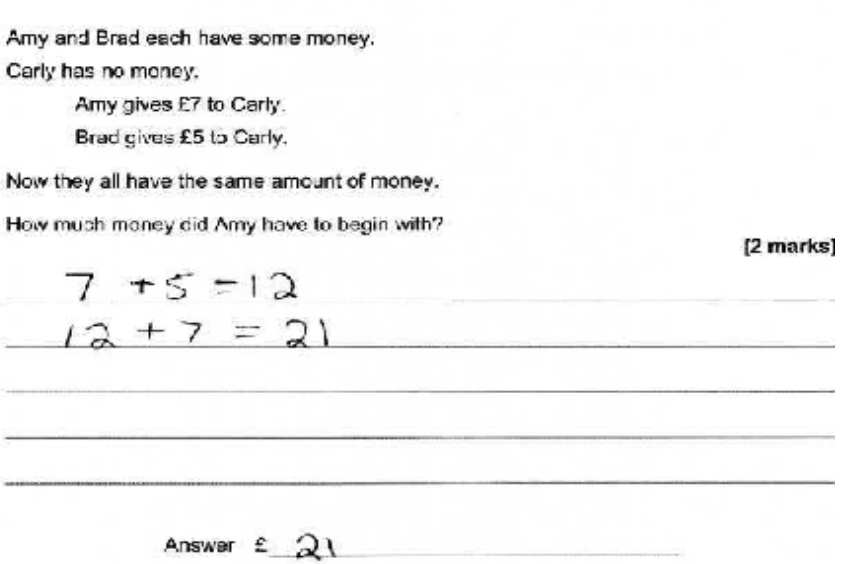
6. Non-calculator arithmetic

Some very basic errors in non-calculator arithmetic are commonly seen on exam papers. Students should adopt the good practice of checking their arithmetic carefully to avoid losing marks.



7 Amy and Brad each have some money.
Carly has no money.
Amy gives £7 to Carly.
Brad gives £5 to Carly.
Now they all have the same amount of money.
How much money did Amy have to begin with?
[2 marks]

£7 + £5 = £10
£5 x 3 = £30
£7 + 10 = 17
Answer £ 17 £30



7 Amy and Brad each have some money.
Carly has no money.
Amy gives £7 to Carly.
Brad gives £5 to Carly.
Now they all have the same amount of money.
How much money did Amy have to begin with?
[2 marks]

7 + 5 = 12
12 + 7 = 21
Answer £ 21

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7. Using a calculator effectively

On calculator papers, it is apparent that many students are using non-calculator methods.

This is particularly noticeable on questions requiring a percentage calculation where build-up methods are often used.

For example, writing 10% = 600 is not considered to be a method and is unlikely to gain any marks for working.

Students must learn and practise efficient use of a calculator.

Mia wants to borrow £6000 and repay it, with interest, after two years.
She sees two offers for loans.

Offer 1	Offer 2
Compound interest	Compound interest
3% per year	First year 1%
	Second year 5%

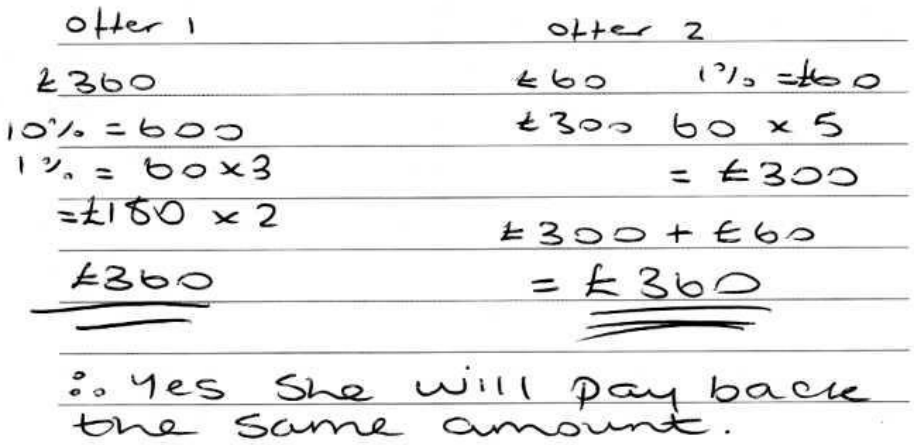
Mia says,

"I will pay back the same amount because the average of 1% and 5% is 3%"

Is she correct?

You **must** show your working.

[3 marks]



7. Using a calculator effectively

Clear working for both offers is shown by this student and, although they have written down an incorrect final value for Offer 2, they still gain two marks out of three.

Miscopying an answer from a calculator onto the exam paper will normally result in losing an accuracy mark.

When a calculator is used for a money calculation, it is important that the final answer has 2 d.p. where appropriate, e.g. £36.80 and not £36.8

10 Mia wants to borrow £6000 and repay it, with interest, after two years.
She sees two offers for loans.

Offer 1	**Offer 2**
Compound interest 3% per year	Compound interest First year 1% Second year 5%

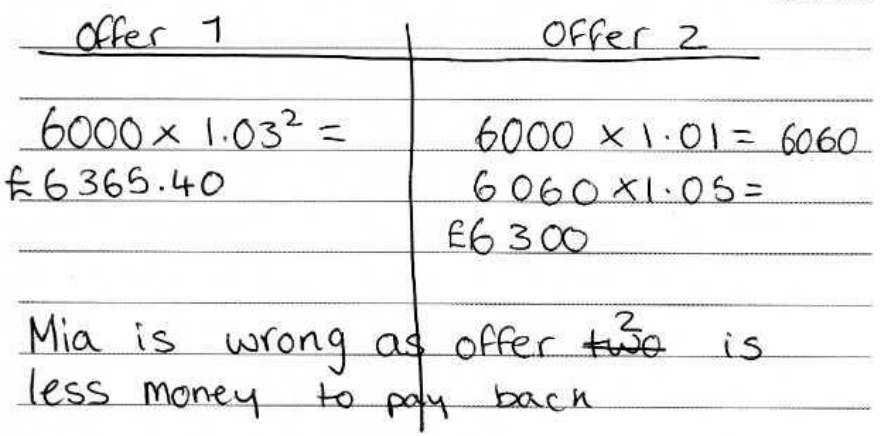
Mia says,

"I will pay back the same amount because the average of 1% and 5% is 3%"

Is she correct?

You **must** show your working.

[3 marks]



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8. Learning and recalling formulae correctly

The formulae which students need to learn and recall correctly are listed in the appendix of the AQA Specification document.

There needs to be a greater emphasis on:

- learning formulae correctly
- knowing which formula to use in a particular context
  e.g. choosing between the sine rule or cosine rule
- recalling formulae correctly
- using formulae correctly
- rearranging formulae correctly.

8. Learning and recalling formulae correctly

This student knows that the quadratic formula is required to answer this question but is unable to recall it correctly and has also assigned an incorrect value to c

No marks are awarded.

18 (b) Solve $x(3x - 9) = 4$

Give your answers to 2 decimal places.

[2 marks]

$3x^2 - 9x = 4$ $3x^2 - 9x = 4$

$a = 3$

$b = -9$

$c = 4$

$\frac{b \pm \sqrt{b \times 4ac}}{2a}$ $\frac{-9 \pm \sqrt{-9 \times 4 \times 3 \times 4}}{6}$ 4.96

-196

Answer 4.96 -1.96

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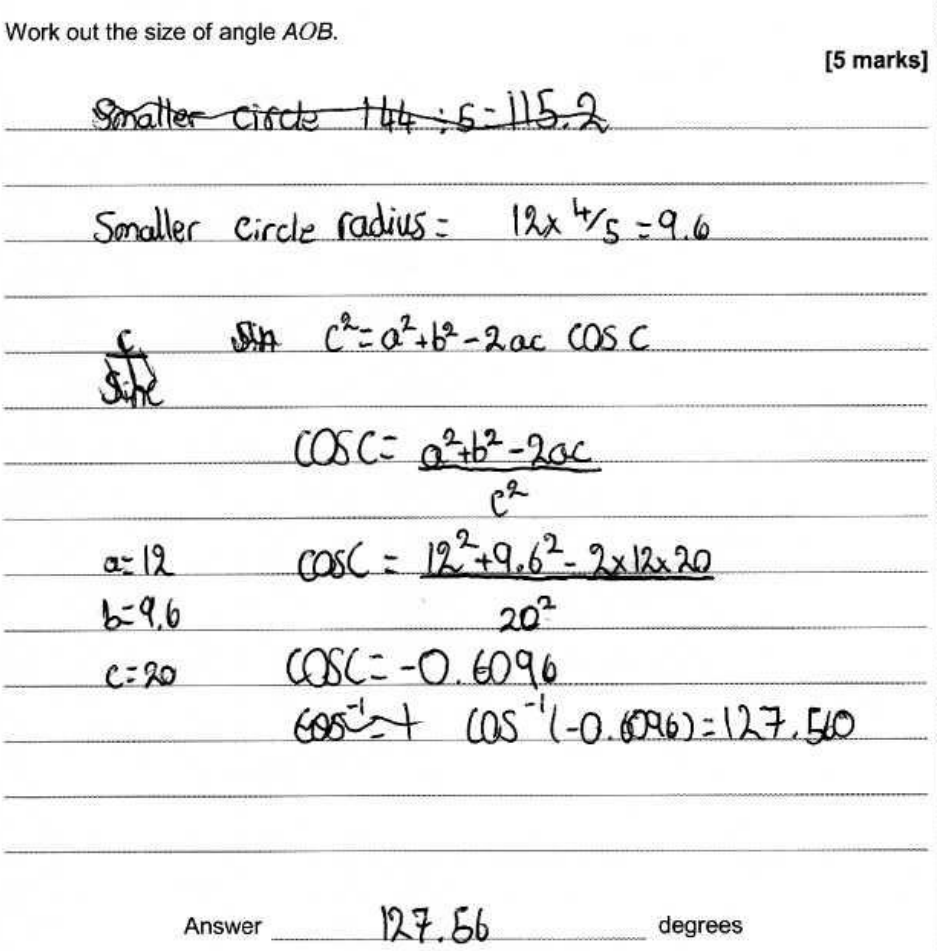
8. Learning and recalling formulae correctly

This student has correctly identified that the cosine rule is required to answer the question and that it must be rearranged to find the missing angle.

However, they have not recalled the formula correctly and performed an incorrect rearrangement. Only two marks out of five are awarded.


Work out the size of angle *AOB*.

[5 marks]

~~Smaller circle 144 ÷ 5 = 115.2~~

Smaller circle radius = $12 \times 4/5 = 9.6$

$c^2 = a^2 + b^2 - 2ac \cos C$

$\cos C = \frac{a^2 + b^2 - 2ac}{c^2}$

$a = 12$

$b = 9.6$

$c = 20$

$\cos C = \frac{12^2 + 9.6^2 - 2 \times 12 \times 20}{20^2}$

$\cos C = -0.6096$

$\cos^{-1} = \cos^{-1}(-0.6096) = 127.56$

Answer 127.56 degrees

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9. Poor use or no use of brackets

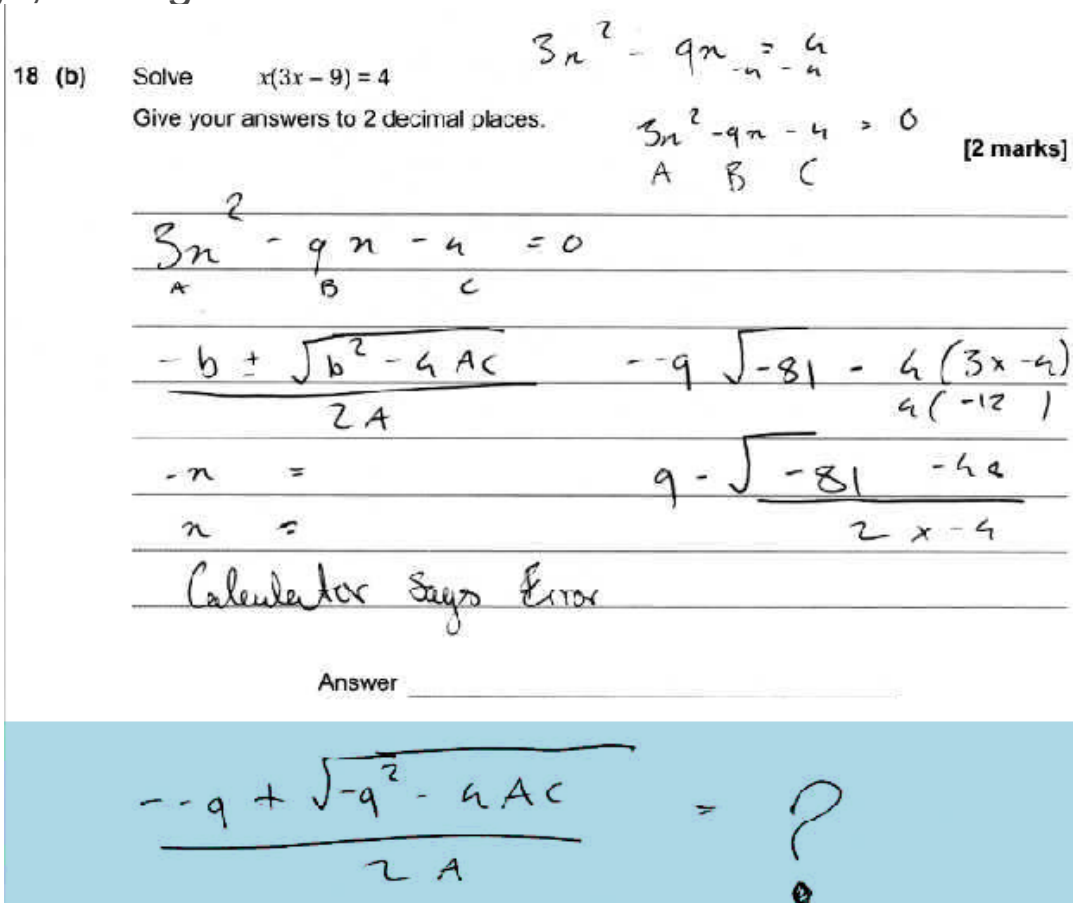
Students often forget to use brackets in their working.

Here are some of the common places where they are missed out:

Common mistake	Incorrect version from exam papers	Correct version
Writing coordinates	5,0 or (5,0	(5,0)
Calculating a mean	$150 + 126 + 138 + 127 \div 4$	$(150 + 126 + 138 + 127) \div 4$
Setting up an algebraic expression or equation from words	'add 10 to x and multiply the answer by 2' written as $2x + 10$	$2(x + 10)$
Using formulae for area or volume	Radius is $1.5r$ Area of a circle = $\pi \times 1.5r^2$	Area = $\pi \times (1.5r)^2$
Using the quadratic formula with negative b	e.g. $b = -9$ b is written as -9^2	$b = (-9)^2$

9. Poor use or no use of brackets

This student has remembered the quadratic formula correctly but missed out the brackets and scored no marks. They have also been careless writing their square root sign, writing 81 as –81 and made a calculation error.



18 (b) Solve $x(3x - 9) = 4$

Give your answers to 2 decimal places. [2 marks]

$3x^2 - 9x = 4$

$3x^2 - 9x - 4 = 0$

A B C

$3x^2 - 9x - 4 = 0$

A B C

$\frac{-b \pm \sqrt{b^2 - 4AC}}{2A}$ $\frac{--9 \sqrt{-81 - 4(3x-4)}}{4(-12)}$

$-x =$ $9 - \sqrt{-81}$ $-4a$

$x =$ 2×-4

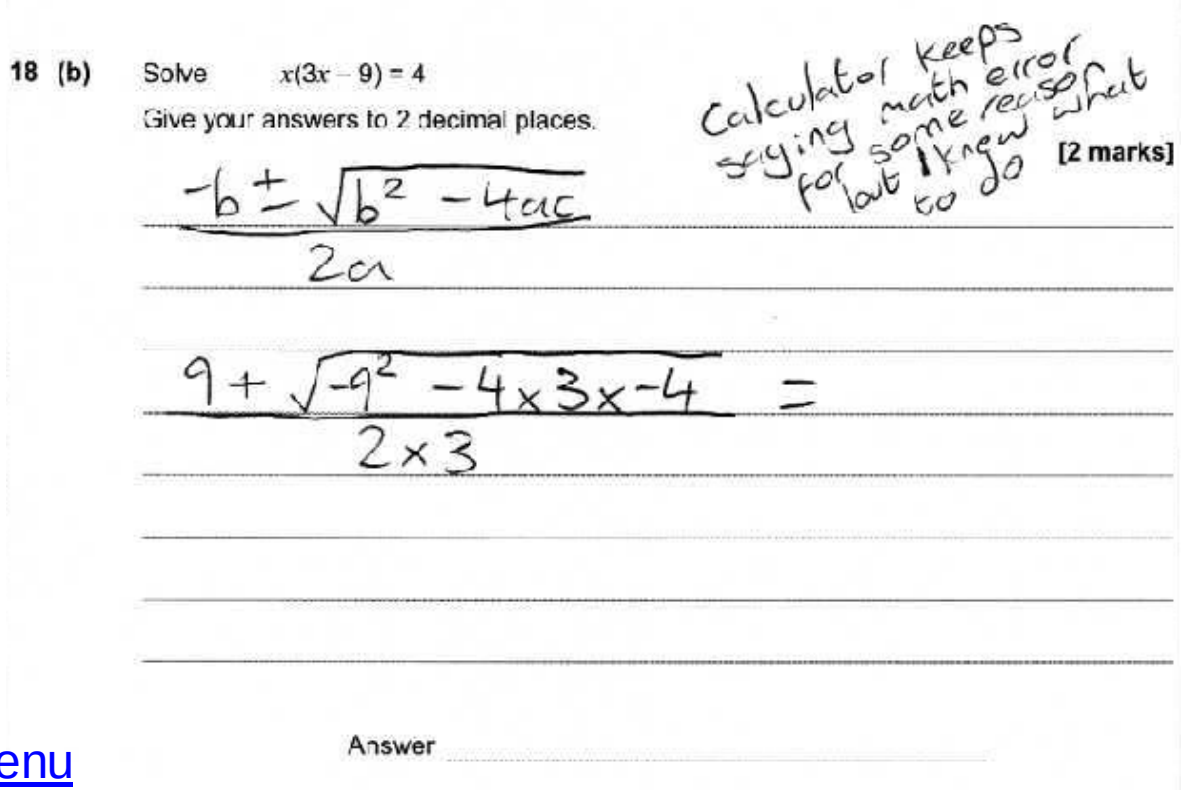
Calculator says Error

Answer _____

$\frac{--9 + \sqrt{-9^2 - 4AC}}{2A} = ?$

9. Poor use or no use of brackets

When the calculator displays 'maths error' it should be alerting the student to check their working. This student has also learnt and recalled their formula correctly but they score no marks as their substitution is incorrect with brackets missing.



18 (b) Solve $x(3x - 9) = 4$

Give your answers to 2 decimal places. [2 marks]

Calculator keeps saying math error for some reason but I knew what to do

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{9 + \sqrt{-9^2 - 4 \times 3 \times -4}}{2 \times 3} =$$

Answer .....

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10. Writing an equation or expression from words

Many students find setting up an equation or expression from words challenging.

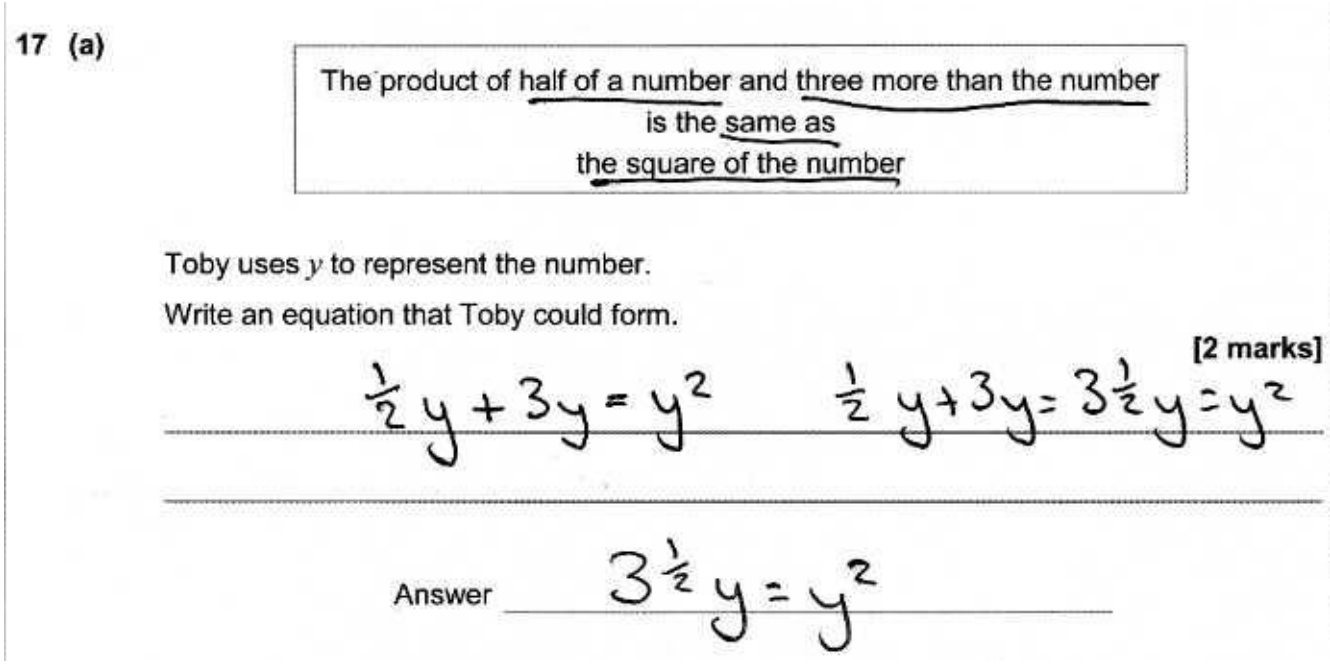
For example they often:

- misinterpret the words ‘product’ and/or ‘sum’
- write ‘length *PR* is 10 km more than length *PQ*’ as $PR + 10 = PQ$ or $10PR$
- write ‘5 more than a number’ as $5n$ or $n - 5$
- write ‘the value of x is double the value of y’ as $y = 2x$
- choose some numbers and use trial and improvement to find a relationship that might work
- use a mixture of letters, especially when writing an equation
- set up an equation but make an error when solving.

There is general reluctance to use algebra to solve a problem in words even when it provides a more straightforward and quicker solution.

10. Writing an equation or expression from words

The word ‘product’ has been interpreted by this student as addition.
‘Three more than the number’ has been interpreted as multiplication by 3.



17 (a)

The product of half of a number and three more than the number
is the same as
the square of the number

Toby uses y to represent the number.

Write an equation that Toby could form.

[2 marks]

$\frac{1}{2}y + 3y = y^2$ $\frac{1}{2}y + 3y = 3\frac{1}{2}y = y^2$

Answer $3\frac{1}{2}y = y^2$

10. Writing an equation or expression from words

The correct letter is used in this response and the student has interpreted the words correctly.

Brackets which are missing in the working are inserted on the answer line, so full marks can be awarded.

The inclusion of the multiplication sign in the final answer is not penalised as the question did not say 'simplify your answer'.

It is also important that × and + signs are clearly written and distinguishable.

17 (a)

The product of half of a number and three more than the number
is the same as
the square of the number

Toby uses y to represent the number.

Write an equation that Toby could form.

[2 marks]

$\frac{y}{2} + y + 3 = y^2$

Answer $\frac{1}{2} y(y+3) = y^2$

10. Writing an equation or expression from words

Correct algebra is used for each of the three distances by this student, who uses the diagram to help them.

A full equation is not set up and, as there is an error using the numbers (170 + 30 instead of 170 – 30), only one mark is scored.

It is important that students can form a correct equation and then solve it without making any errors.

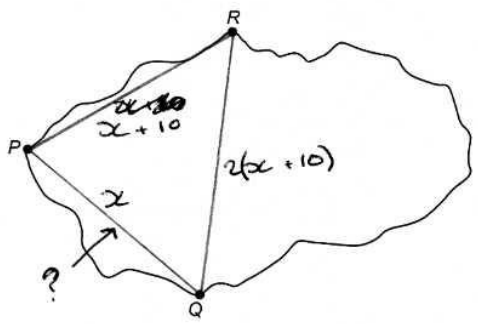
Towns *P*, *Q* and *R* are connected by roads *PQ*, *PR* and *QR*.

PR is 10 km longer than *PQ*.

QR is twice as long as *PR*.

The total length of the three roads is 170 km

Not drawn accurately



Work out the length of *PQ*.

[4 marks]

$2(x + 10) = 2x + 20$

$2x + 20 + x + 10 + x = 4x + 30$

$170 + 30 = 200$

$200 \div 4 = 50$

$x = 50$

PQ = 50

Answer 50 km

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