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OCR
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GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/02 Summer 2023 series

Version 1

ocr.org.uk/maths

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers is also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from our secure Teach Cambridge site (https://teachcambridge.org).

Paper 2 series overview

This non-calculator paper is the second of the three papers taken by foundation candidates for the GCSE (9-1) Mathematics specification.

A variety of numerical methods were evident throughout candidates' papers. One area to highlight is the incorrect use of place value when doing basic arithmetic. This was seen positively when in context (e.g. Question 14(a)), but less when not in a contextual situation (e.g. Question 11).

Many candidates found the later questions in the paper difficult to access, particularly those assessing ratio, vectors, angles in parallel lines, trigonometry, factorising & solving quadratic equations and exterior angles of regular polygons. Other areas that many candidates struggled with were questions involving fractions of time, cube rooting a number, identifying squared number patterns and substituting into formulae. One particular area that candidates found challenging was finding percentages of amounts, particularly in the context of simple interest.

Candidates were given a formulae sheet to use in the examination. It was however often evident that this was not being used to aid candidate's responses.

Presentation overall was good, but some candidates require improvement in the formation of some numbers, mainly 4, 9 and 5. Appropriate use of basic equipment (such as a 30 cm ruler, protractor and pencil) was absent for some candidates. Questions requiring drawing were completed in pen and not pencil by some candidates, which caused problems at times.

Responses to questions stating 'You must show your working' are improving, however candidates still need to be reminded that even simple calculations should be written down in these questions.

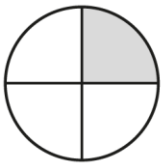
Centres are advised to focus more on teaching for understanding rather than 'quick methods'. This is particularly the case for fractional questions, where we often see incorrect methods used for the different operations required.

It was a pleasure to see several of the later questions answered well by many candidates, particularly those dealing with scatter graphs and direct proportion in context.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• showed each step of their working • had the equipment necessary to complete questions on topics such as bearings and scatter graphs • used systematic methods to solve complex problems • used the formulae sheet for questions appropriately • worked with fractions of time • could work within a contextual mathematical situation.	• made basic numerical errors • could not link percentages, decimals, and fractions appropriately • did not check their answers using inverse processes • did not attempt many of the questions • used a pen when a pencil was expected • did not make use of a protractor or 30 cm ruler • could not identify appropriate place value when required.

Question 1 (a)

1 **(a)** Write down the percentage of this circle that is shaded.



(a) ..... % **[1]**

Many candidates were able to answer this question correctly. Those that did not often gave non-percentage equivalents, i.e. 0.25 or $\frac{1}{4}$.

Question 1 (b)

(b) Shade $\frac{2}{3}$ of this rectangle.

[1]

The majority of candidates correctly shaded the 4 sections required. The common mistake was to shade only 2 sections, likely from not taking into account that the rectangle had a total of 6 sections.

Question 2 (a)

2 **(a)** Work out.

$20 - 16 \div 2$

(a) ..... **[1]**

Many candidates were successfully able to apply BIDMAS to this calculation and arrive at 12 correctly. The most common incorrect answer given was 2, through calculating from left to right. Some candidates answered -12, most often when logical working was not shown.

Question 2 (b)

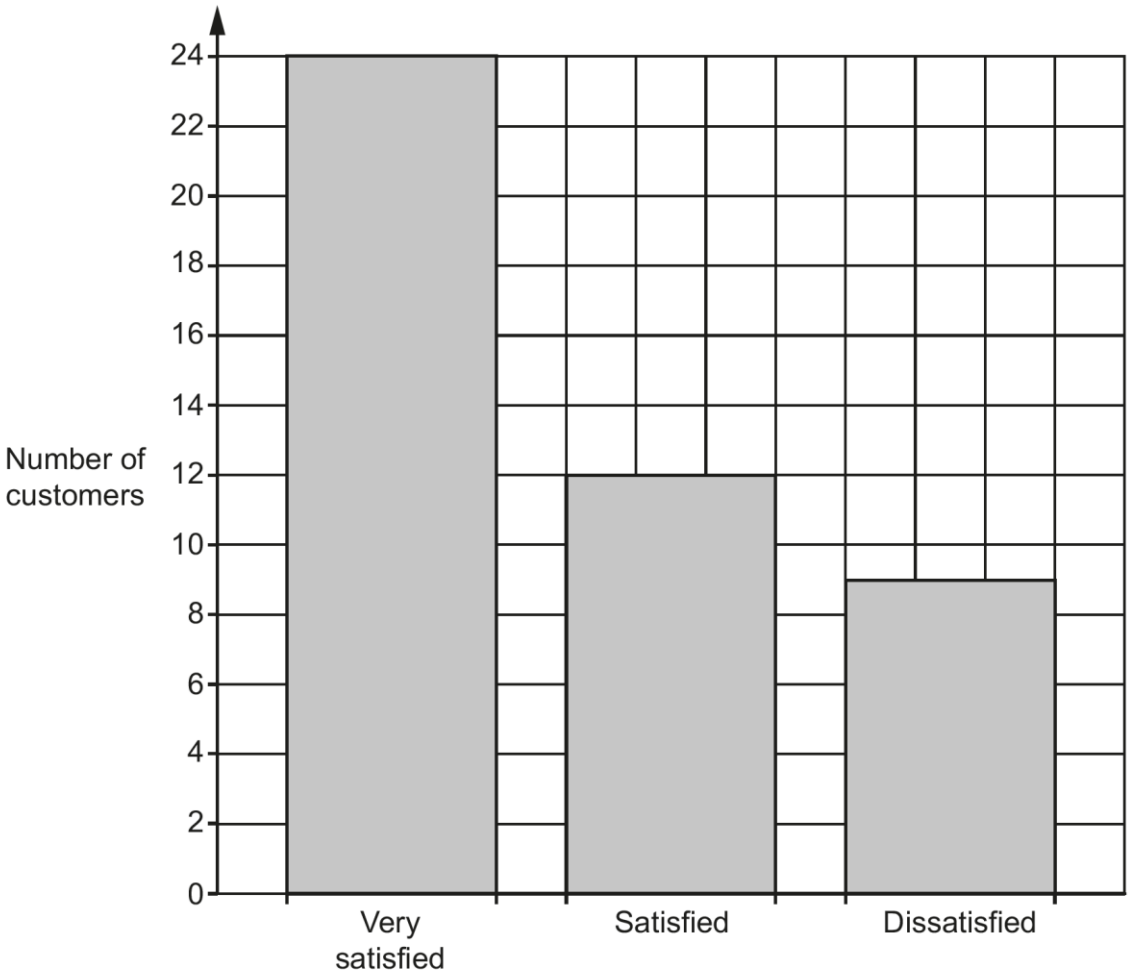
(b) Insert **one** pair of brackets to make this calculation correct.

$$2 + 7 - 3 \times 8 = 34$$ **[1]**

Many candidates were able to position the brackets correctly around the '7 – 3' (though often seen after an initial wrong attempt and then corrected). Working was often seen in the space provided below the question. The most common error seen was '2 + 7 – (3 × 8)', with the candidate showing how BIDMAS should be performed on the calculation given.

Question 3 (a)

3 A store carries out a satisfaction survey on a sample of its customers.
The bar chart shows the results.



(a) Work out how many customers were in the sample.

(a) ..... **[2]**

This was answered correctly by the vast majority of candidates. Those that didn't receive full marks often scored M1 for giving 24 and 12, usually seen in an addition calculation. There were a few candidates that gave one of the bar values as their answer, not interpreting the question.

Question 3 (b)

(b) The store manager decides to display the results in a pictogram.

Complete the final row of the pictogram and the key.

Very satisfied	◇ ◇ ◇ ◇
Satisfied	◇ ◇
Dissatisfied	

Key: ◇ represents..... customers. **[2]**

A high proportion of candidates correctly labelled the key as '6' customers. The pictogram was often correctly drawn; the half-shape for '3' was given in numerous orientations, often shown as a triangle, an incomplete triangle or as half a square in the given orientation or a rotated state. The most common error in this question was in drawing the pictogram, seemingly caused by the orientation of the squares.

Question 4 (a)

4 **(a)** Complete this statement by writing the missing value in the box.

$$\frac{17}{5} = 3\frac{\square}{5}$$

[1]

The majority of candidates correctly answered this question. The most common error seen for the missing numerator was '14'.

Question 4 (b)

(b) Write $2\frac{1}{4}$ as an improper fraction.

(b) ..... **[1]**

The vast majority of candidates that attempted this question came to the correct answer of $\frac{9}{4}$. Common incorrect responses were $2 \times \frac{1}{4} = \frac{2}{4}$, $2 + 1 = \frac{3}{4}$ and $2 + 4 = \frac{1}{6}$.

Question 4 (c)

(c) Work out.

$$\frac{4}{7} - \frac{5}{14}$$

(c) ..... **[2]**

A large number of candidates achieved full marks. Simplest form was not required and common correct answers seen were $\frac{3}{14}$, $\frac{21}{98}$ and $\frac{6}{28}$.

Candidates generally understood a common denominator was required, but some did not use correct equivalent fractions. The most common mistake seen was converting $\frac{4}{7}$ to $\frac{4}{14}$.

Some candidates less secure with this topic gave $\frac{1}{7}$ or $-\frac{1}{7}$ as an answer.

Question 4 (d)

(d) Work out, giving your answer as a fraction in its simplest form.

$$\frac{2}{5} \times \frac{15}{16}$$

(d) ..... **[2]**

This question had a variety of responses. A good proportion of candidates were able to multiply numerators and denominators correctly, but a number of these didn't simplify fully and an answer of $\frac{30}{80}$ or $\frac{15}{40}$ was often seen.

It wasn't unusual to see candidates who 'flipped' the second fraction and then multiplied, giving $\frac{32}{75}$.

The most common issue was candidates finding a common denominator and then either adding, subtracting or multiplying, but being unable to do this with the more challenging numbers.

Question 5 (a)

5 Solve.

(a) $\frac{x}{3} = 6$

(a) $x =$ ..... **[1]**

A high proportion of candidates understood the requirement of inverse operations.

The most common error was to give '$x = \frac{6}{3} = 2$'.

Question 5 (b)

(b) $2x = -14$

(b) $x =$ ..... **[1]**

The majority of candidates identified division as the inverse operation needed here. The common error was to ignore the negative and give $x = 7$.

Candidates who didn't identify division as the inverse operation generally responded with '$x = -14 + 2 = -12$' or '$x = -14 - 2 = -16$'.

Question 6 (a)

6 **(a)** Alex is 1.34 metres tall.
Gabi is 95 centimetres tall.

Find, in centimetres, how much taller Alex is than Gabi.

(a) ..... cm **[2]**

Most candidates attempted to convert 1.34 m to 134 cm and subtract, many successfully.

There were a few candidates who gave an answer of 0.39, scoring B1.

Some candidates did not set up their column subtraction correctly and a few candidates used incorrect figures (often 94 cm instead of 95 cm).

Question 6 (b)

(b) Arrange these units of capacity in order of size starting with the smallest.

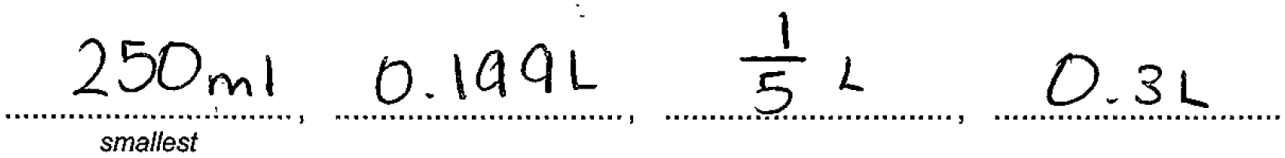
250 millilitres $\frac{1}{5}$ litre 0.3 litres 0.199 litres

....., ..., ..., ... **[2]**
smallest

Many candidates did not successfully attempt this question. The most common mark given was B1 for 3 values in correct order (using the 'cover up' method). The challenge for many candidates was in converting $\frac{1}{5}$ into a decimal/percentage, or in converting 0.199 litres and 0.3 litres into ml.

There were a few candidates who had written the largest value where the smallest value should have been placed. To aid candidates, 'smallest' was written under the first missing answer space.

Exemplar 1



If you cover up the 250ml, this candidate has three capacities in correct order (0.199 L, $\frac{1}{5}$ L and 0.3 L).

This response scored B1.

Question 7 (a)

7 Azmi invests £700 at a rate of 2% per year simple interest.

(a) Work out the interest Azmi receives after one year.

(a) £ ..... **[2]**

This simple interest question was a challenge for many candidates.

Responses often attempted the calculator method of '700 × 1.02'.

Candidates often used labels such as '10% =' in their working, but rarely wrote the operation they were using to arrive at their values. Candidates who therefore realised they required 1%, but arrived at an incorrect value, had not shown the required method to score the method mark available.

An answer of 714 was commonly seen, scoring M1.

Question 7 (b)

(b) Work out the value of Azmi's investment after 3 years.

(b) £ ..... **[2]**

The majority of candidates who gave a correct answer in part (a) were able to answer part (b) correctly.

Those who gave 714 in part (a) often gave 42 as an answer in part (b), scoring 0.

Those candidates who had written 700 × 1.02 in part (a) often attempted compound interest calculations in part (b).

The most common answer here was to multiply their answer to part (a) by 3, but not add it to 700, which scored 0.

Question 8

8 Increase 200 by 15%.

..... **[3]**

The majority of candidates were able to calculate 15% of 200 and add this to 200 correctly. The most common method seen was to find 10% and 5%, then add these together.

Some candidates correctly wrote the calculator method of '200 × 1.15', but struggled with the place value when long-multiplying their numbers, thus scoring M2.

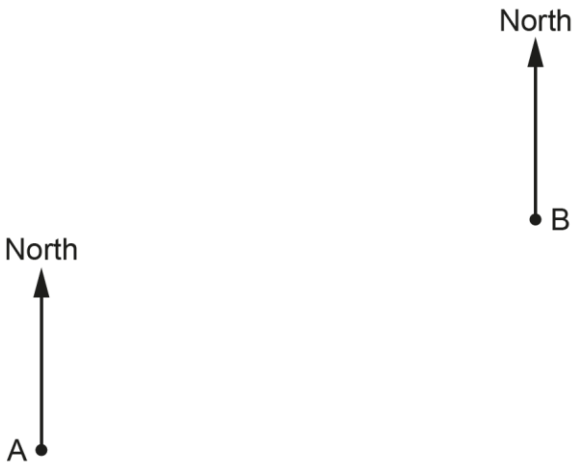
Other candidates were able to calculate that 15% of 200 was 30, but did not then add this to 200.

Those that received zero marks in the question often had '200 + 15% = 215' as their response.

Question 9 (a)

9 The scale drawing shows the positions of two towns, A and B.

Scale: 1 cm represents 10 km



(a) Find the actual distance between town A and town B.

(a) ..... km **[2]**

The vast majority of candidates were able to measure the length AB and multiply by 10 correctly, often without writing their initial measurement down or joining A and B with a line.

The most common errors seen were writing their measurement (e.g. 7) as the answer (not understanding the scaled nature of the question) and not multiplying by 10 correctly. Those that gave no working and responded just with an answer such as 60.7 received zero marks.

Question 9 (b)

(b) Town C is 55 km from town B on a bearing of 330°.

On the scale drawing, mark and label the position of town C with a cross. **[2]**

Few fully correct responses were given here.

Most marks given in this question were for marking a point within 5.3 cm-5.7 cm from B.

Candidates found measuring the bearing difficult, often giving their C at either 030°, 060°, 120°, 150°, 210° or 240° from B.

There was a high number of candidates who did not attempt this question.

Question 10

10 Hiro and Ling work in a restaurant.
Hiro is paid £9 per hour and Ling is paid £10 per hour.

One week, Hiro works a total of 30 hours.
Ling earns £50 more than Hiro that week.

Work out the number of hours that Ling works.

..... hours **[4]**

This question was answered well by many candidates. Almost all showed organised calculations and part-marks could often be awarded when the correct answer was not reached.

The most common response seen was $90 \times 3 = 270$, followed by $270 + 50 = 320$ and then $\frac{320}{10} = 32$.

When numerical errors occurred (often with 90×3 or $270 + 50$) candidate were often able to score M1M1M1 as their method was shown.

There were a few candidates who correctly found 32, but due to writing an embedded calculation of $10 \times 32 = 320$, wrote 10 as their final answer and scored M1M1M1 only.

Question 11

11 Work out.

$\sqrt[3]{64} \times \left(\frac{1}{2}\right)^2$

..... **[3]**

Candidates struggled in numerous ways to access this question.

Often candidates carried out $\sqrt{64}$ and not $\sqrt[3]{64}$, arriving at 8 instead of 4. Some candidates worked out $\frac{64}{3}$.

A number of candidates converted $\frac{1}{2}$ to 0.5, but then calculated 0.5^2 to be 2.5 rather than 0.25. Others stated $\frac{1}{2} \times \frac{1}{2} = 1$.

The mark given most often was B1 for $\sqrt[3]{64} = 4$.

Those candidates that stated $4 \times \frac{1}{4}$ almost always gave the correct answer.

There was a high number of candidates who did not attempt this question.

Question 12 (a)

12 Sasha is trying to remember a 4-digit pin number.
Sasha knows it has the following digits and that **the first digit is 9**.

9	3	2	7

(a) Write down all of the possible orders for Sasha's 4-digit pin number. **[2]**

The majority of candidates were given 2 marks here.

The candidates that systematically listed the possibilities performed the best, even without a blank table being given as has been there in similar past listing questions.

Some candidates didn't repeat the original combination given, but they were given full marks still if they responded with the remaining correct combinations.

Common errors were writing 24 combinations, listing repeated combinations and missing some combinations.

Question 12 (b)

(b) Sasha tries one of these orders at random.

Write down the probability that the last digit of the pin number that Sasha tries is 2.

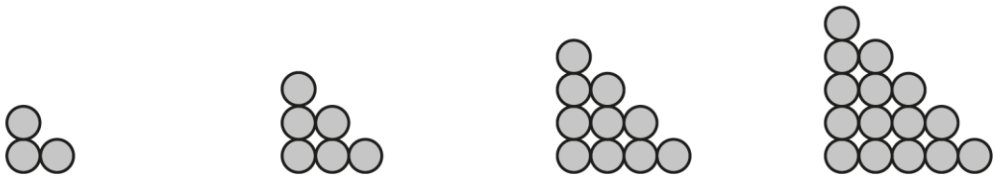
(b) ..... **[1]**

Most candidates were able to follow through from their part (a) and give a correct fraction (or in some cases a decimal or percentage).

Responses that did not score this mark were generally either an answer in words, a ratio or just the number of combinations that had 2 as their last digit, i.e. 2 as an answer.

Question 13 (a)

13 Ryan is making a sequence of patterns using counters.
Here are the first four patterns in the sequence.



Pattern 1
3 counters

Pattern 2
6 counters

Pattern 3
10 counters

Pattern 4
15 counters

(a) Ryan started with 80 counters.

Ryan says

I still have enough counters to make Pattern 5 and Pattern 6.

Is Ryan correct?
Show how you decide.

..... because .....

..... **[4]**

Candidates accessed this question in numerous ways.

Almost all candidates attempted to find the number of counters needed for patterns 5 and 6. The most common methods to then reach the answer were to find the total counters needed (i.e. 83), or to find the number of counters remaining after pattern 4 and the total counters needed for patterns 5 and 6, then compare them.

Many candidates made basic arithmetic errors in both addition and/or subtraction, but many showed their method and in most cases were able to score M2 or M3. The subtraction 80 – 34 was often seen as 56. Some candidates chose to draw the patterns out, but then often miscounted their counters.

Some candidates added the pattern numbers (i.e. 5 and 6) instead of the counters needed for those patterns.

Assessment for learning

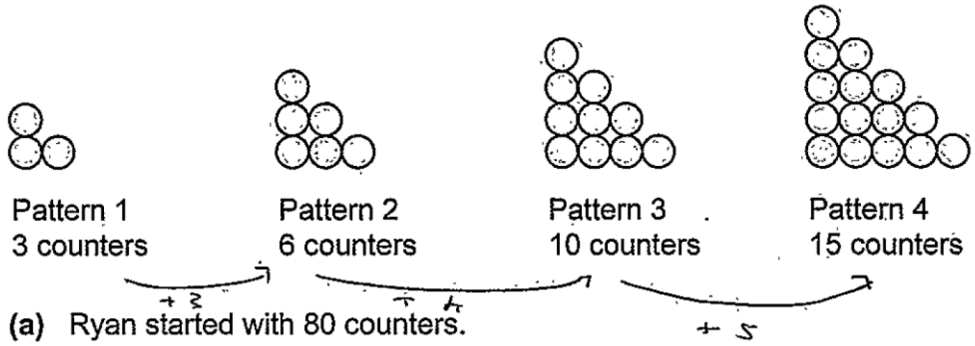
This question is a 'Show how you decide' question.

If calculations aren't shown, then only correct numbers can imply method, as stated in the mark scheme.

Candidates must show the comparison figures, not just make a statement.

They do not need to write an extensive justification; the expected justification will be in their figures.

Exemplar 2



(a) Ryan started with 80 counters.

Ryan says

I still have enough counters to make Pattern 5 and Pattern 6.

Is Ryan correct?
Show how you decide.

3 + 6 = 9 + 10 = 19 + 15 = 24
80 - 24 = 56
56 - 49 = 7
15 + 6 = 21
21 + 7 = 28
49

Yes because after pattern 5 and 6 he will still have 7 counters left. [4]

This candidate adds the given numbers 3, 6, 10 and 15 in stages, but with a numerical error (they reach 24). They then subtract this from 80 to get 56. The candidate correctly identifies 21 and 28 as the number of counters in patterns 5 and 6 counters, then adds them (to get 49). The candidate is given M3 for '*their* 21 + *their* 28 and 80 – *their* 34'.

Question 13 (b) (i)

(b) (i) Complete the table below for the addition of counters in consecutive patterns.

Patterns to add	Counters to add	Total counters
Pattern 1 + Pattern 2	3 + 6	9
Pattern 2 + Pattern 3	6 + 10	16
Pattern 3 + Pattern 4		

[1]

This question was answered well by candidates, with only basic arithmetic errors being made.

Question 13 (b) (ii)

(ii) The number of counters in Pattern k + Pattern $(k+1)$ is 144.

Find the value of k.

(b)(ii) $k =$ ..... **[2]**

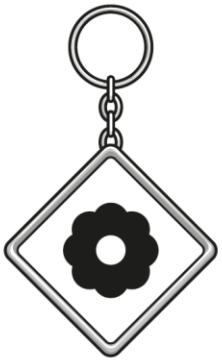
Very few candidates were able to access this question. Many candidates did not provide a response.

It was very rare to see a candidate identify the square number pattern in the final column of the table and not many candidates were able to write the continuing pattern from the table.

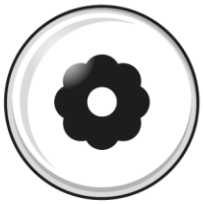
Candidates often formed the equation $2k + 1 = 144$ and attempted to solve it, reaching 71.5 as an answer.

Question 14 (a)

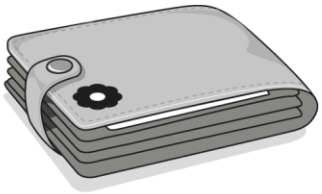
14 A student is buying some gifts for their friends.
The gifts are shown below with the prices.



Key ring
£3.50



Badge
£2.99



Wallet
£7.50

The student has £50 to spend.
They first buy 6 key rings and 2 wallets.
They then buy badges with the remainder of the money.

(a) Work out the maximum number of badges that the student can buy.
You must show your working.

(a) Number of badges ..... **[5]**

The majority of candidates were able to interpret the question. Almost every candidate appreciated the requirement to 'show your working'.

Candidates were generally able to show good working, often achieving the first 3 method marks for £50 subtract the cost of key rings and wallets. While there often numerical errors seen in calculations, the M3 could be given because method was shown. For the cost of the key rings, candidates were seen to use multiplication (i.e. 6 × £3.50) or repeated addition.

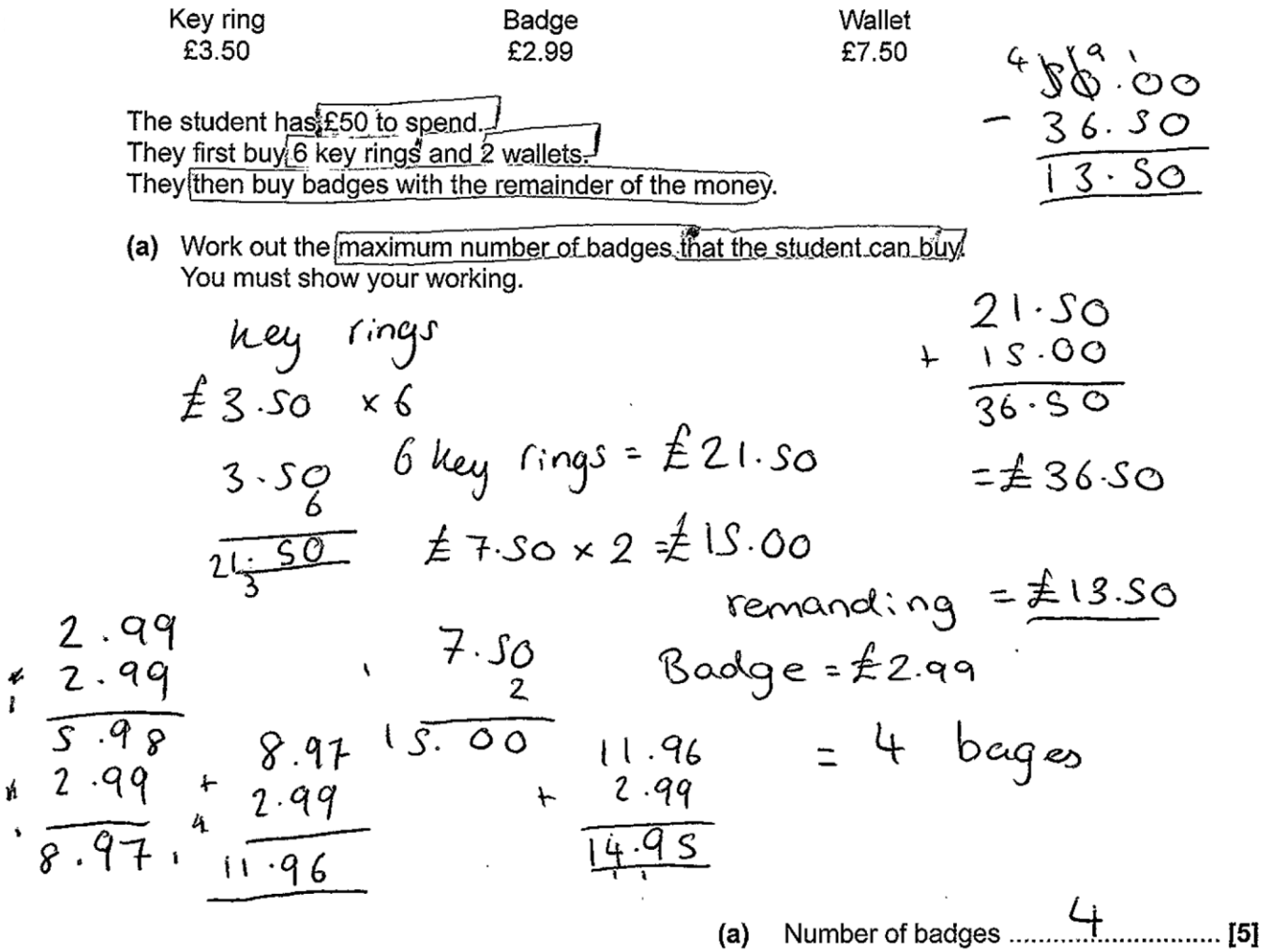
There were a number of different ways to find the number of badges. The most common was to add £2.99 repeatedly until they reached £11.96 (or, in most cases, going on until £14.95). If one arithmetic error was seen here the candidate was still able to score M1.

Other responses repeatedly added £2.99 onto £36 until they reached £47.96 (or, in most cases, £50.95). Some candidates performed $\frac{£14}{£2.99}$ = 4.[..]. Other candidates used £3 instead of £2.99 to obtain the number of badges, which was acceptable (but caused some an issue when answering part (b)).

Those candidates who made arithmetic errors in attaining '*their* £14' could still be awarded method marks here for finding the multiple of £2.99 (or £3) that would be *their* limit.

Candidates at times struggled to organise their working appropriately, which caused issues for both candidates and markers because of the unstructured nature.

Exemplar 3



This candidate correctly shows 3.50 × 6 (although they obtain 21.50) and 7.50 × 2 (= 15). They add these values to reach 36.50 and then carry out 50 – 36.50 to get 13.50. M3 is given for this.

The candidate then repeatedly adds £2.99 up to *their* value of 13.50.

2.99, 5.98, 8.97, 11.96 and 14.95 are all correct and include the value below *their* £14, so another M1 is given.

The candidate isn't given 5 marks due to their arithmetic errors, but still scores M3M1.

Question 14 (b)

(b) Work out the amount of money they have left over.

(b) Amount left over £ ..... **[2]**

Many candidates were able to follow through from part (a) and score M1 here. Their working was often seen in the response to part (a).

One common error seen was from candidates who had rounded £2.99 to £3 in part (a), often giving an answer of £2 or £1.96 instead of £2.04.

Notably, there was a few candidates who wrote £2.4 instead of £2.04.

Question 15

15 Taylor performs in a show.

Taylor spends $\frac{1}{8}$ of the show singing, $\frac{1}{4}$ of the show dancing and the remaining 55 minutes backstage.

Work out how long the show lasted.
Give your answer in hours and minutes.
You must show your working.

..... h ..... min **[5]**

The majority of candidates struggled with the contextual nature of the question, though almost all candidates appreciated the requirement to 'show your working'.

Candidates who accessed the question well often began by performing $\frac{1}{8} + \frac{1}{4}$ correctly, then equated 55 minutes with $\frac{5}{8}$.

At this stage some candidates performed $\frac{55}{5} \times 8$. Others stated $\frac{1}{8} = 11$, $\frac{3}{8} = 33$ and $55 + 33 = 88$, or used the activity names (i.e. singing = 11, dancing = 22 and 55 + 33 = 88).

Some candidates did not show their method to achieve 88 minutes, generally limiting themselves to M1A1M1 as a maximum.

The common errors occurred when candidates misinterpreted the question. Attempts to calculate $\frac{1}{8} \times 60$ and $\frac{1}{4} \times 60$, or $\frac{1}{8} \times 55$ and $\frac{1}{4} \times 55$, were often seen. Some candidates attempted to convert the fractions to decimal equivalents, resulting in equating to 55 minutes more challenging.

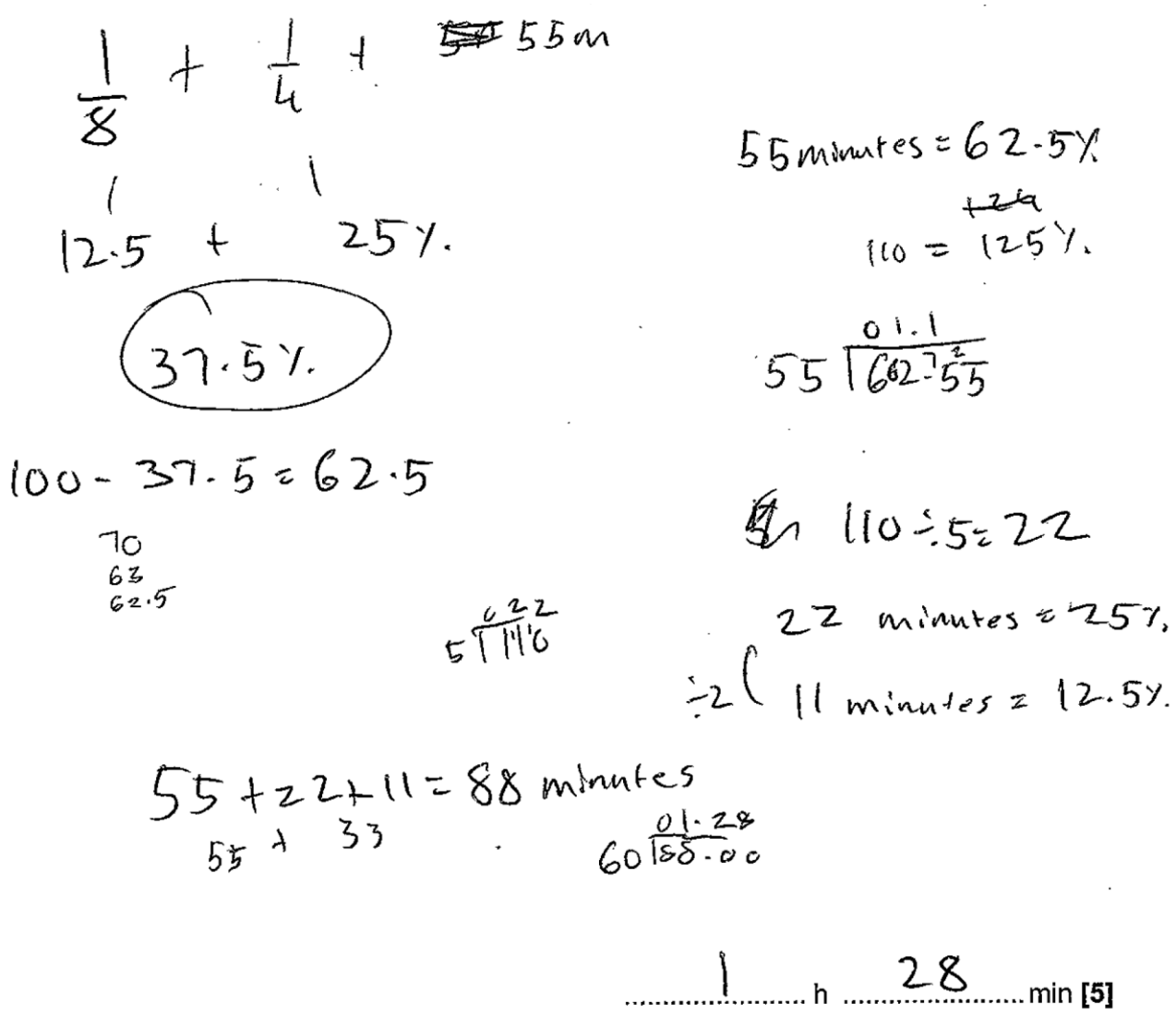
There was a high number of candidates who did not attempt this question.

Misconception

There are 60 minutes in an hour, not 100 minutes.

Using decimals when calculating with time can be challenging, so becoming confident in using fractions is important for when working with time.

Exemplar 4



This candidate converts the fractions to percentages and adds these correctly to give 37.5% scoring M1A1. The candidate correctly equates 55 minutes = 62.5%, then correctly find that 22 minutes = 25% and 11 minutes = 12.5%, then sums 55 + 22 + 11, which is equivalent to M2 (seen in the mark scheme's alternative method).

Their answer of 1h 28min with no wrong working therefore scores 5 marks as the threshold has been met.

Question 16

16 Complete this identity by writing in the missing numbers.

$$4(.....x+1)=14x-6(x-2)-.....$$ **[2]**

Candidates found this question particularly difficult.

Working seen was often in trials.

Candidates that attempted the question often entered numbers without working.

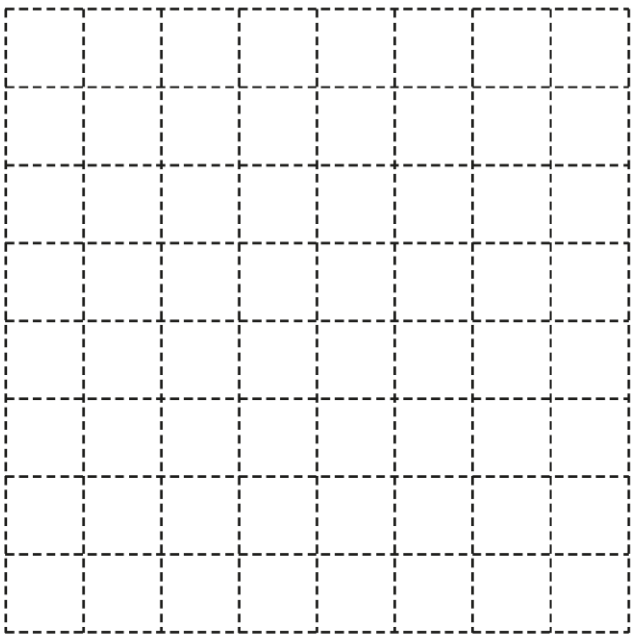
The most common mark given was B1 for the 2 on the left side of the identity. The 8 was more challenging to reach, due to the 'double negative' from expanding the bracket on the right of the identity.

There was a high number of candidates who did not attempt this question.

Question 17 (a)

17 Vector $\mathbf{a}=\begin{pmatrix}3\\2\end{pmatrix}$ and vector $\mathbf{b}=\begin{pmatrix}1\\-4\end{pmatrix}$.

(a) On the grid, draw vector **a**.



[1]

Many candidates showed a lack of knowledge of drawing vectors.

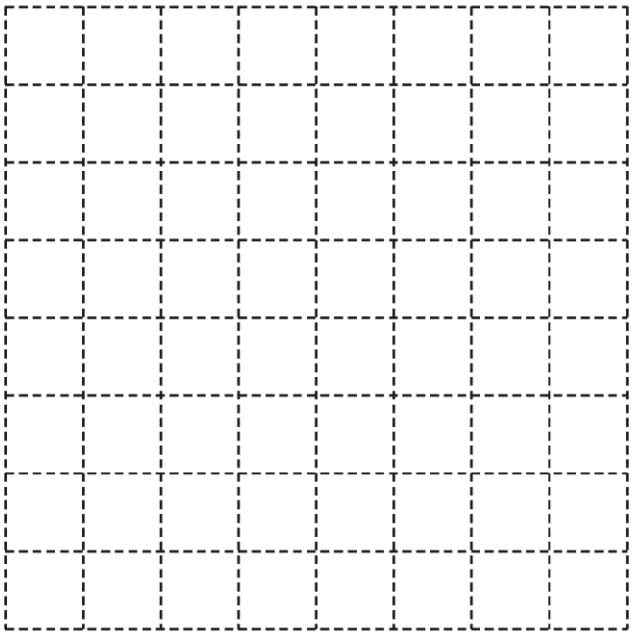
Most turned the space into a coordinate grid and attempted to plot the vector as if it was a pair of coordinates.

Where candidates did attempt to draw a vector, often the direction arrow was omitted.

There was a high number of candidates who did not attempt this question.

Question 17 (b)

(b) On the grid, draw vector $\mathbf{a} + \mathbf{b}$.



[2]

Candidates overall scored more marks here than in part (a), as the omission of direction arrows were only penalised in the first response from a candidate. Some candidates scored no marks in (a), but full marks in (b).

Several candidates who did not show knowledge of drawing vectors did score M1 for correctly adding the vectors numerically to get $\begin{pmatrix} 4 \\ -2 \end{pmatrix}$. Some omitted the brackets. Only a few candidates wrote a fraction line in the vector.

There was a high number of candidates who did not attempt this question.

OCR support

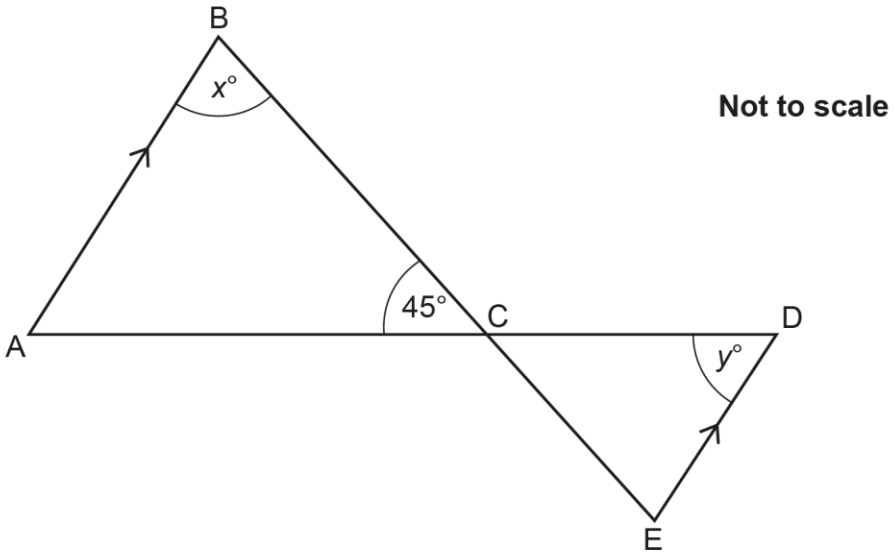
These resources would be useful for this topic:

Check In test: 9.03 Plane vector geometry (or download all Foundation check In tests)

Section Check In test: Topic 9: Congruence and similarity

Question 18

18 In the diagram, line AB is parallel to line ED.
The points A, C and D lie on a straight line.
The points B, C and E lie on a straight line.



Angle BCA = 45°, angle ABC = x° and angle CDE = y°.
The ratio x : y is 3 : 2.

x = ... **[4]**

Most candidates attempting this question did not recognise the lines AB and ED were parallel. They were hence unable to identify angle BAC or angle CED using alternate angles, so the ratio part of the question was largely not attempted.

Candidates often identified on the diagram that angle DCE = 45° and angle DCB = 135°, scoring B1M1.

A common error was to treat triangle ABC as a right-angled isosceles triangle and hence give x = 45° or 90° as a final answer.

Question 19

19 A sphere has a radius of 3 cm.

Calculate the volume of the sphere.
Give your answer in terms of π in its simplest form.
[The volume V of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

..... cm^3 **[3]**

Candidates attempting this question were often able to substitute $r = 3$ into the formula.

Some were able to correctly evaluate $3^3 = 27$, but did not know how to evaluate with the fraction. Some candidates wrote 27 as their final answer and others did not write π in subsequent working.

A number of candidates attempted to complete the question in one attempt, leading to loss of the second method mark.

Common errors seen were substituting into $V = \frac{4}{3}\pi r^2$, the conversion of $\frac{4}{3}$ to a decimal, the conversion of π to 3 and $3^3 = 9$ rather than 27.

There was a high number of candidates who did not attempt this question.

Assessment for learning

Substitution into formulae should be treat like a BIDMAS question.

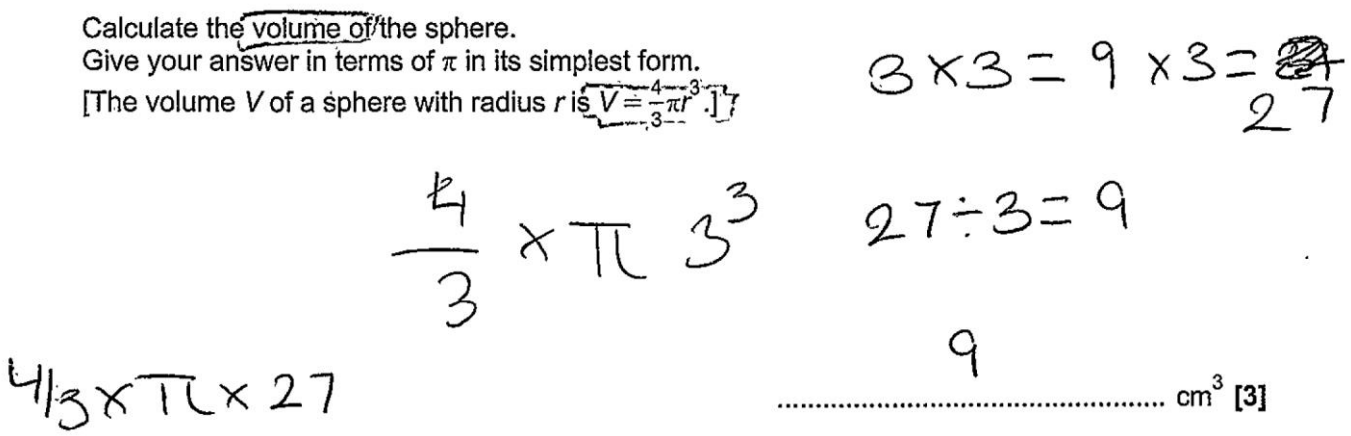
Single steps written can gain a method mark.

Assessment for learning

Candidates should be confident to respond 'in terms of π'.

Incorporate the symbol π into calculations and use it throughout (i.e. not replacing it with 3.14 or similar), so that candidates become more accustomed and confident to leave their answer in terms of π.

Exemplar 5



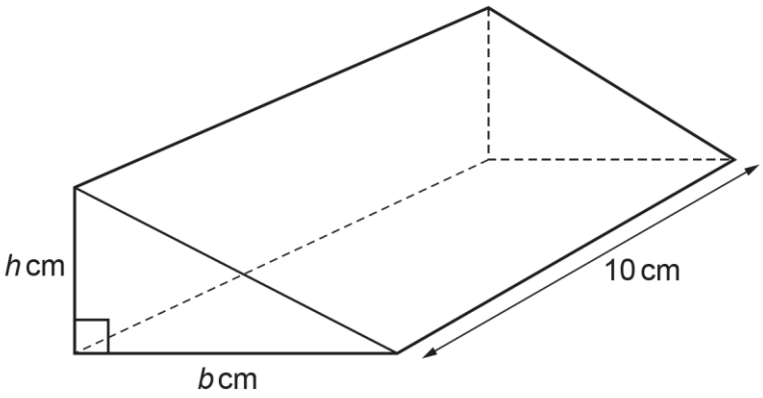
This candidate correctly substitutes $r = 3$ into the formula, scoring M1.

The candidate then correctly writes $\frac{4}{3} \times \pi \times 27$, scoring M1M1.

The candidate doesn't complete the required working as they only divide 27 by 3 and don't multiply it by 4. They also don't include π in their answer.

Question 20

20 The diagram shows a prism of length 10 cm.



The cross-section of the prism is a right-angled triangle.
The base, b cm, is 2 cm longer than the height, h cm.
The volume of the prism is 240 cm^3.

A student is explaining how they worked out the value of b.

They say

b is 6 because that means h is 4 and 6 × 4 × 10 = 240.

Describe the student's error and find the correct value of b.

The error is .....

.....

b = ... **[3]**

This was the first cross-over question of the exam paper, i.e. those questions that also appear on the Higher tier paper.

Candidates often gave vague responses regarding the error, for example 'they have done the calculation wrong'. It wasn't sufficient to just state 'they forgot to halve it' and make no reference to triangle; the formulae sheet that candidates had access to gave the formula for volume of a prism, so it was required to identify that the error was in the area of the triangle.

Correct answers of 8 often came from trialling pairs of numbers (with 10), rather than using the volume given.

Some candidates scored M1 for factor pair(s) of 48 seen.

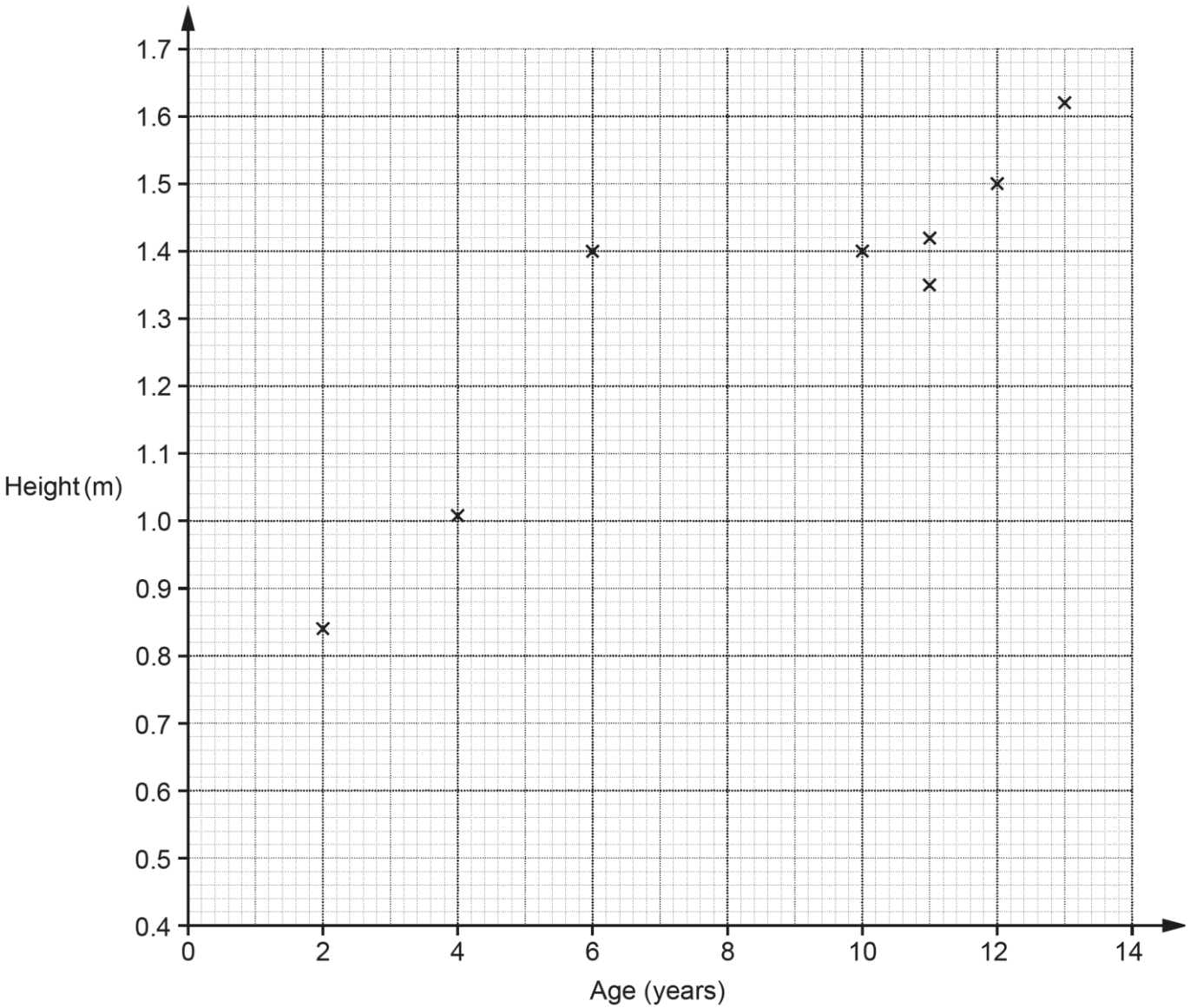
A high number of candidates did not attempt this question.

Question 21 (a)

21 The table shows the ages and heights of 12 children.

Age (years)	2	4	12	6	10	11	13	11	5	7	9	14
Height (m)	0.84	1.01	1.5	1.4	1.4	1.35	1.62	1.42	1.14	1.24	1.26	1.68

The points for the first eight children (shaded in the table above) are plotted on the scatter diagram.



(a) Plot the points for the remaining four children. **[2]**

The majority of candidates attempted this question and most scored at least B1 for two or three points correct.

All points were designed to be on grid lines, but some candidates found the height axis scale of 0.02 per box difficult to deal with. A common error was plotting (5, 1.12) instead of (5, 1.14), for example. Also often seen was (5, 1.4) instead of (5, 1.14), which then affected Question 21(c).

Question 21 (b)

(b) Describe the type of correlation shown in the completed scatter diagram.

..... **[1]**

The majority of responses were correct, with a few including embellishments (but less often than in previous exam series).

Some candidates described the relationship between height and age rather than the correlation.

Very few stated negative, but there was a number that responded with 'increasing'.

Question 21 (c)

(c) One of these children is taller than expected for their age.

On the scatter diagram, circle the point representing this child. **[1]**

Most candidates identified the correct plot.

Those candidates who created another outlier in part (a) often did not identify all the outliers here on *their* diagram, just *their* created outlier.

Some candidates selected the highest age plot as the outlier.

Question 21 (d) (i)

(d) **(i)** Kai is 8 years old.
By drawing a line of best fit, estimate Kai's height.

(d)(i) ..... m **[2]**

The question stated, 'by drawing a line of best fit', which aided it being attempted by a large proportion of candidates.

Many candidates drew a line from (0, 0.4). Some drew a dashed line instead of a solid line.

Candidates with a line of best fit out of tolerance were still often able to estimate correctly from *their* line (though a few struggled with the scale of 0.02 per box).

A number of candidates gave an estimate without a line of best fit.

Appropriate equipment

Centres should ensure candidates have 30 cm rulers, not 15 cm rulers (or set squares). For a question such as this it is important to have an accurate straight line through the whole graph.

Centres should enforce the use of pencils, in case of mistakes.

Assessment for learning

When learning about scatter graphs, make sure that candidates understand that the graph is a zoomed-in image of a larger graph and that is why (in most cases) it is incorrect to draw a line of best fit from the bottom left corner of the graph. Graphs of negative correlation (where a line of best fit rarely goes through the origin) can also be used to highlight this.

Question 21 (d) (ii)

(ii) Describe an assumption you have made in giving your answer to part **(d)(i)**.

.....

..... **[1]**

Candidates often correctly referred to 'average for his age' or 'not taller/shorter than expected'.

Some candidates attempted to put it into greater detail, e.g. 'Kai hasn't suffered any growth difficulties'.

Candidates not given the mark often described the process of using the line of best fit or 'Kai is between a 7 and 9 year old'.

Question 21 (e)

(e) Explain why using this data to estimate the height of a child that is 17 years old may be unreliable.

.....

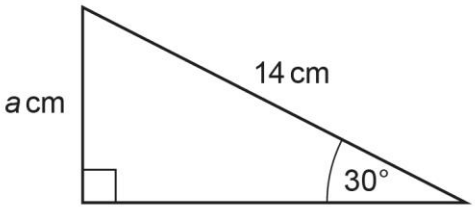
..... **[1]**

Candidates who explained well described the lack of data for 17 year-olds either on the graph or in the table given.

The most common error seen was to describe the graph as not going far enough for 17-year-olds. Other responses not accepted were those describing external factors such as puberty, growth spurts, etc..

Question 22

22 The diagram shows a right-angled triangle.



Not to scale

Work out the value of a.

$a =$ ..... **[3]**

Very few candidates recognised the need for trigonometry in this question. The most common error seen was to attempt to use Pythagoras' theorem.

When trigonometry was identified, candidates were often unable to write a correct trigonometric equation. Missing the angle out was a common error, e.g. sin = $\frac{a}{14}$.

Candidates who received credit often scored M1 for sin(30) × 14 or B1 for sin(30) = $\frac{1}{2}$, but were rarely able to complete the question.

Assessment for learning

Using trigonometry involves setting up an equation to solve, as with any basic equation.

When teaching 'SohCahToa' or an equivalent, make sure that the emphasis is on writing an equation to solve, try not to teach 'tips and tricks'. This will help with retention.

Question 23 (a)

23 (a) Factorise $x^2 + 10x + 24$.

(a) ..... **[2]**

Many candidates attempted this question, but often attempted to factorise into a single bracket and gave responses such as $x(x + 10) + 24$.

Some candidates had knowledge of the requirement of factor pairs of +24, but often did not know how to use these correctly.

Responses commonly awarded the M1 were $(x + 12)(x – 2)$ and $(x + 8)(x + 3)$.

Question 23 (b)

(b) Write down the solutions to $x^2 + 10x + 24 = 0$.

(b) $x =$ ..... or $x =$ ..... **[1]**

Those candidates who scored full marks in part (a) were rarely able to give a correct answer here in part (b); +4 and +6 were often given as *their* roots.

Very few follow-through marks could be given, as most responses in part (a) were single bracket responses.

Question 24 (a)

24 A volunteer packs boxes for a charity.
They can pack 5 boxes in 45 seconds.

(a) Use this information to show that they can pack 55 boxes in less than 9 minutes. **[4]**

A high proportion of candidates were able to access this question.

Many candidates were able to use direct proportion in context to either find that 1 box would take 9 seconds, or that 55 boxes would take 495 seconds. Some candidates compared this with the total number of seconds in 9 minutes (540 seconds). Errors were often seen if the candidate attempted to convert 495 seconds into minutes, particularly when division was used.

Repeated addition of 45 in a systematic list was frequently seen rather than an attempt at 11 × 45, but this method often scored M2 for candidates.

A less common approach was to find that 60 boxes could be packed in 9 minutes.

Numerical errors were often seen when working with time, e.g. the use of 0.45 instead of 45 seconds or 0.75 minutes. Some candidates attempted to convert 8.25 minutes to minutes and seconds with numerical errors.

Question 24 (b)

(b) What assumption did you make in part **(a)**?

.....

..... **[1]**

Responses commonly identified the need for a constant speed to be used, the volunteer not getting tired, or not stopping.

Those responses not credited were almost always information repeated from the original question, e.g. 'pack 5 boxes in 45 seconds' or '1 box in 9 seconds', making no reference to the consistency of the work or the pace.

Question 25

25 A student draws two different regular polygons.
The exterior angle of one polygon is $p°$.
The exterior angle of the other polygon is $q°$.

The sum of p and q is 112°.
The difference between p and q is 32°.

Find the **number of sides** of each polygon.
You must show your working.

..... sides and ..... sides **[6]**

Of those candidates attempting this question, the common mark given was B1B1, for the correct equations ($p + q = 112$ and $p – q = 32$) being written.

Many candidates made attempts to use 112 and 32, often subtracting to give 80, but often didn't give any worthwhile working. Of those that did, they often started at 80 and attempted pairs of numbers to sum to 112 and have a difference of 32.

Some candidates did state the interior angle formula $(n - 2) \times 180$, but often did not know how to use it in this context. Some candidates attempted to draw shapes, but with no success.

There were a few instances of a single correct answer without supporting evidence, which was awarded SC1.

This question was rarely attempted by candidates at foundation tier.

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