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GCSE (9-1)

Examiners' report

MATHEMATICS

J560
For first teaching in 2015

J560/06 Summer 2018 series

Version 1

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. 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 can be downloaded from OCR.

Paper J560/06 series overview

J560/06 is the third and final paper in the higher tier of the GCSE (9-1) Mathematics specification.

Use of calculators

In this paper it is expected that calculators will be used. It is important that accuracy is maintained in calculations and also with values which are transferred between processes.

The breadth of content examined, and the distribution of marks allocated to AO1, AO2 and AO3, are similar to J560/04 and J560/05.

To do well on this paper, candidates need to be confident and competent in all of the specification content. They also need to be able to:

- use and apply standard techniques (AO1)
- reason, interpret and communicate mathematically (AO2)
- solve problems within mathematics and in other contexts (AO3).

Questions 1, 2, 3, 4 and 11 were also set on the foundation tier paper J560/03.

Candidate performance overview

Candidates who did well on this paper generally did the following.

- Performed almost all standard techniques and processes accurately. Q2, Q3, Q4(a), Q5(a), Q5(b), Q6, Q13(a), Q15, Q19.
- Usually interpreted and communicated mathematics accurately. In particular, information presented in words or diagrams was understood and correct notation was used when presenting a mathematical argument. Q1, Q5(c), Q8, Q10, Q11, Q16, Q17(b), Q18(a).
- Produced clear solutions to multi-step tasks. Q12, Q13(b), Q14.

Candidates who did less well on this paper generally did the following.

- Made errors in performing low-grade processes. Q1, Q5(b), Q6, Q9a.
- Produced responses that lacked notation of an appropriate standard. Q10, Q11.
- Showed poor setting out of multi-step tasks. Q2, Q5c, Q12, Q13(b).
- Misinterpreted questions and information or did not follow instructions. Q3, Q4(a), Q8, Q14, Q15, Q16(c).

There was no evidence that any time constraints had led to candidates underperforming.

Question 1

1 Ping chooses four numbers.

The mode of these four numbers is 8, the range is 7 and the mean is 11.

Find Ping's four numbers.

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

The question had an element of problem solving as no direction was given. It required knowledge of statistical terms, some reasoning and some processing. Therefore, it contributes to AO1, AO2 and AO3.

The majority of candidates scored full marks. They worked logically through the given information, realising that two 8's were required. They then deduced that a mean of 11 implied a total of 44, and so they needed to find two numbers that summed to 28. Most then used the range information to identify 15 (from 8 + 7) and, finally, 13.

The most common error was to make the missing two numbers themselves have a difference of 7, leading to the answer 8, 8, 10.5, 17.5. This was credited two marks for satisfying two of the three statements.

Question 2

2 A box contains only red, blue and green pens.
The ratio of red pens to blue pens is 5 : 9.
The ratio of blue pens to green pens is 1 : 4.

Calculate the percentage of pens that are blue.

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

Candidates needed to combine the two given ratios into one triple ratio and then find a percentage. They were not told to do this and so there is a high problem solving, AO3, demand.

Just over half of the candidates scored full marks. The best responses showed clear presentation using columns to find the number of green pens, such as:

red	blue	green	leading to	red	blue	green	
5	9			5	9		
	1	4	× 9		9	36	
				5	9	36	= 50

Those candidates able to do this and determine that there were 36 green pens usually found the percentage of blue pens correctly.

There was a small number of candidates who lost marks due to errors in arithmetic but, where possible, the method marks were still credited. A few misread the question and found the percentage of green pens instead. Again, some marks could be credited for their working.

A significant number of candidates simply added three or four of the given ratios to give the fraction of blue pens as $\frac{9}{18}$ or $\frac{10}{19}$. In such cases, there was no follow through for the percentage work and the response scored zero.

Question 3

3 Asha worked out $\frac{326.8 \times (6.94 - 3.4)}{59.4}$.

She got an answer of 19.5, correct to 3 significant figures.

Write each number correct to 1 significant figure to decide if Asha's answer is reasonable.

....

.... **[3]**

Candidates needed to round each given number, perform the calculation and interpret the answer in the context of the question. The processing involved is standard and so the focus of the marks is AO1.

The majority of candidates scored full marks. There were a few instances of candidates performing all the computation correctly but drawing the wrong conclusion. These responses scored two marks.

Less able candidates usually rounded at least two of the numbers correctly or sometimes included unwanted zeros after the decimal points. Both received one mark.

Those credited zero marks on the question usually just performed the calculation on their calculator without any attempt to round the numbers.

Question 4(a)

4 **(a)** Show that $a^5 \times (a^3)^2$ can be expressed as a^{11}. **[2]**

This was a "show" question assessing the laws of indices. Candidates needed to be careful not to just write down the given answer.

Almost all candidates scored one mark for a^6. However, from $a^5 \times a^6$, many just wrote down the answer without showing that it was obtained by adding the indices.

Question 4(b)

(b) Write $\frac{1}{125} \times 25^9$ as a power of 5.

(b) .... **[3]**

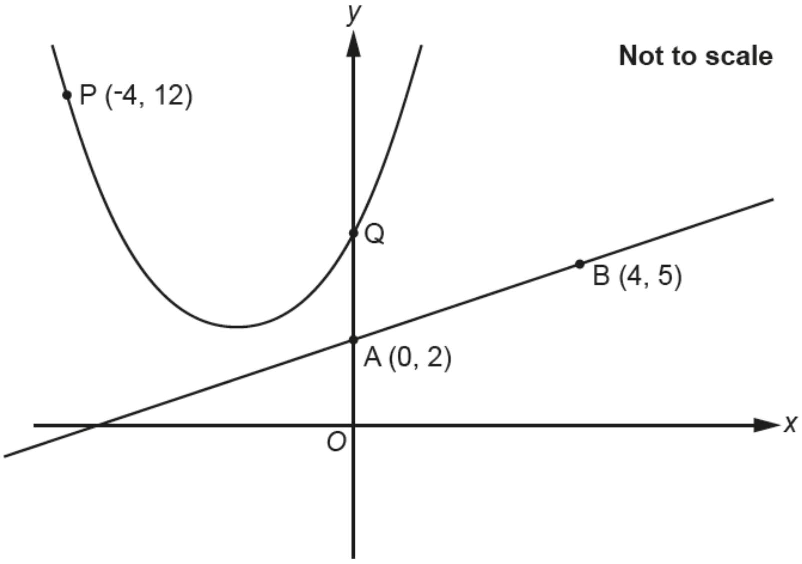
The question assessed further the candidates' knowledge of index notation. The processes required are standard, AO1, with the first term being more straightforward than the second.

This part was found much more difficult and only the more able candidates scored full marks. Some identified $\frac{1}{125}$ as 5^{-3} (or 125 as 5^3) for one mark but only candidates who scored full marks could express 25^9 as 5^{18}.

Many merely performed the calculation as presented and gave an answer in standard form.

Question 5(a)

5 The diagram shows a straight line that passes through points A and B, and a curve that passes through points P and Q.



(a) Find the equation of the straight line.

(a) .... **[3]**

Candidates needed to find the equation of a straight line, in any form, using the coordinates of two points. This is a standard AO1 technique which has been examined previously.

The full range of marks was seen. Many candidates demonstrated excellent knowledge and understanding of $y = mx + c$. They calculated the gradient using the two coordinates and then wrote the equation straightaway using the *y*-intercept of 2.

Some needlessly substituted a known point to find *c* and made an error. If their gradient and equation were otherwise correct, then two marks were credited. Some candidates inverted their gradient but still realised the intercept was 2 and so scored one mark. A few carelessly lost marks by not including *x* in their final answer.

Question 5(b)

(b) The equation of the curve is $y = x^2 + kx + 8$.

Find the value of k.

(b) k = ... **[3]**

Candidates needed to identify point P and substitute its coordinates into the equation of the curve. They needed to evaluate accurately and solve the equation. An element of deduction is required at first but then it becomes a standard technique.

About one-third of the candidates achieved full marks.

Others achieved one mark for the substitution of ($^-4$, 12) into the equation, but there was much poor notation. A particular error was to write $^-4^2$, which was sometimes recovered as 16 but often seen as $^-16$, leading to a wrong answer. A few did not substitute y with 12 and so did not have an equation to solve.

A few able candidates rearranged the equation of the curve accurately but did not make a substitution. They scored one mark.

Candidates can improve their accuracy with a calculator by putting brackets around negative numbers.

Question 5(c)

(c) Diann draws line BQ.
She says

Triangle ABQ is isosceles.

Is Diann correct?
You must show all your working.

.... **[4]**

This is a very open question and the mark scheme covered five different ways of demonstrating that the triangle is isosceles. Candidates needed to decide on a method (AO3) and communicate their work clearly and precisely using appropriate notation (AO2).

Only some of the more able candidates provided a convincing argument that merited full marks. Candidates often achieved the mark for finding the coordinates of Q but then merely claimed the triangle was isosceles without properly demonstrating it. Some of these claims were based on incorrect facts, such as AB = QB = 4.

Different approaches were seen by those attempting to show that the triangle was isosceles. The most common and successful method was to use Pythagoras' theorem. However, often only one of AB or QB was calculated and an unsupported assumption was made that the other would be the same.

Candidates could also achieve the second mark for a description involving symmetry, gradients or translations. Again, they usually then jumped to the isosceles conclusion without really showing that two sides or angles were equal.

Question 6

6 y is inversely proportional to x.
$y = 0.04$ when $x = 80$.

Find the value of y when $x = 32$.

$y =$ .... **[3]**

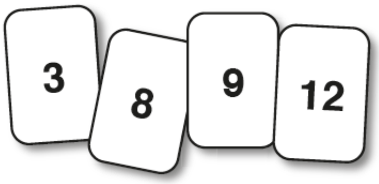
With no context, solving this inverse proportion question is a standard AO1 process.

Just over half of the candidates scored full marks. The best responses usually started by writing $y = \frac{k}{x}$ and then substituted $y = 0.04$ and $x = 80$. Occasional errors were then seen in finding the value of k but, generally, candidates from this point completed the question correctly.

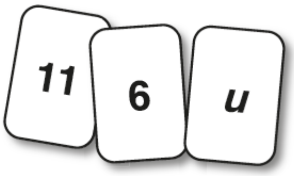
Most other candidates scored zero because they used direct proportion.

Question 7

7 Edsel has four number cards.



Sharon has three number cards.
u represents a number that Sharon knows.



Edsel and Sharon each pick one of their cards at random.
They calculate the **difference** between the numbers on their cards.
This is their sample space.

		Edsel			
		3	8	9	12
Sharon	6	3	2	3	6
	11	8	3	2	1
	u	11	6	*r*	*t*

Work out the values of *r* and *t*.

r = ...

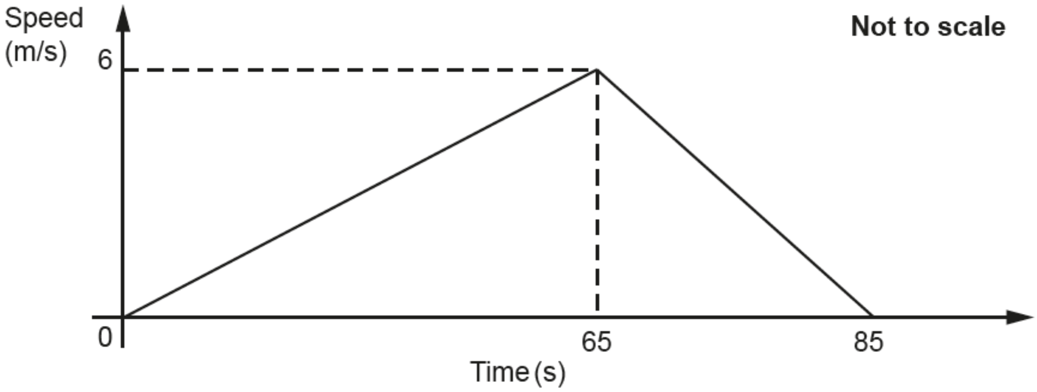
t = ... **[4]**

This novel question required some logic prior to some routine arithmetic.

The majority of candidates scored full marks and found the question straightforward. However, there were some candidates who went wrong after correctly identifying $u = 14$, or who only used half of the given information leading them to select $u = -8$ or $u = 2$.

Question 8(a)

8 The graph shows the speed of a tram as it travels from the library to the town hall.



(a) Calculate the deceleration of the tram as it approaches the town hall.

(a) .... m/s^2 **[2]**

To achieve success across the parts of this question candidates needed to be able to interpret a speed-time graph (AO2). They needed to understand how acceleration, distance and speed are represented and then perform the appropriate calculations accurately.

Responses suggested that candidates were either well-prepared for all parts of the question or they were unfamiliar with this type of graph. Many appeared to use it as a distance-time graph.

In part (a), nearly all candidates identified that 6 and 20 were crucial numbers to be used in obtaining the deceleration but only about half found a valid gradient of 0.3 (two marks) or $^-0.3$ (one mark). Some had the gradient inverted and some found 6 × 20. The use of Pythagoras' theorem was common, presumably because there was a right-angled triangle.

Question 8(b)

(b) Calculate the distance travelled by the tram between the library and the town hall.

(b) .... m **[3]**

Again, about half of the candidates scored full marks for finding the area under the graph correctly.

The answer, 255, was almost always obtained from two separate triangles as 195 + 60 rather than just one large triangle. This led to errors, such 195 + 120 or 390 + 60, where they omitted the $\frac{1}{2}$ from one of their calculations. Candidates who only found the area of a rectangle, such as 6 × 85 = 510, scored 0 marks. Again, use of Pythagoras' theorem was common.

Question 8(c)

(c) What was the maximum speed of the tram as it travelled between the library and the town hall?
Give your answer in **kilometres per hour**.

(c) .... km/h **[4]**

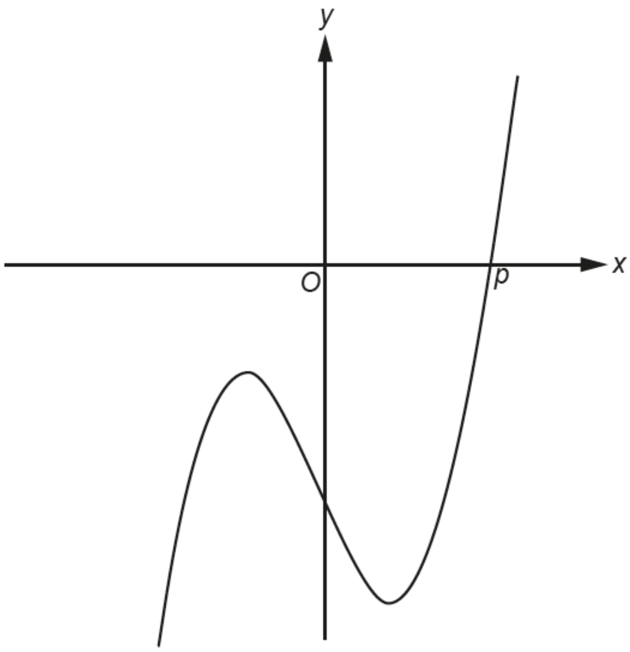
The full range of marks was seen. Overall, about one third of the candidates managed to obtain the correct answer of 21.6 km/h.

Candidates first needed to read the maximum speed in m/s from the graph. Only about two thirds of candidates were able to do this. Others resorted to the speed = distance/time formula, with better candidates using $\frac{255}{85}$ to obtain an average speed. Others continued to completely misinterpret the graph by using a speed of $\frac{6}{85}$, for example.

Candidates then proceeded to change 6 m/s into km/s or their distance in metres into km, although there were instances of multiplying by 1000 instead of dividing. This was followed by multiplication by 60^2 to obtain an answer in km/h, or division of their time in seconds by 60^2, although some got very confused about when to multiply and when to divide. Very few seemed to be aware of the shortcut × 3.6 conversion for turning m/s into km/h.

Question 9(a)

9 The graph of $y = x^3 - 7x - 12$ is shown below.
The root of the equation $x^3 - 7x - 12 = 0$ is p.



(a) Calculate y when $x = 3$.

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

The three parts of this question asked candidates to find an interval for the root of a cubic equation. 6.03e of the specification states that, “Specific methods will not be requested” when answering this type of question.

Most candidates used a form of “trial and improvement”. However, it was evident that some centres have taught alternative methods.

Part (a) was intended to help candidates make progress with part (b). The vast majority answered it correctly. Most of the others knew what to do but made an arithmetic error. A small percentage of candidates omitted the part.

Question 9(b)

(b) Show that $3 < p < 4$. **[2]**

Despite part (a), one third of the candidates omitted this part. Most candidates who made an attempt correctly obtained the answer of 24. For full marks, the answer needed to be interpreted in order to show why $3 < p < 4$. Various approaches were allowed including "change of sign" and "$^-6 < 0 < 24$".

A few candidates used a value of x other than 4. This was acceptable provided it produced a valid, narrower interval than $3 < p < 4$ but they then needed to find an even narrower interval in part (c).

Some centres had taught their candidates the technique of creating an iterative formula and using a starting point such as $x_1 = 3$. This approach was acceptable and successful in parts (b) and (c) provided the candidate actually answered the question asked. In some cases, their answer to both parts was the same and so (c) was not a "smaller interval". Additionally, if using this method, it would be good practice to show the values of x_1, x_2, x_3, etc.

Question 9(c)

(c) Find a smaller interval that contains the value of p.
You must show calculations to support your answer.

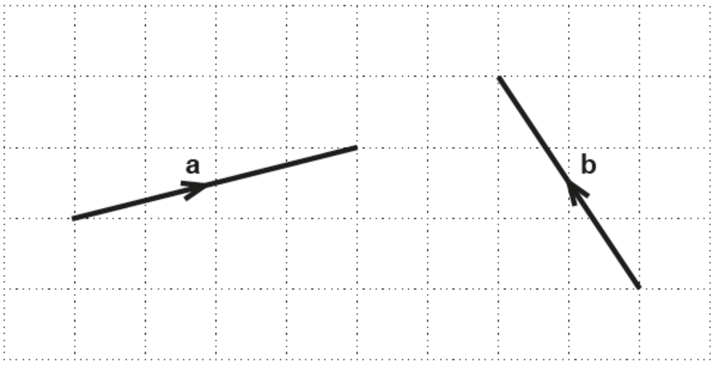
(c) .... $< p <$ .... **[3]**

The question only required a narrower interval for p. So, for example, showing $y = 6.375$ when $x = 3.5$ and giving the answer $3 < p < 3.5$ was sufficient. Some candidates, however, produced a lot of unnecessary work to find, for example, $3.26 < p < 3.27$.

There were many intervals given that were narrower than $3 < p < 4$ but it was a requirement of the question to "show the calculations" to support the answer, this was often not done by less able candidates.

Question 10

10 Two vectors, **a** and **b**, are shown on the 1 centimetre grid below.



Show that the vector **a** + 2**b** has length 7 cm.
You may use the grid below.

[3]

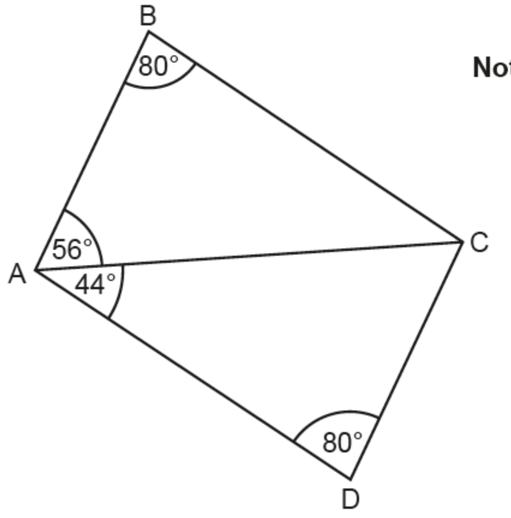
The question required candidates to use a method to show the addition of vectors. This is assessing the communication of mathematics, AO2. The correct use of direction arrows, labels and vector brackets was expected for full marks.

Most candidates chose to answer the question using the grid. Over half of the candidates scored at least two marks for a diagram representing **a** + 2**b**. For full marks they needed to include direction arrows, labels and the resultant (or "7 cm"). Candidates received one mark for producing **a** – 2**b**, although they might have realised their diagram had contradictory direction arrows and did not produce an answer of 7 cm.

Candidates using the alternative method of vector arithmetic were equally successful. Writing **a** and **b** correctly as vectors scored part marks and full marks were credited for $\begin{pmatrix}4\\1\end{pmatrix}+2\begin{pmatrix}-2\\3\end{pmatrix}=\begin{pmatrix}0\\7\end{pmatrix}$. Correct notation was required for full marks but missing brackets were condoned for part marks.

Question 11

11 The diagram below shows two triangles.



Not to scale

Prove that triangle ABC is congruent to triangle ACD.

....

....

....

....

....

.... **[4]**

Candidates were required to produce a proof of congruency, AO2. For full marks, a proof should be formal, comprehensive and logical, and include appropriate notation.

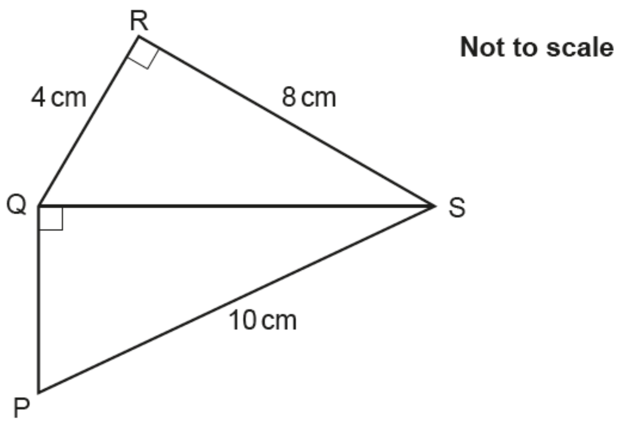
Although many candidates seemed familiar with the term "congruent", very few gave a clear and coherent proof of congruency. The full range of marks was seen, with two marks being the modal mark as this could be obtained without formal notation and precise statements.

The best solutions were concise: angle BCA = 44 and angle DCA = 56 because angles in a triangle sum to 180°; two or three pairs of angles matched using formal angle notation; crucially, side AC identified as being common, and finally the reason for congruence given as either AAS or ASA.

Common errors were to claim BCA = 44 and DCA = 56 because of "alternate angles" or "a parallelogram". However, it cannot be assumed that this is a parallelogram without further proof, which itself often relied on congruence being true. Many wrongly claimed the triangles were congruent because of AAA having found angle BCA = 44 and angle DCA = 56 and then making the observation that "all the angles were the same".

Question 12

12 The diagram below shows two right-angled triangles.



Prove that triangles PQS and QRS are similar.

....

....

....

....

....

.... **[5]**

This question also required a proof but is more open than Q11 and has some processing involved. Therefore, it provides assessment of AO1, AO2 and AO3.

Although many candidates seemed familiar with the term "similar", very few seemed well practised in structuring an efficient formal proof of similarity.

The majority of candidates correctly started by finding the length of QS using Pythagoras, achieving two marks.

Although many then attempted further working, this often scored no additional marks. For example, repeating Pythagoras to find PQ had no purpose unless the result was going to be used. Similarly, stating that QS is common to both triangles was irrelevant and appears to be heading towards an attempted proof of congruency.

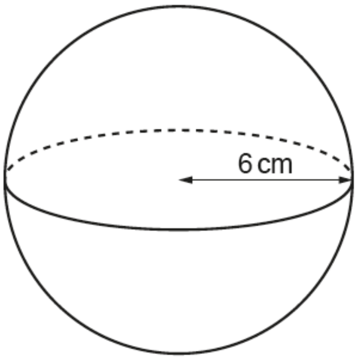
Candidates who scored more than two marks used either ratio/scale factors or trigonometry to show similarity. Each method was equally popular and successful.

The mark schemes for each method were comparable. For the third mark, candidates needed to show either two pairs of corresponding sides were in the same ratio or that two corresponding angles were equal. For the fourth mark, the third pair of corresponding sides needed to be shown to be in the same ratio (which is where PQ found by Pythagoras is used), or a second set of corresponding angles were equal. The final mark was only credited following a correct reason for similarity following their method together with clear notation, such as labelling the sides used alongside the calculations.

The best solutions usually retained surds in their working, so that ratios/scale factors and trigonometric ratios were exact. Premature rounding, such as QS $= \sqrt{80} = 9$, led to ratios of corresponding sides or angles that were not the same to 3 significant figures. Sometimes the candidates commented that they ought to be the same, which should have been a prompt to revise their working.

Question 13(a)

13 (a) Calculate the volume of a sphere with radius 6 cm.



[The volume V of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

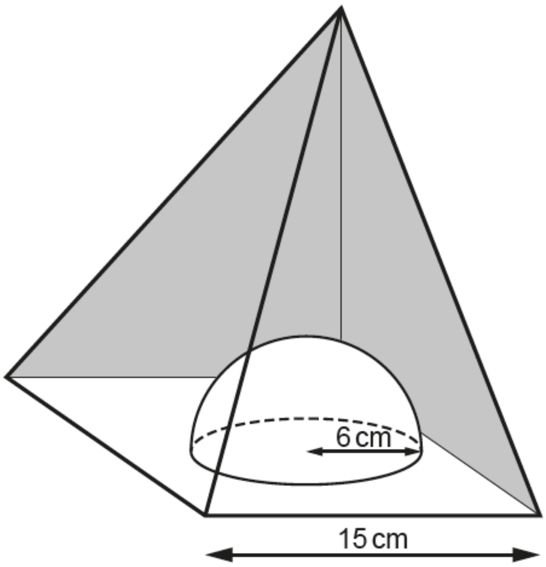
(a) .... cm^3 **[2]**

Substitution and evaluation of a given formula is a standard AO1 process.

Almost all candidates answered this correctly. There were occasional answers of 48π from the use of r^2 rather than r^3. Some of the least able candidates were unable to apply the $\frac{4}{3}$ part of the formula.

Question 13(b)

(b) An ornament is made from a solid glass square-based pyramid.
The base has side length 15 cm.
A hemisphere with radius 6 cm is cut out of the base of the pyramid.
This reduces the volume of glass contained in the ornament by 30%.



Calculate the perpendicular height of the pyramid.

[The volume of a pyramid is $\frac{1}{3}$ × area of base × perpendicular height.

A hemisphere is half a sphere.]

(b) .... cm **[5]**

To answer this unstructured question successfully, candidates needed to combine techniques from shape, number and algebra. It provided assessment of both AO1 and AO3.

More able candidates usually earned all five marks with occasional slips spoiling an otherwise correct solution. Good solutions were characterised by working that was clearly laid out and easy to follow. Other solutions tended to be muddled and difficult to follow, with some requiring a lot of interpretation to determine the candidate's method.

Many candidates did not realise they could use their answer from part (a) to find the volume of the hemisphere and so started again, not always successfully second time around.

Most used the given formula for the volume of the pyramid correctly but some calculated the base area as the area of the square minus the area of the hemisphere's circular base, $15^2 - \pi \times 6^2$.

The next step, and key to scoring more than two marks, was to use the fact that the volume of the hemisphere was 30% of the volume of the pyramid. Dividing the hemisphere's volume by 3 and then multiplying by 10 was a very common, valid method. Some candidates went wrong by multiplying by 7 rather than 10, which gave them 70% of the pyramid's original volume.

The final step required this new volume to be divided by $\frac{1}{3} \times 15^2$. Those who first simplified this to division by 75 were much more successful than those performing the division in two steps. In the latter method, the division by $\frac{1}{3}$ caused errors such as division by 0.3 or by 3.

Question 14(a)

14 (a) Standard bricks have dimensions 21.5 cm by 10.3 cm by 6.5 cm, correct to 1 decimal place.

A house is built using 4663 standard bricks.

Joslin says

Placed end to end, the bricks from the house would definitely reach over 1 km.

Show that Joslin's statement is correct. **[4]**

Candidates needed to identify the correct dimension to use. Then they needed to find its lower bound and use it in an appropriate calculation. Finally, they needed to make a unit conversion and draw a conclusion. Individually, each step is a standard technique, but the lack of any structure or guidance gives the question some AO3.

The question was found challenging, and few candidates earned full marks. Almost all opted for the multiplication method, rather than the possible division routes. The first mark was lost by the majority of candidates (and consequently the final accuracy mark) by not recognising this as a question involving bounds.

Most of those who did opt for a bound correctly chose the lower bound. Most candidates earned M1 for multiplying 4663 by *their* 21·45. However, many calculated and used the volume of a brick rather than just its length.

The most common method to convert from cm to km was to divide by 100 to get metres and then divide by 1000 for kilometres. Less able candidates often did not know these conversions.

Question 14(b)(i)

(b) A standard brick should weigh 2.8 kg, correct to 1 decimal place.
A truck can carry a maximum load of 20 tonnes.

(i) Calculate the maximum number of standard bricks that the truck should be able to carry.

(b)(i) .... **[3]**

As in part (a), most candidates did not appreciate the need to use a bound and so 7142 from $\frac{20000}{2.8}$ or $\frac{20}{0.0028}$ was a very common answer credited two marks. Some candidates gave both the upper and lower bounds for 2.8, but then used 2·75 or 2.8 in their calculation.

Many candidates did not know that 1 tonne was equal to 1000 kg, but many did earn the method mark for the division following an attempted conversion. Some incorrect conversions led to answers such as 71 bricks or over 7 million bricks. In such cases, the candidate should have realised the answer was not sensible for the real-life context.

Question 14(b)(ii)

(ii) Explain why your answer to **(b)(i)** may not be possible to achieve.

....

.... **[1]**

While many grasped the concept that the bricks may take up too much space to be able to fit on the truck, many other comments referred to the weight of the load. Other unaccepted reasons included inaccurate calculations due to rounding, not being able to have parts of bricks or the weight of the driver.

Question 15

15 Ratna invests £1200 for 2 years in a bank account paying r % per year compound interest.
At the end of 2 years, the amount in the bank account is £1379.02.

Calculate r.

r = ... **[4]**

Candidates needed to decide to set up and solve an equation involving compound interest. They then needed to make a decision on how best to solve their equation. The decisions assess AO3 and the processing is AO1.

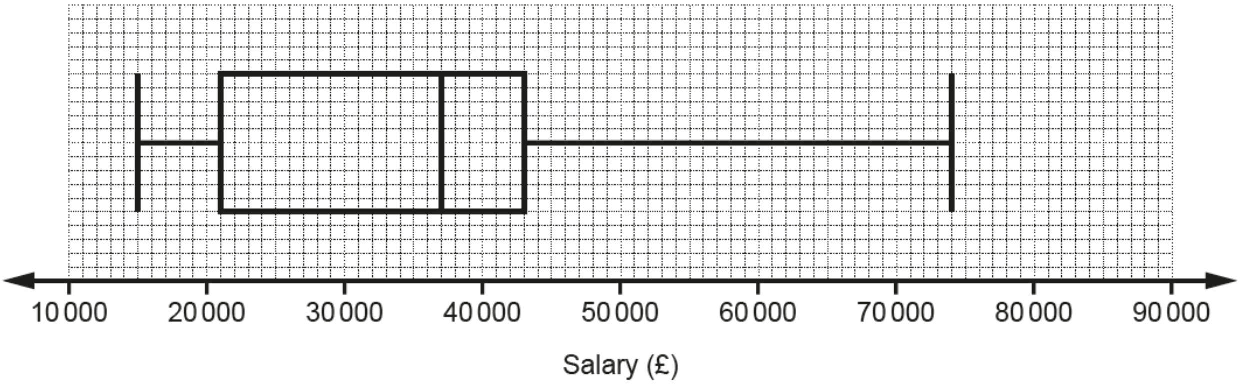
About half of the candidates scored at least three marks whereas one third scored zero. Many candidates started with an acceptable compound interest equation, either $1200x^2 = 1379.02$ or $1200 \times (1 + r/100)^2 = 1379.02$. Few candidates were able to make progress with the latter, usually expanding the bracket and then abandoning the resultant quadratic. Incorrect starting points included $(1200r)^2 = 1379.02$ and $1200 \times 2^r = 1379.02$.

Of those starting with $1200x^2 = 1379.02$, the most able candidates were able to solve it to reach $x = 1.072$ for three marks, but not all interpreted this as 7.2%.

Less able candidates often applied simple interest: finding the interest per year as 89.51 $(179.02 \div 2)$ and expressing this as a percentage out of 1200 to get an answer of 7·46%. This did not receive any credit. However, some candidates used this answer productively in a check for compound interest by calculating 1200×1.0746^2. When realising this was incorrect, some then used trial and improvement to obtain 1.072 for three marks or 7.2% for full marks.

Question 16(a)

16 The box plot shows the distribution of the salaries for the workers at Bexbridge Biscuits.



(a) State the median salary.

(a) £ .... **[1]**

Most candidates gained the mark for the median. 30 700 was the most common incorrect answer, caused by incorrect use of the scale.

Question 16(b)

(b) Find the interquartile range.

(b) £ .... **[2]**

The interquartile range was often given correctly. The majority of candidates who did not gain marks calculated the range or, again, made incorrect use of the scale.

Question 16(c)

(c) The following salary information is true for workers at Camford Cookies.

- The highest paid worker earns £85 000.
- The lowest paid worker earns 20% of the salary of the highest paid worker.
- 25% of the workers earn more than £50 000.
- 25% of the workers earn less than £28 000.
- The median salary is £37 000.

Draw a box plot to show the salaries of the workers at Camford Cookies.

[3]

About three quarters of candidates scored full marks for a fully correct box plot.

Most successfully calculated the lowest salary, and correctly plotted the median and highest salary. There were some instances of the upper quartile being plotted at 62 500 (from 50 000 × 1·25), and the lower quartile at 21 000 (from 0·75 × 28 000). Candidates need to ensure they read the question carefully.

Question 16(d)

(d) Make two different comparisons between the distribution of the salaries at Bexbridge Biscuits and the salaries at Camford Cookies.

1:..

....

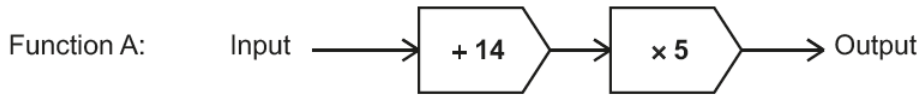
2:..

.... **[2]**

When comparing the two distributions, candidates were expected to comment on the average (the median) and the spread (either the range or the interquartile range). Comments referring to an individual worker, such as "Camford Cookies has the highest paid worker", were not accepted.

Question 17(a)

17 Here is a function.



(a) The **output** of function A is x.

Write an algebraic expression, in terms of x, for the input of function A.

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

While there were many candidates who achieved full marks for the inverse function, many others gave an expression for the function itself, $5(x + 14)$, often written incorrectly as $5x + 14$ or as $x + 14 \times 5$.

Some struggled to express their inverse function using formal algebra and either mixed up the order of operations or gave answers in the form of a function machine.

A few candidates attempted to find the inverse by starting with $y = 5(x + 14)$ and changing the subject of the formula. Although a few candidates were successful using this approach, most made errors either in their manipulation of the algebra or lost track as to which letter was to become the subject such that some ended back where they started.

Question 17(b)

(b) A number, *k*, is put into function A.
The output is also *k*.

Find the value of *k*.

(b) $k =$ .... **[3]**

Candidates needed to decide whether to equate an input or output expression to *k*. In order to lead to a correct solution, their use of brackets needed to be accurate. The question, therefore, addresses elements of AO1, AO2 and AO3.

More able candidates who started with a correct equation were able to solve it using formal algebraic techniques. Candidates starting with $5(k + 14) = k$ were generally more successful in solving their equation than those starting from $\frac{k}{5} - 14 = k$. However, some less able candidates expanded the bracket incorrectly leading to $5k + 14 = k$.

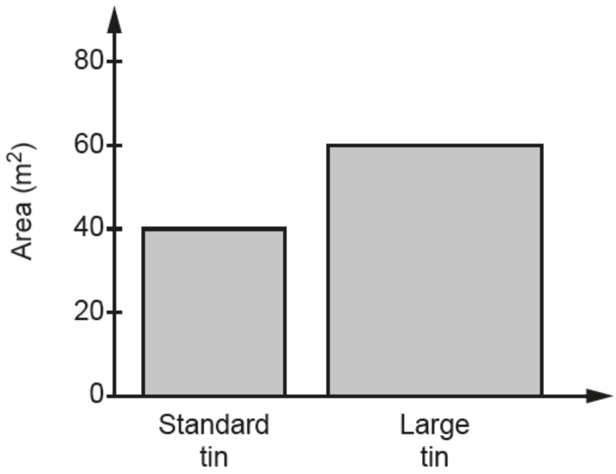
Up to two follow through marks were available for steps of comparable difficulty to the correct solution. So, those starting with $5k + 14 = k$ and finding $k = -3.5$, could achieve two marks. Those starting with $k + 14 \times 5 = k$ followed by $k + 70 = k$, however, did not have an equation of comparable difficulty and scored zero.

There were a large number of candidates who attempted to find the solution using trial and improvement. This needed to be completed through to $k = -17.5$, in which case full marks were credited. Few of these attempts contained clear, systematic working.

Question 18(a)

18 Percy sells paint in standard tins and large tins.
The standard tin covers 40 m^2 and the large tin covers 60 m^2.

(a) Percy publishes this chart showing the area that can be covered with each tin of paint.



Explain why the chart is misleading.

....

.... **[1]**

There were many correct answers. Some candidates were not sufficiently specific in their phrasing, such as referring to "size" rather than "width". Some unsuccessful answers included a comment on a lack of numbers on the *x*-axis.

Question 18(b)

(b) The standard tin and the large tin are mathematically similar.
The **volume** of the large tin is 50% more than the volume of the standard tin.
Both tins are cylinders.
The radius of the standard tin is 10 cm.

Calculate the radius of the large tin.

(b) .... cm **[4]**

Candidates needed to interpret the given information accurately and then apply the standard technique of changing a volume factor into a length factor. It was not necessary to work out any volumes in order to answer the question.

Most candidates identified that a scale factor of 1.5 was involved but the vast majority did not appreciate that it represented a volume factor. Only the most able immediately calculated $10 \times \sqrt[3]{1.5}$. The majority of attempts merely treated 1.5 as a length factor, leading to an answer of 15. Others thought that 1.5 was an area factor and so worked out $10 \times \sqrt{1.5}$.

Many candidates tried to find a volume for the standard tin from its given radius, despite not being told its height. Often the formula used for the volume of a cylinder was incorrect. It was an approach that could have worked if pursued carefully but any success using this method was extremely rare.

Question 19

19 Show that $\frac{2x^2+13x+20}{2x^2+x-10}$ simplifies to $\frac{x+a}{x-b}$ where a and b are integers. **[4]**

This question tested the standard algebraic techniques of factorising quadratic expressions and simplifying an algebraic fraction.

Many able candidates successfully factorised both the numerator and denominator. Most then completed the question by cancelling the common factor.

A variety of approaches to factorisation were seen. Some candidates appeared to have done this 'by sight'. Others used a grid method. Some candidates attempted factorisation by partitioning (e.g. $2x(x + 4) + 5(x + 4)$). Many were successful with this, but some did not complete the factorisation.

Some candidates attempted to use the quadratic formula, treating the numerator and denominator separately. Even if performed accurately, few could relate their roots to factors and make progress with the actual question asked.

A large number of less able candidates merely crossed through the $2x^2$ terms leaving $\frac{13x+20}{x-10}$.

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