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OCR
Oxford Cambridge and RSA

GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/03 Autumn 2020 series

Version 1

Introduction

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

i	Reports for the Autumn 2020 series will provide a broad commentary about candidate performance, with the aim for them to be useful future teaching tools. As an exception for this series they will not contain any questions from the question paper nor examples of candidate answers.

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.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Paper 3 series overview

Performance on early parts of the paper was often satisfactory, although many candidates found giving reasons, visualising objects and solving problems quite challenging.

Many candidates appeared unprepared to answer the more demanding parts of the paper and performance by this cohort was not as strong as in previous years.

A significant number of candidates did not demonstrate good algebraic, calculator or arithmetic skills.

Candidates who did well on this paper generally did the following:	*Candidates who did less well on this paper generally did the following:*
• Read the questions carefully • Showed clear working to support their answers • Planned and recorded solutions in an orderly manner • Demonstrated a good knowledge of fractions • Used correct conversion factors when changing between units • Demonstrated good calculator skills.	• Were insecure with standard methods for calculating percentages, areas and volumes • Were unfamiliar with using and interpreting fractions • Were insecure with metric conversion factors • Used inefficient methods • Did not know about angles in polygons • Did not solve inequalities or display the result on a scale • Did not plan solutions to questions requiring problem solving techniques • Were unfamiliar with trigonometry • Were unfamiliar with vector notation.

Comments on responses by question

Question 1

Most candidates gave a correct factor in part (a) and a few listed more than one factor or included 5 in their answer. As long as all factors were correct, the mark was awarded.

In part (b) a small number of candidates gave a further factor rather than a multiple.

Question 2

Many correct responses were seen. Candidates who treated part (a) as a sequence and used differences to find the missing term were not always successful.

Question 3

Most candidates realised that two calculations were necessary. 3 – 5 was often correctly evaluated as $^-2$ although some candidates gave an answer of 2. When candidates did not score full marks, it was often the answer to 2 – 3 × 2 that was wrong. Some candidates gave the answer "Incorrect…the two answers are different". This scored no marks unless the correct values were shown. Some candidates did not understand that they were supposed to evaluate each side and compare them but considered the statement as a whole. Comments such as '2 take away 3 × 2 equals $^-4$ not 3' were seen and gained B1.

Question 4

Many good answers were seen, although very few candidates could answer part(b)(ii). Most candidates chose an average and defined it or said it would be suitable. Few chose the median and very few described clustering around this value. Some candidates used a number, rather than the name of the average. Some chose the range or bar chart or pie chart, not realising these are not an average.

Question 5

Many candidates gave the answer 'rectangle' for (a).

Part (b) was often the better answered part and pyramid was a common answer. Square, prism or square-based prism were also common incorrect answers.

Question 6

More able candidates answered using the method 50 ×. Some candidates used inefficient methods such as 10% of 50 = 5 and then 5 + 5 + … . If these contained an error and did not show operations then no method marks were scored.

In part (b) some candidates scored B1 for finding $\frac{3}{10}$ but some just repeated the operations given (× 3 and ÷ 10). Some candidates chose a number to start with, multiplied their number by 3, divided by 10 but then gave their result as their answer. Most candidates could not associate finding $\frac{3}{10}$ of a quantity with a reduction of $\frac{7}{10}$.

Part (c) presented the greatest challenge. The answer $\frac{3.5}{7}$ was very common and scored 0. The most successful candidates changed the fractions to decimals and found a fraction between. Very few candidates used fractions with a common denominator or converted fractions to decimals to a sufficient accuracy.

Question 7

This problem solving question was occasionally answered with no working and a correct answer.

Most candidates were not able to find the length of one side of the square or draw any square anchored on (4, $^{-}2$). A common wrong answer was (4, $^{-}2$) or ($^{-}4$, 2) without relevant working.

	Misconception	Candidates tried to find the length of the side of the square by dividing 36 by 4, confusing area with perimeter.

	AfL	The area of a square is calculated using length × length. If the area is 36 cm^2, the calculation is ... × ... = 36, so the missing number is 6 (because 6 × 6 = 36). This is the same as $\sqrt{36}$ [$(\text{length})^2$ = area so the reverse process is $\sqrt{\text{area}}$ = length].

Question 8

In part (a) some good and efficient solutions were seen but, once again, inefficient methods for finding a percentage increase were common. Many students divided 2300 by 10 to get 10% but then incorrectly divided by 10 again when working out 5% (10% = 230 and 5% = 23). It was common amongst candidates who did score marks to gain M1 for 7 × 2300 or 2300 × 0.15. A very common answer was 2645 which scored M2.

Part (b) presented many challenges to the majority of candidates. Most used incorrect methods, such as finding 10% of 63 and subtracting the answer from 63. Very few correct answers were seen.

	Misconception	Candidates did not associate 63 with 90%.

	AfL	When an amount has been reduced by 10%, the new amount is 90% of the **original** amount. If you divide this new amount by **9** you will find **10%** of the **original** amount. The original amount is 10 times this value. e.g. A price is reduced by 10% to £54. Find the original price. • £54 is 90% $\left(\frac{9}{10}\right)$ of the original. • £54 ÷ 9 = £6 (10% $\left(\frac{1}{10}\right)$ of the original price). • The original amount is £6 × 10 = £60.

Question 9

Most candidates could not answer this problem solving question. Part of the technique is to make a list, or draw a tree diagram, to answer the question. The few candidates that made a list often went on to gain full marks. Many answers relied upon the number of gloves and gave an answer that stated that the denominator of the fraction should be 5 or said that the answer was correct because there were three colours and two gloves that paired.

Question 10

Many candidates scored 2 or more marks on this question. Some candidates found multipliers, 1.12 and/or 1.13. Some correctly wrote down the percentage increase but did not show how they found this value. Some candidates said that 400 had been increased by 13%. They then showed 400 ÷ 10 = 40 and 40 ÷ 10 = 4 and 40 + 4 + 4 + 4 = 52 and 400 + 52 = 452 which was not needed. Some candidates used a non-calculator method such as 10% = 40 and 1% = 4, etc. Where no operations were seen, and an error was made, no marks were scored. Most candidates did not deal well with the problem solving element of this question. Very few realised that a good strategy was to find the rate for Bank B and apply it to £400. If the question had directed them to do this then it would have been an AO1 question.

SC1 was awarded on many occasions for candidates finding a difference between an amount for A and an amount for B. This was often 52 – 30 = 22. These candidates demonstrated little understanding of comparing exchange rates.

	AfL	Practice using efficient calculator methods in Papers 1 and 3. When you find a multiplier show how you do this e.g. 250 → 280 = $\frac{280}{250} = 1.12$.

Question 11

Most candidates did not have strategies to solve this problem. Many thought that they should find a value for x. The obvious approach was to expand the brackets and a number of candidates gained two marks for two correct expansions. The common error was to show $5(2x + 1)$ as $10x + 1$ and $c(x + d)$ as $cx + d$. Having expanded the brackets, very few candidates isolated the terms and $10x + cx = 12x$ was very rarely seen. Some, having expanded the brackets did deduce the value of c but did not show how they did it.

	Misconception	Candidates confused an identity with an equation.

	AfL	When a number/letter is in front of a bracket, the number/letter multiplies **each** letter or number in the bracket. When an identity is seen, isolate the terms that have a letter in common. e.g. Find the value of a when $3x + 5 = ax - x + 8$ Isolate the terms containing x: $3x = ax - x$ $3x + x = ax$ $4x = ax$ so a must have a value of 4.

Question 12

Many candidates answered part (a)(i) correctly. Part (a)(ii) was less well answered. Some gave 5 as the answer and 32 and 16 were common errors.

Part (b) was often answered correctly and sometimes the correct answer appeared with no working. One mark was rarely scored. Others demonstrated misunderstanding of indices. A common incorrect answer was $^{-}3$ from 2 × 2 = 4 then 4 – 3 = 1.

Question 13

Many correct answers were given to part (a). Most, but not all, lines were ruled and most passed through the origin. Some candidates gave crosses in a straight line. If this would have passed through the origin, 1 mark was scored. Diagrams showing strong, but not perfect, correlation did not score.

In part (b)(i) some efficient solutions were seen. A large number of candidates added 120s but, not making 432, did not know how to proceed. Some got to 120 + 120 + 120 + 60 = 420 and scored a method mark. Some candidates seemed to know that 432 ÷ 120 was needed but were unable to do the calculation. This could have been avoided with efficient calculator use. Some candidates were confused about the 2 kg of sugar and tried to incorporate it into their calculations for part (b)(i) when it was only needed in part (b)(ii).

In part (b)(ii) some candidates scored B1 for showing 2 kg = 2000 g. Some scored 0 marks because they showed that 20 batches needed 2000 g of sugar and did not show a conversion.

Question 14

This is the first of the common questions.

In part (a) many correct plots were seen, although errors were sometimes made when plotting (210 min, £130).

Many candidates correctly circled the bottom, right plot in part (b).

Part (c) was quite well answered. The common error was to draw the line of best fit through the origin or far too steep and therefore not within tolerance. Most candidates used a ruler to draw a line of sufficient length.

The final part was very poorly answered and very few correct answers were seen. The statement '7 hours is well beyond the recorded data' would have sufficed, but most candidates alluded to the graph being too small. Some candidates ignored the graph and gave answers relating to stopping to refuel, the flight taking more or less than 7 hours and discounts.

Question 15

Another problem solving question. Most candidates did not have an efficient strategy to solve the problem. Some tried finding perimeters but without the length being three times the width. Some divided 44 by 4 but were unable to proceed. Some divided 44 by 4 and then by 2 to reach 5.5 and scored 3 marks.

	AfL	Practice solving simple problems and then discuss the strategies you have used with others and compare the solutions you have each found.

Question 16

Another common question. This was not well answered with few methods shown. Many candidates replaced the < with = and some worked through to $x = 5$ and forgot to change to $x < 5$. Trials were commonly seen and sometimes these ended with 5 being used. A number of candidates got to 5 and then gave $x = 4$, not realising that numbers are continuous. Most candidates were not able to show the inequality correctly on the line. Many just marked a point on the line. A very few got to $x = 5$ and then recovered by showing x < 5 correctly. A tiny minority did not gain the mark because they placed the hollow circle to the left of 5. Common errors were $3x + 4 = 7$ or $7x$ and $x = 7$, leading to marks at 7 on the number line. Some candidates understood that x needed to make $3x + 4$ less than 19, but then chose a particular number that did this, rather than saying $x < 5$.

Question 17

Very few correct answers were seen. Candidates demonstrated poor recollection of the necessary formulae. A common error was to say that the area of the triangle was 8 × 9 = 72. Some did find the area of the triangle and could go no further. They gained 2 marks. Most candidates were reluctant to state the trapezium formula and substitute the values 12, 20 and h. Those who tried to equate the formula with their triangle area did this in stages, first working out 12 + 20 and then dividing by 2. Some, but not all, then divided the area of the triangle by their value. This was very rare to see. Most experimented with values or did not attempt a solution. 12 × 20 rather than 12 + 20 was often seen.

Question 18

Many candidates did not answer this question. A number tried Pythagoras' theorem and others attempted to combine the given numbers in novel ways. 34 ÷ 8 was not uncommon but also tan (34 × 8) and 34 × 8. Some candidates realised they must use trigonometry but could not do so correctly. Others attempted scale drawings which were, inevitably, insufficiently accurate and did not meet the demand of the question.

Question 19

This was also a common question. A small number of candidates answered part (a) correctly although 180 ÷ 12 was often seen.

In part (b) a few candidates scored a follow through mark but candidates with answers above 180 in (a) could not do this. 150 was not often seen. Candidates generally did not demonstrate knowledge that the sum of the exterior angles of a regular polygon is 360°.

Question 20

This was also a common question. The 6 marks were rarely awarded. Most candidates gained a mark for correctly changing 15 tonnes to 15 000 kilograms, though 1500 and 150 000 were also seen. Very few candidates worked with consistent units and 2.4 × 1.2 × 1.8 and 2.4 + 1.2 + 1.8 were common when attempting to find a volume. It was not uncommon amongst the few candidates who reached this point to then see 5.184 ÷ 750 or 750 ÷ 5.184, which denied a method mark. A small number of candidates gained a mark for dividing figs 15 by their volume.

?	**AfL**	Learn the correct conversion factors for units of length making use of "hints" such as kilo which implies a thousand.

Question 21

This was the final common question. A significant number of candidates did not attempt an answer. For those who did, the correct answers were rare but some gained a mark for one correct component in each part.

In part (a) some candidates gave the answer in the form of coordinates or fractions, such as $\left(\frac{4}{-2}\right)$. In both cases a 1 mark penalty was incurred. Thereafter, these were condoned.

In part (b) a few candidates gained 1 mark for $\begin{pmatrix} 4 \\ 9 \end{pmatrix}$.

Question 22

In part (a) many candidates gained a mark for (1, 0) but errors were often made when calculating (⁻1, 2).

The candidate's coordinates were followed through to the plots in part (b) which were often accurate. Curve drawing skills were almost entirely absent. Polygons were common, or no line at all. A number did not plot their points or drew one, or more, straight lines.

In the final part, some candidates read the answers accurately from their points of intersection but a common error was to give the values of x where the curve crossed the x-axis. Some candidates expanded the axes to accommodate their incorrect coordinates, not realising that their answers were incorrect as they did not fit on the axes.

Question 23

The vast majority of candidates could not answer this question.

The common response for (a) was 0.8 from 0.6 + 0.2.

In part (b) the common answer was 1.1 or 0.11 when a candidate was deterred by a value greater than 1. This did not bother the majority of candidates as some found 0.4 + 0.3 + 0.6 + 0.8 and gave 2.1. Occasionally 0.3 × 0.8 was seen.

Common misconceptions

A lengthy non-calculator method is needed to find percentage.

An original amount, reduced by 10%, can be found by finding 10% and adding it on to the amount and not realising that what is seen is 90% of the original amount.

Confusing area with perimeter for plane shapes.

Identities are equations.

There are 100 kg in a tonne or there are 100 g in a kilogram.

A vector can be written as a fraction or as coordinates.

The probability of two events is the sum of their probabilities and not the product.

A solid is a 2D shape.

Key teaching and learning points – comments on improving performance

Encourage students to use efficient methods to find percentages in calculator papers. When a percentage increase is needed, realise that, for example, a 15% increase gives 115% of the original and so this is $\frac{115}{100} = 1.15$.

Explore the meaning of percentages and the application to reverse percentages.

Encourage and practise efficient calculator usage.

Give many opportunities for solving simple problems and discuss strategies used and solutions seen.

There are many useful websites in which the problems can be adapted or used as given such as Nrich https://nrich.maths.org/

Learn the relevant formulae. Many candidates were unaware of the correct formulae and thought that the area of a triangle formula was $A = b \times h$ and the trapezium formula was $A = h(a + b)$ or $A = h(a \times b)$.

Many candidates did not know that the sum of the exterior angles of a polygon is 360° or the connection between an interior and an exterior angle.

Many candidates could not answer vector questions.

Teach that, if coordinates do not fit on the given axes, then they are incorrect and the student should go back and check calculations.

Practice interpretation, and discussion of limitations, of data and not supplying "real life" factors.

Guidance on using this paper as a mock

Students who do not read or understand the problem solving questions, or who have had insufficient preparation for such questions, will have difficulty in deciding what steps to take and may not demonstrate skills they know. Using this paper purely as a diagnostic tool for basic skills may, therefore, give misleading results. The paper does cover a variety of basic and more advanced skills with questions accessible to all levels of Foundation students.

Before using this paper as a mock, work through some of the misconceptions outlined using related, but different, questions.

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