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OCR
Oxford Cambridge and RSA

GCSE (9–1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/02 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.

	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 exam paper nor examples of candidate responses.

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 exam paper and the mark scheme can be downloaded from OCR.

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.

Many responses were accompanied by appropriate working but for some candidates this was disorganised and unclear. The knowledge displayed varied widely: some did well on the first five questions and on the later questions. Others struggled on the early questions, displaying gaps in their knowledge of basic numerical facts, but performed better later in the paper. There was evidence across questions of more 'no response' than usual.

Generally, candidates scored better on the short, structured questions. On the unstructured questions many struggled with their presentation and communication. Writing down key words or headings to calculations would help with structuring their solutions.

Questions involving topics that are covered later in the Foundation specification, such as solving simultaneous equations, sketching and identifying types of graphs and finding the area of a sector, appeared very difficult for most and were often not attempted at all.

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• Set out working clearly and logically. • Showed calculations for every step of their working rather than just stating numerical results. • Used correct conversion factors when changing between units. • Were secure in manipulating and simplifying algebraic expressions. • Were clear and precise in explanation responses.	• Steps for working through a problem were disorganised and unclear. • Found difficulty with dealing with place value in their calculations. • Reversed numbers when using the bus stop method for division. • Were unfamiliar with metric conversions. • Did not consider reasonableness of their responses. For example, in Question 11(b), results ranging from amounts less than 500 to a response of 65 000. • Used incorrect forms for probability such as ratios or words and omitted the percentage sign if giving probabilities as a percentage. • When giving explanations or comments, not enough detail was given or statements were not specific enough.

Comments on responses by question

Question 1

Part (a)(i) was usually correct, and some candidates drew number lines to help them. The most common incorrect response was -7, suggesting the negative at the front applied to both digits.

Part (a)(ii) was less successful with incorrect responses more common than the correct response of 10. Usual mistakes were -10, 4 and sometimes -4.

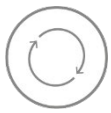
In part (b) several candidates gave pairs of numbers below 10, often both prime numbers, demonstrating knowledge of primes but not careful checking of the question requirement. 15 was the most common incorrect number to be included.

Question 2

Many candidates were aware of the conversion from cm to m in part (a)(i), knowing that 100 cm = 1 m, but dividing by 100 incorrectly was common which led to wrong responses of 35 and 0.35. Others multiplied by 100 giving a response of 35 000.

Part (a)(ii) was much less well done with most candidates unfamiliar with the conversion from litres to millilitres. Some split the numbers by inserting a 0 usually between 5 and 2 to give 1502. The most common incorrect response was 152.

In part (b) candidates frequently incorrectly converted 30 mm to 0.3 cm leading to a response of 6. Quite a few correctly stated that 30 mm = 3 cm but then made an error in their addition by aligning their 3 with the 7 in 5.7 also leading to a response of 6. Other errors were 35.7 from adding the numbers given and 0.87 from 0.57 + 0.30.

	**AfL**	Encourage candidates to check their place value when adding together decimals and make sure decimal points are clearly marked.

Question 3

Both parts (a)(i) and (ii) were usually correct. Common errors in part (a)(i) were a denominator of 5 or 3 and in part (a)(ii) a numerator of 1 or 2.

Parts (b)(i) and (ii) were also well answered. In part (b)(i) 4 was a common incorrect response as was 0.16 from multiplying rather than dividing. In part (b)(ii) common errors were 2.14 from multiplying each digit separately and 2.4 from forgetting the carry figure when completing the multiplication.

Question 4

Part (a) had a good number of correct responses, often coming from a start of $\frac{16}{100}$ although this was not always correctly simplified. Common errors included $\frac{16}{10}$, $\frac{1}{6}$ and $\frac{1}{4}$.

Candidates found part (b) more challenging. The equivalent fraction of $\frac{35}{100}$ was often used to help get to the decimal. Common errors included problems with dividing 7 by 20, attempting 20 ÷ 7, $\frac{7}{10}$ = 0.7 giving $\frac{7}{20}$ = 0.07, 0.72 and leaving the answer as $\frac{35}{100}$ or giving the equivalent percentage.

?	**Misconception**	Candidates commonly, when putting e.g. 7 ÷ 20 into the bus stop method, place the numbers the wrong way around.

Question 5

Part (a)(i) was mostly answered correctly with varying spelling arrangements that provided a clear intention. In part (a)(ii) candidates found it difficult to identify the quadrilateral was a rhombus. Some referred to it as a diamond but it was more usual to name an incorrect quadrilateral, commonly square and kite, or state 'quadrilateral'.

Most lines were drawn freehand in part (b)(i) but the intention was usually clear. A few candidates drew diagonal lines. Part (b)(ii) proved very difficult and a significant number did not attempt this. Many confused rotational and reflection symmetry, this was clear from sketches involving line symmetry that candidates drew to support their reasons. M1 was occasionally earned for correct rotational symmetry of another quadrilateral, most often a square although many assumed this had a rotational symmetry of 2.

Part (c) was often correct however, many candidates used more than one arrow to indicate the two parallel sides. There were many errors, dashes used instead of arrows, lines extended from the shape or angles marked.

?	**Misconception**	Diamond is not an acceptable alternative to rhombus.

Question 6

Of all the problem solving questions on the paper, this was probably the most successfully attempted, with many fully correct responses seen. The most common error was to subtract the '20 minute break' from the 2 hours of travelling leading to a final calculation of 10:10 − 1hr 40mins and a response of 8:30.

The formula $s = \frac{d}{t}$ was generally well known and often candidates would draw a DST triangle to assist them. Errors arose from multiplying 100 by 50 instead of dividing, arising from their triangle having D, S and T in the wrong positions. Other errors involved using the 20 in their DST calculations. Some ignored the 20 minute break giving a response of 8.10.

Question 7

Most candidates were able to read off the graph and identify the goals scored by the teams in part (a) and this was sufficient to gain the mark. However, further explanation sometimes contradicted their correct readings and hence this mark was lost. Most successfully distinguished between 'twice' and 'two more'.

In part (b) many candidates correctly identified that the scale should start at zero. Incorrect responses came from candidates suggesting the scale should go up in twos or fives or that colouring the bars would improve the chart.

Rarely did a candidate grasp the concept of part (c). Many did not offer a statement. Some referred to the total goals as the reason and a few confused 'mean' with meaning the most.

Question 8

Part (a) was generally well answered although some candidates got the numbers the wrong way around; 4^3 was the most common error as well as 3^3. Some gave just a numerical response and occasionally 3^4 was spoilt by also stating 81.

Less success was seen in part (b) with candidates scoring almost exclusively from calculating $2^6 = 64$. In evaluating 2^6 some started with 2 then multiplied by 2 six times getting to 128. The negative index proved too difficult for many, mostly being evaluated as $^{-}4$ or $4 - 1 = 3$ or 4. For many, their final working was 64×4^{-1}. Others dealt with indices incorrectly by multiplying the numbers and adding the powers leading to 8^5 and then sometimes attempts were made to work this out. Very few candidates addressed the question 'Show …. is a square number' as most, due to the difficulty with dealing with the negative power, were unable to progress to find a square number.

Question 9

Part (a) was well answered with errors of 3 : 5 and 12 : 15 seen.

Part (b) was usually attempted by changing 1.8 kg to grams; this resulted in a ratio of 600 : 180 being simplified due to an incorrect conversion. A few changed 600 g into kilograms successfully. Often, after an incorrect change of units, many were able to score M1 for a correct partial simplification.

	**Misconception**	There are 1000 g in 1 kg but many candidates incorrectly think the conversion is 1 kg = 100 g.
	**Misconception**	Probabilities are **not accepted** as ratios or in words. They are best written as a fraction unless a question clearly requires them to be given as a decimal or a percentage.

Question 10

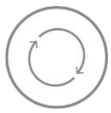
Many candidates appeared unfamiliar with the laws of indices particularly in part (a) with a variety of errors including 5^4, $5b^8$, $5b^3$, 5 × 5 × 5 × 5 and 5 × 4 = 20.

In part (b) x^7 was the most common response. Other errors seen were $4x^3$, $12x$, $7x$, 4 × 3 = 12 and 4 + 3 = 7.

Question 11

In part (a) many candidates attempted to break 500 down in to separate percentages in order to use a non-calculator method to find 6% of 500. They started well with 10% = 50, 5% = 25, but the final divide by 5 proved tricky and many could not identify 1%. Several candidates used 0.06 but after starting with 500 × 6 found problems with positioning the decimal point. Others incorrectly attempted 500 ÷ 6. Some of the better attempts overcomplicated the question, believing that the 6% was per month or per day, so methods of trying to multiply *'their 30'* by either 12 or 365 were seen. The majority of M1 marks were given to candidates who gave 530 as a final response where they misunderstood the term 'interest' and gave the value of the investment.

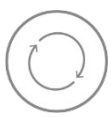
This comprehension issue continued into part (b) but to a much larger degree. Few interpreted the term 'investment' correctly so many candidates multiplied the original 500 by 5 in addition to the interest. Others multiplied their interest value from part (a) and did not consider the initial deposit. Occasionally a candidate attempted compound interest.

	**AfL**	Highlight the difference between 'work out the interest' and 'work out the value of the investment' when looking at simple and compound interest problems.

Question 12

Few candidates recognised this as a reverse percentage problem and candidates generally found 20% of £56 and then either added to or subtracted from £56. Almost all candidates worked out 10%, doubled their answer to get the 20% and added to £56 giving the jacket price as £67.20. This was often completed with clear laying out and mostly secure calculations but gained no marks as few realised that this was the wrong method. When a candidate identified that £56 was 80% of the required answer, there was difficulty with dealing with 56 ÷ 0.8. The most successful were those who divided 56 by 4 then added their result on.

	**Misconception**	Candidates did not associate 56 with 80%.

	**AfL**	The jacket price has been reduced by 20%, the sale price is **80%** of the price before the sale. Divide the sale price by 8 to find **10%** of the presale price. The presale price is **10 times** this value. e.g. £56 is **80%** of the presale price. £56 ÷ **8** = £7 (**10%** of the presale price). The price before the sale is £7 × **10** = £70.

Question 13

Most scoring responses achieved either M1A1 or all 5 marks. Occasionally candidates lost a mark as the probabilities were transposed in the table. For those not achieving full marks, most M1A1 scoring responses correctly showed the method to get to 0.42 and recognised this as the total for the missing probabilities. Not all showed clear and explicit working, but 0.42 was stated somewhere in their working or was implied by values in their table. A few however, lost the A1 as they struggled to subtract the decimals, seemed to swap to percentages but omitted using the percentage sign. The second M1 was often lost as the misconception here was to divide 0.42 by 2 rather than by 3. Some candidates attempted trial and error to try to sum the two missing probabilities to 0.42 but this approach was rarely successful.

Question 14

All 3 graphs appeared unfamiliar to many candidates.

Part (a)(i) saw some candidates scoring although most gained M1 for a vertical line. A few $y = 3$ lines were drawn and many lines attempted were sloping. Some drew a cross at (3, 0). Quite a number did not attempt part (a)(ii). A few partial curves were drawn but rarely was the correct shape seen and almost all of these passed through the origin rather than 1.

Part (b) was not attempted by many candidates and appeared beyond the knowledge of almost all. Most comments intimated that the sketch was correct.

Question 15

Most candidates understood algebraic simplification in part (a) but often made errors with the directed number aspect resulting in 1 mark, usually for a response of $2a - 7b$. Other errors included $6a + 7b$, $6a - 7b$ and $5ab$ (with and without $2a + 3b$ seen first).

Part (b)(i) was answered well. Common errors included $12x$, $4x + 3$, $7x$ and $x^4 + 12$. Candidates who performed best in part (b)(ii) worked in steps, expanding then simplifying and the grid method seemed the most helpful. Again, there was often a problem with the directed number aspect. Common errors included $5x - 2 = 10$, $-2x + 5x = 7x$ or $-3x$. The algebraic error of $(x + 5) = 5x$ and $(x - 2) = -2x$ was often seen.

Question 16

The vast majority gained no marks and over a quarter of the cohort did not attempt this question. Candidates found difficulty with the unstructured nature and were unable to identify that there were multiple steps to reach the answer. Most started off by attempting expressions for the perimeter, and less often the area, and a few attempted to equate them. Rarely did a candidate consider the option of equating the two algebraic expressions for the sides. Some looked at simplifying each side rather than equating them, often resulting in $4x - 10 = 6x$ or $-6x$ and $11 - 2x = 9x$. These candidates did not recognise at this stage that this did not support the key requirement that the sides were equal. Some did not differentiate between an expression and an equation and so performed the same operations to both terms of their expression for the area $(4x - 10) \times (11 - 2x)$ when attempting to simplify. This quadratic very quickly became an expression beyond the level of understanding of almost all candidates. The rare attempts at equating the two expressions for the sides generally did not continue to $x = 3.5$, with candidates getting as far as $6x = 21$ but progressing no further.

?	**Misconception**	Candidates are not clear about the difference between an expression and an equation.

Question 17

In part (a), some candidates looked for patterns in the numbers rather than using the information given in the stem of the question; 7, 7, 7 was a common error. Sometimes the numbers were multiplied rather than added; errors such as 7, 9, 7 with the 9 coming from multiplying rather than adding the 3s and 10 in place of the 7s were seen. A few did not attempt to complete the table even though they often went on to attempt subsequent parts.

Many candidates were able to access part (b)(i) either giving the correct result or the correct response following through from their table. Most used the denominator 25, but a few miscounted and had 24 or 26. Some had a denominator of 36 from including the table headings and considering it as 6 by 6. The most common incorrect response was $\frac{3}{5}$ which came from using the original 5 cards rather than the combined totals of selecting two cards. Several candidates gave an answer of just 13, the number of outcomes rather than the probability. In part (b)(ii) $\frac{15}{25}$ was reasonably common and evidence suggests this was from including 10 as a multiple of 3 or 4. Another common answer was $\frac{4}{25}$ from only counting the number of 3s and 4s or from only considering multiples of 3.

Question 18

The intention was there in many cases but omission of clear and structured working was a barrier to many candidates gaining higher marks. There were many attempts to add $\frac{1}{3}$ and $\frac{2}{5}$ so M1 was often earned but correct addition of fractions was a struggle for many with $\frac{3}{8}$ a far more common response than $\frac{11}{15}$. Further formal working of $\frac{11}{15} \times 10$ was rare to see and many candidates opted instead to represent the next step pictorially. This was commonly either incorrect or not at all clear so a further M1 was rarely achieved. On the rare occasion it was clear, candidates did not show $3\frac{1}{3}$ but went straight to 4 cartons for Charlie without explanation. This meant that most lost the M1 for *their* improper fraction/decimal/mixed number rounded up to the next integer. The M1 for *their* integer multiplied by 70 or 0.7 was often earned but again marks were lost by candidates not explicitly showing the working for this last step and just writing *their* final response without it. For an alternative method some candidates attempted to multiply their fractions separately by 70p and then sometimes by 10, trying to add these together somewhere later in their working so this earned the M1 or M2. The A1 mark was commonly not earned due to rounding errors. This method lost the final two M marks because their costs were not usually rounded due to misunderstanding that the juice cartons were sold in whole units.

Question 19

Nearly all candidates used an approach of listing times rather than identifying the LCM of 8 and 20. Rarely was the length of time between 8:01 and 12:30 considered, and many confused 8:01 as the time of the first chime and flash. The most successful candidates were those who wrote out two complete lists and, from them, identified the correct timings when a flash and chime coincided. Those not achieving full marks often gained B2 or M1 for successfully starting but not completing their lists or for errors made in their additions beyond 9:00. The final M1 was also scored by some of these candidates. Marks were lost when no times were identified even though lists were complete, or only 8:40 was identified. Many lists were well laid out and clear to understand, however some candidates working was jumbled with disorganised groups of times. A few added 8 and 20 and took this as their time interval proceeding to list 8:00, 8:28, 8:56, etc.

Question 20

The very few candidates who scored well on this question tended to be systematic in their approach. They labelled the key numbers on the axes to help them gain the dimensions of the triangle before working out the coordinates. Others struggled to adopt a logical approach and several responses consisted of a series of seemingly random calculations. These responses showed little evidence of candidates appreciating the necessity of finding the short side and the long side by using the given coordinates, and the fact that the triangles were congruent. The short side of 3 (from 12 − 9) was occasionally seen on the diagram below point B but was then inconsistently used. A common approach was to attempt a scale on each axis and then to estimate the coordinates, although this was rarely successful. B1 was a common mark, usually for the *y*-coordinate of C being 9. Many candidates did not attempt this question.

Question 21

Most candidates attempting this question generally trialled different numbers to see if they could find ones that fit. A few of these gained SC1, usually for the values $x = 2$ and $y = 2$. However, the higher scoring candidates knew the numbers had to fit both equations and so often did not give a final response as they could not satisfy both. There was a minority who knew the method to equate coefficients and some did this successfully, often resulting in finding one of the values. Errors then tended to occur with identifying the other value due to *x* being negative and *y* being positive. Other candidates made errors multiplying the equations, sometimes forgetting to multiply the constant, or making an arithmetic error. The few that successfully equated their coefficients for *y* and got to $10x + 15y = 50$ and $9x + 15y = 51$ often did not subtract correctly and ended with $x = 1$.

Question 22

Many candidates recognised and could identify the information on the diagram. Most realised that 0.35 was an error or that 0.55 + 0.35 = 0.9 or did not add to 1. Some referred to 90 instead of 0.9 without the clarity of a percentage sign. In a few cases a mark was lost due to an arithmetic error, 0.55 + 0.35 = 0.80. Marks given for 'Monday doesn't add to 1' and 'Tuesday rains should be 0.25' or stating '0.75 and 0.25 are the wrong way around' were common. Very few candidates referred to the missing part of the tree diagram and a third comment was often about the cosmetic appearance, with non-scoring statements such as 'her tree diagram is not right', 'the branches should be closer together', 'it should be 'it will rain' not 'rains' on the branches' or 'she should have used percentages not decimals.' In some statements, candidates were not specific enough in answering the question, especially for the Tuesday error, e.g. 'probability it rains on Tuesday is plotted wrong' and 'In the second tree diagram she has the wrong number for rain'. Sometimes, errors mentioned did not give enough detail to clearly pinpoint them such as 'they do not add up to 1' as they did not reference 0.55 and 0.35 and 'there should be another branch' so the position was not clearly identified. Candidates need to be encouraged to add more detail to fully explain what they mean. Some errors came from candidates thinking that all the paths through the probability tree should add to 1. For example, it rains on Monday (0.55) and it rains on Tuesday (0.75) should add to 1 and therefore there was an error because they added to 1.3.

Question 23

A third of candidates did not attempt this question and area of a sector was beyond the understanding of almost all candidates who appeared unaware of the methods to be used: use of πr^2 for area, use of $\frac{120}{360}$ for the sector, use of the area given ($8\,cm^2$). Many calculations using the given numbers were seen including the very common 8 ÷ 2 = 4 but also 120 ÷ 8, $r^2 = 120$ or 8, 120 − 8, 360 − 120 and 180 − 120 = 60.

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