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Examiners' Report

Principal Examiner Feedback

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Students who were well prepared for this paper were able to make a good attempt at all questions. It was encouraging to see some good attempts at topics new to this specification. Of these new questions, students were particularly successful in the question assessing standard form and depreciation over 3 years but less successful in dealing with the factorisation of a quadratic and then solving the associated equation.

On the whole, working was shown and easy to follow through. There were some instances where students failed to read the question properly. For example, in question 1d a significant number of students gave the number of unsold tickets as their answer rather than the number of tickets sold.

Metric unit conversion continues to be a weakness as does the recall of the correct circle formulae. On the whole, problem solving questions and questions assessing mathematical reasoning were tackled well although not all students provided a conclusion where one was necessary – for example, in question 11.

1 Part (a) was well done although a few students gave the incorrect response of 0.7. There were a surprising number of incorrect answers in part (b), some gave an equivalent but unsimplified fraction, usually $\frac{12}{15}$ but there were a significant number of incorrect answers that gave fractions not equivalent to the original. Part (c) was very poorly done with a significant number of students apparently unaware of the definition of a mixed number. The modal answer was to attempt to convert the fraction to a decimal, thus 5.6 was a common incorrect answer. In part (d), most students were able to work out 1/7 of 840 for the number of unsold tickets to gain one mark and many went on to give the correct answer for the number of tickets sold. However, many students failed to read the question carefully and gave the number of unsold tickets as their final answer.

2 When an incorrect answer was given in part (a) it was usually 'Great Britain' suggesting that students had either misread or misinterpreted the question and given the country with the greatest rather than the fewest number of medals. The success rate in part (b) was very high, with the majority able to read the total number of medals from the bar graph and subtract 27 gold medals to find the number of non-gold medals. Misreading the graph but subtracting 27 from this value allowed a few students to gain one mark. While the majority of students could give a correct ratio in part (c), a surprising number were not able to give this in its simplest form and so only scored one of the two marks. Other errors occurred both from misreading the graph and from not using ratio notation. Part (d) also had a good success rate, with most able to give a correct fraction for the number of gold medals out of the total, which was found by adding three given values. A few used the total of silver and bronze as their denominator rather than the correct total.

3 Many students were unable to recognise the 3-D shape as a triangular prism; pyramid was the most common incorrect answer seen. Students were more successful in giving the

correct number of faces rather than the correct number of vertices. A common incorrect answer in part (iii) was 9 from those who presumably confused vertices with edges.

4 Conversion between metric units continues to be a weakness. In part (a) 65 and 6500 were common incorrect answers suggesting that students were unsure of whether to multiply or divide even when the correct conversion of 1 m = 100 cm was known. A significant number of students divided by 1000 rather than 100. There were similar problems evident in part (b), this time with 100 used rather than 1000 and again, some students choosing the wrong operation. The problem posed in part (c) was well understood and most students could convert 6kg correctly into grams (perhaps surprising given the poor responses in parts (a) and (b)) and divide this by the 475grams of rice needed to fill bags. The majority appreciated that their answer needed to be 'rounded down' in this practical context. Inevitably some incorrect conversions were seen and some ignored the difference in units but in that case usually divided 475 by 6 showing little understanding of the question.

5 Part (a) was well done. In part (b) when the answer given was incorrect it was generally 9*ef*. When there was an incorrect answer in part (c) it was usually 16 from subtracting 3 rather than dividing by 3. Similarly, instead of the correct operation of addition in part (d), students sometimes used either subtraction giving an answer of 9 or division giving −3.25 (or 3.25). Part (e) produced many fully correct responses. Where this was not the case, one mark was often awarded for one of the two terms correctly seen, often then incorrectly combined to produce an incorrect term as an answer. Inevitably there was difficulty for some students with how to interpret the addition and subtraction signs.

6 Th two-way table was usually completed correctly. In part (b), a good number of correct answers was seen from students who could select correct values from the table and convert them into a percentage for full marks. Students who were unable to convert to a percentage often gained one mark for at least selecting 9 from the table although a significant number of students failed to read the correct value from the table.

7 This multi-step problem was well understood and many students gained all four marks. The most commonly seen error was subtracting one of the given costs by the other, showing little understanding of how to use the information given in the question. A number of students did divide 4 kg by £3.80 (rather than the other way round) but then went on to carry out the correct subsequent calculations.

8 It was very pleasing to see a good number of fully correct responses here, with the size of three angles calculated and two reasons given for the answers. There were also a noticeable number of seemingly random attempts at the question, sometimes with reference to non-existent parallel lines. In-between these were a significant number of responses with the correct values found but no reasons given and all the correct individual angles found but the 60 and 63 not added to give the required answer. Where not all the angles were calculated, it was the 60 in the equilateral triangle that was most often missed or wrongly calculated, noticeably by students giving 90, 45 and 45 as the angles.

9 The majority of students misinterpreted the information in part (a) and gave the Fahrenheit equivalent of 20ºC instead of the equivalent of a 20ºC increase in temperature. However, correct answers were seen, albeit somewhat rarely. Part (b) produced a mixture of responses, many agreeing (wrongly) that doubling a temperature in ºC would mean a doubling in ºF, some disagreeing but unable to express a reason for this and a good number able to indicate in some way that doubling doesn't work; this they sometimes did by producing a counter-example and a few by stating that the temperatures are not directly proportional.

10 There seems to be a good deal of confusion for students between LCM and HCF, though this was more in evidence in part (a) where the LCM of 12 and 20 was required. Answers trying to give the lowest common factor (as 2) were more in evidence than the correct answer of 60. Many students gained one mark for giving the prime factors of both numbers. Part (b) saw more correct responses for the HCF of 24 and 56 than appeared in part (a) but attempts at finding a common multiple were regularly seen. Again, one mark was often awarded for giving the prime factors of both numbers. Even when these were shown and sometimes given in a Venn diagram, students were unsure how to use the values in both parts.

11 The practical context of this question was missed by the majority of students, who failed to recognise that the dimensions of the box and the cartons would mean that not the whole volume of the box could be filled by cartons. Thus they worked only with the total volumes. Some of these divided the volume of the box by the volume of a carton to give 115.2 and a conclusion that 110 cartons would therefore fit in the box. Others calculated the volume of the box and the volume of 110 cartons and concluded that the cartons would therefore fit with room to spare. With a relevant conclusion, such responses were awarded one mark, but a noticeable number of students failed to give one. There were students who appreciated what was needed here and used the dimensions appropriately to work out that only 108 cartons would fit. Provided they stated their conclusion, full marks were awarded.

12 In part (a), the correct answer of reflection in the line $x = -1$ for describing fully the transformation was given by some students but many, who could at least recognise the reflection, omitted to state the line of reflection or gave it as $y = -1$ or $x - 1$. A huge variety of incorrect responses was seen, with translation, rotation and even enlargement making an appearance, and non-mathematical descriptions, such as the triangle being flipped were common. Translating a triangle in part (b) produced many correctly positioned triangles but equally many that were in the incorrect position, most often sitting on the lower edge of the given grid. While many students could recognise that the transformation needed in part (c) was a translation, only a few could additionally give the correct vector to gain the mark. Many others simply gave a description of the transformation in terms of number of squares moved to the left/right, up/down, not appreciating that vector notation is required in describing a translation.

13 Given the ratio of the number of girls to the number of boys, and the number of girls,

most students started promisingly to find the number of children in a cinema and gained the first two method marks. Given also that 3/5 of the people in the cinema were children, some were able to proceed to find the number of adults, and gain the full five marks. However, the majority at this stage incorrectly went on to work out 3/5 of the 765 children.

14 Those who knew which angle to measure generally gained the mark in part (a) but the vast majority of students measured either the acute or reflex angle at M once LM had been drawn. Marking the position of a ship given a distance and bearing proved problematical for most students. Some could work out that the required distance on the scale drawing was 8cm and gained a mark either for stating this or for showing 8cm on the drawing. However, a significant number measured 8 cm from M rather than from L suggesting that they had not read the question carefully enough. A smaller number were able to indicate the correct bearing to gain one mark. Surprisingly, there were students who could do both but were still unable to mark the correct position, although successful answers were seen. Many responses showed little understanding of what was required and blank drawings were regularly seen.

15 Common incorrect answers in part (a) were 2 (the mode of the numbers in the frequency column) and 19 (the frequency rather than the modal class). In part (b), a pleasing number of students now recognise what is required to work out the mean for grouped data and a good number of fully correct answers were seen. Some understanding was also shown by students who used end-points of the class intervals instead of the mid-points but who otherwise worked correctly. Where an error followed from a correct start, this was usually to divide by 5 rather than by 40 Incorrect responses included the sum of the frequency column divided by 5 and the mid-point values summed and divided by 5

16 In part (a) very occasionally the indices were multiplied rather than added giving a common incorrect answer of y^{45}; $2y^{14}$ was also seen fairly regularly. Fully correct answers in (b) for $(2m^3)^4$ were rare, with the common error being not to realise that the index number 4 applies to the 2 as well as to m^3 – thus $2m^{12}$ appeared far more often than the correct answer and gained one mark. $2m^7$ was also a very common incorrect answer from adding the indices and gained no marks. Showing algebraic working to solve an equation appears to be more generally attempted than in the past and full marks in part (c) were quite often awarded. Where this was not the case, many students could multiply out the brackets and knew that the terms in x needed to be one side of the equation and the constants on the other, but were very muddled by whether terms should be added or subtracted – errors of this nature appeared more often than correct working. While most students did make at least a correct start, there were also a number of seemingly random attempts. In part (d), only a handful of students knew how to factorise the given quadratic and even fewer how to move from that to the solution of the corresponding quadratic equation but very occasionally full marks were awarded. There were some attempts to factorise the first two terms or the last two terms giving the un-factorised term as part of an answer. In (ii), most students, even those few who had been able to give a correct answer in (i), started to solve the quadratic equation from the beginning, but the majority of attempts suggested no knowledge of how to do so.

17 In part (a), given a Venn diagram, many students could write down the numbers in set A, although a common error was to omit the numbers that were in the intersection with set B. Writing down the numbers in set $B \cup C$ was slightly less well done, again with the values in the intersection omitted, or interpreting $B \cup C$ as the intersection of these sets. Giving a reason for a statement in part (b) regarding a null set was very well done, with many able to explain that the two sets in question had no numbers that were in both sets or that there was no intersection between the sets. Occasionally the mark was lost by failing to state whether a candidate agreed with the statement or not. Part (c) required recognition of the notation for the complement of a set, which was rare. A frequent error therefore was to give the probability of picking at random a number that was in C, instead of in C' – this gained the method mark, as did any understanding that the probability was 'out of 12' provided it was written using acceptable probability notation.

18 It was encouraging to see so many correct answers to part (a) although 320 from $8 \times 10 \times 4$ was given by those students who had presumably not met standard form. In (b), the majority were able to use a calculator to divide two numbers given in standard form and find a correct answer, but some of these failed to give their answer in standard form, giving their answer as 0.0005 or $\frac{1}{2000}$, which gained one mark; these answers were not infrequently given when the correct standard form answer was shown in the body of the script. Another common error was to divide the numbers the wrong way round and some errors occurred by students attempting to write out the numbers in the question in ordinary notation.

19 From responses in part (a) it would seem that an increasing number of students are able to draw a straight line graph. A few missed one or two marks by not giving the complete line, or by failing to join the points, or by working out but not drawing two or more points. However, there were a number of lines with a negative gradient, seemingly random lines and some blank responses. Finding a region defined by three inequalities in part (b) was far more problematical, with blank responses and incorrect rectangles often seen. A small number of students were able to indicate the lines $x = 2$ and $y = 1$ for one mark and even fewer the correct region.

20 The correct use of Pythagoras' theorem to work out the length of the diameter of a circle and then the correct use of this to find the circumference of the circle enabled some students to gain the full four marks. For those who made a correct start, the main error was in using the wrong formula for the circumference. Confusion between the circumference and area formulae and whether diameter or radius was needed was much in evidence; some did use 9.7 cm as the diameter. A large number of students were not able to appreciate that Pythagoras' theorem was needed and the values given in the question, both the lengths of the two sides and the 90° angle, were incorporated into a variety of meaningless calculations.

21 While there were students in part (a) who could work out the value at the end of three years of a boat that depreciated in value by 4% per year, incorrect answers appeared far

more often than the correct one. Working with simple interest rather than compound was the most frequent means of this happening, but usually gained a candidate one mark, as did increasing the value over the three years. There was almost no evidence of use of the more efficient method of $160\,000 \times 0.96^3$, with the 'year at a time' method often shown in full, with the likelihood of incorporating errors and introducing premature rounding. Even fewer students were successful in part (b), where understanding that the given value had already been increased by 5% was rare. The incorrect method of finding 5% of 252000 and then subtracting was widespread.

Summary

Based on their performance in this paper, students should:

- learn and be able to recall metric conversions such as 1 kg = 1000 g
- ensure that, when writing down a ratio, the numbers are given in the correct order
- learn and be able to recall the formulae for the area and circumference of a circle and recognise when to use each
- read the question carefully and review their answer to ensure that the question set is the one that has been answered
- ensure that they are familiar with topics that are new to this specification. For example, standard form, factorising quadratic expression, solving quadratic equations, repeated percentage change (compound interest and depreciation over successive years).

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