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General Certificate of Secondary Education

Mathematics 4301

Specification A

Paper 1 Higher

Examiners' Report

2008 examination – June series

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Specification A

Paper 1: Higher Tier

General

This was the first examination for Specification 4301, Paper 1, Higher tier following the change from 3-tier to 2-tier. The distribution of marks was 30% at grade D, 20% C, 20%B, 15%A and 15%A* … the inclusion of questions at grade D and the reduction in marks available at A and A* being the main differences to the previous Specification 3301, Paper 1, Higher tier examination.

The availability of 30 marks at grade D ought to have been a welcome sight for many candidates who in previous years would have taken the Higher paper (as opposed to the Intermediate paper) but this was not always the case. There were a number of careless mistakes made on many of the, so called, ‘easy’ questions, perhaps because of the unfamiliar nature of these questions. This might not happen to such an extent when this exam has ‘bedded in’ and candidates are more aware of what to expect.

Also, the candidates who previously would have been entered for the Intermediate paper found a significant difference in the thinking skills required for some questions, particularly those in the latter half of the paper. This might explain the fact that on seven of the questions from Question 18 onwards, approximately 20% of candidates made no attempt to answer them.

Notwithstanding all of this, there is still an issue regarding carelessness. Whether it is in the reading of a question (eg. state the units of your answer … Question 14(a)) or in the arithmetic processes used for calculations, the mark loss due to carelessness is significant. The number of marks lost over a whole paper by mistakes such as this can often mean the loss of between 5 and 10%, certainly enough to affect the grade awarded.

Topics that were done well included:

- easy decimal calculations
- percentages
- quadrilateral geometry
- subtraction of fractions
- stem-and-leaf diagram
- linear equations
- retail price index % calculation
- rearranging a formula
- similar triangle geometry.

Topics which candidates found difficult included:

- conversion from km^2 to m^2
- reciprocal
- simplifying algebraic fractions
- standard form
- equating cylinder volumes
- moving averages
- circle geometry
- surds
- proportionality
- probability

- indices
- vectors
- sketch graphs
- algebraic proof.

Question 1

A few candidates treated this as an estimation question and some tried to work out answers using long multiplication and division … entirely missing the point of the question. There were, however, many correct answers with parts (a) and (c) being answered correctly by over 80% of candidates. Part (b) was less successful (63%) perhaps due to the need to rearrange and adjust the given equivalence. The wrong answers in (c) were almost always answers of zero.

Question 2

There was a good response from most candidates. Interchanging C and A was perhaps the most common error, the formula (B) being relatively easy to spot. Only 7% of candidates failed to score.

Question 3

Part (a) was very well done (82% success) but part (b) proved to be beyond all but the most able candidates. Almost everyone knew that 1 km = 1000 m but most failed to appreciate the need to square this scale factor; over 90% of candidates scored zero making this the worst performing part of a question on the whole paper … very disappointing and quite alarming for such a basic skill.

Question 4

Although there were many correct answers of 128° in part (a) the fact that the angles were corresponding was less well known … the term *F*-angles was evident on a number of occasions but is unacceptable. Only 30% scored 2 marks although another 55% scored 1 mark. Too many tried to relate angle x to 85°, the angle on the other transversal of the parallel lines.

A quarter of all candidates scored zero in part (b). Of those who were successful, methods varied … using a combination of angles on a straight line and corresponding/alternate angles was popular, some used vertically opposite angles combined with the angles of the quadrilateral formed by the parallel lines and the transversals. As always in geometry questions, answers on the diagram were given full credit as long as there was no contradiction with an answer written on the answer line (which would take precedence).

Question 5

Almost 70% of candidates obtained the correct answer of 70% ! Of the others, there were the usual careless mistakes, most of which were due to poor knowledge of the 7 or 12 times table or an inability to cancel correctly. There were also a few who thought that $\frac{84}{120} = \frac{64}{100}$ (subtract 20 !) for an answer of 64%.

Question 6

The centre of enlargement at (0, 2) caused some problems. There were too many enlargements of SF 2 but using the origin as the centre (for 1 mark) … perhaps this was because the question wasn't read carefully enough? Quite a few candidates tried to measure distances and found two of the three points correctly but were out of tolerance with the third point (again for 1 mark). A quarter of all candidates scored zero, which is disappointing.

Question 7

66% of candidates wrote a correct equation and 34% did not. There were many correct versions … something as simple as $x + 3x + 132 + 64 = 360$ was all that was required for this mark. Most of those candidates who failed to score wrote an expression instead of an equation.

There were a significant number of candidates who wrote the complete solution, equation included, in part (b) and this scored all 4 marks for the question as long as there was no contradictory answer in (a). Conversely some did the complete solution in (a), scoring all 4 marks.

Over 75% of all candidates scored at least 2 of the 3 marks in (b); careless mistakes such as … 64 + 132 = 194 or 360 – 196 = 174 … usually being where the 1 mark was lost.

There were very few 'trial and improvement' solutions … full marks in (b), if correct, zero otherwise.

Question 8

Part (a) was a division of fractions … a basic skill … but too much for 25% of candidates. Inverting the first fraction instead of the second was a common error. Those who re-wrote the original question as $\frac{28}{35} \div \frac{30}{35}$ scored 1 mark for doing so and many of these candidates went on to gain all 3 marks. In all, 53% of candidates scored 3 marks.

In part (b), many candidates turned the mixed numbers into improper fractions and most found a common denominator (usually 20), but there were many careless errors in arithmetic in finding the numerators.

Of those who dealt with the whole number parts and the fractional parts separately, some 'forgot' the whole number parts and gave a final answer of $\frac{7}{20}$ (2 out of 3 marks).

In part (c), 30% of candidates knew what a reciprocal was and could evaluate it. Another 7% knew the definition but got no further than $\frac{1}{0.5}$ (for 1 mark), the rest had no idea what to do.

Question 9

This question was very well done with 63% of candidates scoring 3 marks and a further 23% scoring 2 marks.

The most common mistakes were either forgetting to complete the key or missing out one of the entries.

Question 10

In part (a) the y value corresponding to $x = -1$ was frequently wrongly calculated as –5 … a value that might have alerted candidates of a possible error given that there were already two values of -5 in the table, and that it ruined the shape of the quadratic graph!

Plotting the five points given in the table earned 1 mark in part (b) but 2 marks were only awarded for a completely correct table and a smooth curve through the correct points … we were looking for a graph that had its lowest point clearly below the line $y = -5$.

Just over half of all candidates correctly explained that the point of intersection of the graph with the x-axis was the solution of the quadratic equation. A common mistake was to quote the line $x = 0$ instead of $y = 0$, and although many candidates referred to the quadratic graph as a 'line', this was not penalised.

Question 11

Part (a) was done successfully by over 90% of candidates. Part (b) was well done too; there were some bracket expansion errors and 15 ÷ 6 was sometimes given as 2.3 but many candidates scored full marks. An answer left as $\frac{15}{6}$ was condoned.

Part (c) was slightly less well done. Many candidates realised that the easiest first step was to multiply 4 by 7 but there were many sign errors when rearranging the equation. One error all too often seen was 4 × 7 = 21. This part of the question was best done in stages. Those attempting to multiply by 4 and rearrange in one step often made mistakes. Candidates who divided the terms on the left hand side by 4 as their first step frequently forgot to divide the z term by 4 but if they then went on to obtain an answer of $z = -3$ they scored 1 mark (special case) for correct rearranging. A first step of $64 - 4z = 28$ was also a fairly common sight.

Part (d) was very badly done (only 12% scored the 2 marks available). Expansion was common, sometimes with the 2 taken into the top bracket first and there was a lot of poor cancelling of terms.

Question 12

Most candidates scored the 1 mark for an answer of 90% (although 9%, 19% and 190% were seen). In part (b) follow through marks were allowed for those with the wrong percentage increase. A good number of candidates (66%) were successful but a significant number forgot to add on the increase, 0 marks … incomplete method.

Question 13

In (a) answers of 0.7×10^4 were common (for 1 mark). Many started with 2 800 000 000 ÷ 400 000 (not always with the correct number of zeros) and then left an answer of 7 000 (again, 1 mark). Only 32% of candidates scored 2 marks.

Part (b) was worse, only 11% scored 2 marks. There were quite a number of ways to go wrong. Forgetting to square the 5 was one. If starting with a conversion of the expression in the bracket, not always using 0.005 was another. Even if 0.005 was used, squaring it often led to 0.0025. First steps of 25×10^{-6} often became 2.5×10^{-7}. The mark scheme was quite generous and allowed for a variety of responses for 1 mark.

Question 14

Part (a) required answers to be given as a multiple of π and for the units to be stated, instructions that were not always followed. The volume of a cylinder is a common and much used formula so it was disappointing to see so many poor attempts … $\pi \times d \times h = \pi \times 16 \times 5$ was common and also seen was use of $2\pi r^2 h$ and $\frac{1}{3}\pi r^2 h$ … the latter, the volume of a *cone*, being clearly stated on the formula sheet at the front of the paper! Use of the wrong formula meant that the only mark possible in part (a) was the mark for the correct units. There were the usual number of careless arithmetic mistakes that always occur in mensuration questions but 45% of candidates scored either 3 or 4 marks on this part of the question.

Part (b) was a different proposition, however. There were just over a quarter of candidates (28%) who knew to equate volumes and were able to deduce that $r = 4$ by legitimate means. Some knew to do this but tended to 'fiddle' the answer, usually because the π term was eliminated by a rather doubtful process … special case 2 marks was awarded for 'unconvincing' work. Those who obtained $r = 4$ by dividing the two heights to get 4, then dividing this into 16 (clearly wrong method) scored zero. Few candidates, if any, used an area scale factor of 4 hence a radius scale factor of 2 to get $r = 4$, although this would have scored full marks. There were quite a number who knew that the first step was to divide by the height (20) to get a value for base area but then they ground to a halt.

Question 15

In (a) there were many poor attempts … most of them illustrating a lack of realisation as to the significance of the missing value in relation to the moving average of £28.50. Working out the differences between the first three given values, taking an average of them and adding this to £19.40 was a common wrong approach, as was just finding the average of the first three values. Those who knew the correct method made all manner of careless arithmetic mistakes … £28.50 × 4 was almost as often done wrongly as correctly ... and even when all the arithmetic was done correctly an answer of 36.1 instead of 36.10 meant another mark was needlessly lost.

In part (b) there was an easy method (comparing the two March entries) and a longer method (re-calculating the second four-point moving average and then making a comparison), either of which would gain the 1 mark. What did not gain the mark, however, was an answer that referred to the 'last four values' since this was bringing in the June 2007 amount, an amount irrelevant to the calculation of the second four-point moving average. There were quite a number of candidates who answered 'Yes' … not the wisest response to the question '… will it be greater or less?'

Question 16

There was some careless work with brackets and with signs of terms when rearranging, but many candidates had the right idea and 65% scored either 2 or 3 marks on this question. A common sight was $3a - 3b = 2b + 7$ leading to $3a = -b + 7$, but if this became $a = (-b + 7)/3$ then 2 of the 3 marks were awarded (one mistake, 1 mark lost). Also earning 2 out of the 3 marks was a first (correct) step of $a - b = (2b + 7)/3$ but then followed by an incorrect step of $a = (3b + 7)/3$

Question 17

Questions on similar triangles have usually been well done in previous examinations and this one was no exception, with 72% scoring either 2 or 3 marks. As on many other questions, there was some very careless arithmetic seen, for example, $21 \div 6 = 3.5$ (correct) followed by $5 \times 3.5 = 15.5$. Some candidates tried $6 \times 3 + 3 = 21$ so $5 \times 3 + 3 = 18$ (0 marks), some tried 'add 15' so $PQ = 20$ (0 marks) and there were a few attempts at Pythagoras' theorem.

Question 18

Part (a) was not as well done as it ought to have been. This is a standard cyclic quadrilateral property and is only a grade B skill so when 53% score 0 marks it is disappointing. Of those who correctly stated an angle of 75° almost all could accurately describe why it was so (mention of 'opposite angles' was usually enough). There were some answers of 105°, some of 90° (angle in a semi-circle ??) and some of 63°, presumably because it looks to be about the same size as angle *DAQ* … the words 'not drawn accurately' seemingly ignored.

Part (b) required grade A geometry skills, particularly knowledge of the alternate segment theorem. This was not well done (22% scoring the full 2 marks) often because the explanation was either poor or non-existent. An angle of 42° (which was the correct answer) was often unaccompanied by reasoning … it could just be angle *BAP* = 42° … further reasoning is needed to explain why angle *ADB* = 42°. These questions do not just test the ability to do the correct angle calculations, they test the ability to be able to explain the steps of the thought process … a necessary skill for those who wish to study Mathematics beyond GCSE.

Common mistakes included assuming that triangle *ABD* was isosceles or that parallel lines existed somewhere on the diagram and so 'alternate angles' came into play.

Question 19

Frequently seen in part (a) was … $\sqrt{28} = 4\sqrt{7}$ and $\sqrt{63} = 9\sqrt{7}$, so answer = $13\sqrt{7}$ … this was more common than the correct solution. Almost as common, and also 0 marks, was $\sqrt{28} + \sqrt{63} = \sqrt{91} = 13\sqrt{7}$. Just under 30% of candidates scored 2 marks.

Part (b) suffered from some poor presentation. Frequently $\frac{30}{\sqrt{5}}$ was followed by $\frac{30}{\sqrt{5}} \times \sqrt{5}$ which could become either the incorrect $\frac{\sqrt{150}}{\sqrt{5}}$ or the correct $\frac{30\sqrt{5}}{5}$ … it was sometimes hard to tell quite what was happening … and all too frequently this correct version of $\frac{30\sqrt{5}}{5}$ was left as the final answer instead of being simplified to $6\sqrt{5}$.

Some candidates attempted to square the whole expression … 180 is correct but is in itself insufficient for any marks … an attempt to find $\sqrt{180}$ would earn 1 mark and a correct deduction of $6\sqrt{5}$ would score 2 marks.

Question 20

In part (a) a significant number of candidates failed to read and understand the relationship between h and r.

The question stated that the relationship was '*inversely* proportional to the *square* of the radius', so starting with $h \propto r^2$ or $h \propto \frac{1}{r}$ or $h \propto \frac{1}{\sqrt{r}}$ means that 0 marks will result. Only 20% of candidates started correctly and usually scored either 2 or 3 marks … if the final statement of $h = 72/r^2$ was omitted, it was 2 marks not 3.

Most of those successful in part (a) went on to score the 2 marks on offer in part (b). Even those with a wrong value of 'k' (often from careless arithmetic eg, $4.5 \times 16 = 66$) could obtain 2 marks in part (b) on follow through.

Question 21

Probability questions often give rise to messy presentation of answers with fractions and/or decimals scattered all over the page and combined in what seems to be a random way! In this question it was necessary to read the words carefully … to appreciate that Bill (correct) and Ben (wrong) together with Bill (wrong) and Ben (correct) were the combinations to use. Sight of 0.7×0.7, 0.7×0.3, 0.6×0.4 and 0.4×0.4 were commonplace and none of them are relevant. Many tree diagrams had 0.7 and 0.4 on a pair of branches (0 marks).

Almost always in these questions, it is necessary to combine probabilities by multiplication to obtain probabilities of mutually exclusive outcomes which can then be added, and so it was here. The standard of decimal multiplication was often poor ($0.7 \times 0.6 = 0.48$ or, even worse, $0.7 \times 0.6 = 4.2$). Correct answers of 0.42 and 0.12 were often added to get 0.52 or 0.64 … yet another mark lost.

Question 22

In (a), square root (or power $\frac{1}{2}$) of 9, followed by $3^3 = 27$ was the preferred route. Others obtained 729 from 9^3 and then either showed, knew or guessed that $\sqrt{729} = 27$. A small number of candidates used the laws of indices correctly to show that $9^{1.5} = 9^1 \times 9^{0.5} = 9 \times 3 = 27$ for full marks. 28% scored 2 marks but 68% scored zero, the most common incorrect attempts were $3 \times 9 = 27$ (using the 'power' part of the index but ignoring the 'root' … some actually explained that this was the correct thinking!) and $9^2 = 81$ together with $81 \div 3 = 27$, another ingenious (but wrong) approach.

Part (b) (a grade A* skill) was too much for all but the best candidates. A few were successful by using the relationship in part (a), as the question intended, combining powers to give $\frac{3}{2} \times 4 = 6$ (sadly, this was often $\frac{3}{2} \times 4 = \frac{12}{8}$ … for zero marks … they did not notice that the power is unaltered). Other tenacious characters worked out 27^4 (531441) and divided it by 9 as many times as it took … usually for 2, hard earned, marks.

Question 23

This was a vector question with a difference … some candidates just looked at the diagram, realised that the sum of the two vectors given was 6**a** + 9**b** and compared this vector with 4**a** + k**b**, writing 6 on the answer line and scoring 4 marks. Others managed this thought process but at a rather slower pace and explained the fact that the vectors had to be related, correctly working out the scale factor of 1.5 before stating the solution. Only 10% of candidates scored 4 marks. Another 10% did add the two given vectors but did not know what to do next, often trying to equate the result to 4**a** + k**b** (2 marks). The vast majority who made some attempt (another 52% of candidates) either just added everything in sight, usually writing many lines of working before giving up, or subtracted the two given vectors (to get 4**a** – 5**b**) and then stated a solution of $k = –5$. Over 26% made no attempt, clearly put off by the simple fact that this was a vector question.

Question 24

Almost all candidates made an attempt at the sketch graphs but often more in hope than with any real conviction. 26% scored the mark in part (a) for a translation to the right (we were tolerant of a tiny gap between the curve and the x-axis). Common mistakes were translations to the left, vertically upwards or vertically downwards, more or less in equal measure. 27% scored the mark in part (b) with some graphs 'wider' than the original, some 'within' the original but translated upwards and some inverted.

Question 25

Part (a) required algebraic proof. The method is to solve one linear equation and one quadratic simultaneously, an A* skill but nonetheless a standard procedure. Very many candidates either ignored this or were oblivious to the requirement and merely solved the equation $x^2 + 4x – 5 = 0$, which is what was wanted in part (b), but not part (a), thus scoring 0 marks. Other candidates 'spotted' $x = 1$ and $y = 5$ as the most obvious solution to $y = x + 4$ and then verified these values as a possible solution to $x^2 + y^2 = 26$ … again, 0 marks.

Those candidates who realised that expansion and substitution was the correct procedure often produced good, clear, concise solutions. Even with careless expansion (eg, $y^2 = (x + 4)^2 = x^2 + 16$) it was possible to pick up the mark for substitution.

In part (b) a few candidates recovered the part (a) marks, belatedly realising what they ought to have shown from the start. Many others, having failed in part (a), showed good exam technique by keeping going and trying to salvage something in part (b), usually correctly factorising and solving to obtain the correct coordinates for A and B. An interchange of these answers was condoned as long as the correct working was seen. Answers marked on the diagram scored 2 marks as long as they were in the correct place, ie, not interchanged.

Mark Ranges and Award of Grades

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Mark Schemes

Mark Schemes are available on http://www.aqa.org.uk/qual/gcse/newmath_a_assess.php page of the AQA Website.