AQA

LEVEL 3
CERTIFICATE IN MATHEMATICAL STUDIES

1350/2C Paper 2C Graphical Techniques
Report on the Examination

1350
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Criteria for awarding marks and assessment objectives

This paper met the weighting requirements between the assessment objectives, A01; A02; A03 as outlined in the specification. The A01 criteria were covered by questions requiring specific knowledge, examples including recognising a constant as a y-intercept (question 4(c)); or the shapes of functions (question 6(b)). The A03 criteria were mainly assessed by items requiring interpretation and explanation and communication. The performance on items such as 2(b)(iii) showed many students struggled with these outcomes. A02 assesses students' ability to select and use the correct mathematical procedures and these skills were assessed across the majority of the items.

There were three items that expected students to use previous answers and were marked accordingly; there was no evidence of this becoming an obstacle in accessing the items.

Many items included independent method marks, so that an error at one stage would not hinder the opportunity to progress with the question. The only dependent method mark featured on 5(c), requiring valid use of their tangent drawn.

Common questions.

Questions 1 and 2 were common to all three components of the 1350 specification. This is consistent with the structure of previous years' examinations. Students entered on component 2C performed in line with those on the other two components.

Question 1 was generally well attempted, with the most common error coming from mis-interpreting the design requirements on item 1(b).
Question 2 relied on interpretation of the preliminary materials. Some of these items are very much in line with previous years (for example critiquing a graph) and students performed well. 2(b) assessed the ability to be critical of statements and was broken into two parts. The second part, where students had to prove if information was in a stated ratio or not, was less well attempted, with many responses being valid, but incomplete, proofs.

Questions that were well answered unique to paper 2C

Question 3 utilised logarithms to linearise exponential data. This was largely calculator work and graph plotting with a high success rate. In previous years exponential data hasn't been used this early in the paper but it did not prove an obstacle for accessing the items.

Question 4 parts (a) and (b) were also very well attempted, with the majority of students being able to analyse a mathematical model when represented graphically, both by reading off data points and by inspecting the gradient of the curve.

Question 6 was also very well accessed, particularly part (b), which covered recognising the shape of a function and part (c), which involved speed/distance/time from graphical content. Performance on part (a) was hindered by incorrect used of the y-intercept (see misconceptions and common errors)

Questions that were less well answered unique to paper 2C

Very few students scored both marks available on question 3 part (b)(ii). This item required students to make a judgemental comment of two trends. Students who scored zero were often too vague and did not make a valid comparison, while those scoring only one failed to acknowledge that it was based on the assumption of trends continuing.

Question 4 part (d) also showed weakness in commenting on a model. Many students focused on how they might change the experiment rather than why prediction based on the model would not be valid as the control variable increases.

The majority of students failed to score above half marks on question 7, which required the manipulation of an exponential formulae along with the ability to extract variable values from the information presented. This aspect of the specification has proved historically to be less well attempted, which is the rationale for its placement at the end of the paper.

Misconceptions and common errors

Many students failed to recognise that the y-intercept of a quadratic curve would also be the constant on the end of the equation in its general form. While only necessary for one out of three marks on question 4, it proved a sticking point for progression in many instances.

Unit conversion proved to be an issue in question 5 on both parts (b) and (c), requiring hours to seconds and km/h to m/s for each part respectively. In many cases the conversion was either ignored or was simply divided by 60 rather than 3600.

On question 6, the incorrect assumption that the graph's y-intercept was the constant in the equation led to half marks, as the linear model only started from $x = 5$.

On question 7, while it was possible to obtain marks from further working, there was little recognition that determining the constant in the exponential model was a necessary first step. Few students recognised from the information that L would become $\frac{L}{2}$ when the value was halved. Many students simply stated that at half the time, the value was half.

Unexpected or alternative responses

The mark scheme was adapted for question 1(b) to compensate for a more literal interpretation of the design requirements that became apparent. Only a very small proportion of students interpreted the information this other way and were not penalised for doing so.

The marking of question 2(b) exemplified how many different ways there are to prove two values are close to a ratio. The mark scheme detailed 8 alternate methods but any responses with a blend of methods were scrutinised for validity and awarded appropriately.

Question 4 related the 'final temperature' of some drinks to the mass of ice they were submerged in. Many students referred to speed and acceleration of cooling as if the analysis was with respect to time. If they referred to the gradient in 4(b) regardless of variables they could be awarded with benefit of doubt, but simply saying 'drinks cool faster…' would not be valid. The permitted limitations of the model accepted in the responses to 4(d) were increased to include comments on atmosphere or starting temperature, although changing the mass of ice was not permitted, as that was the control variable.

Some students attempted 5(c) without drawing a tangent and were only rewarded if they deduced a gradient in the valid range on the mark-scheme. However, they were not rewarded if they had obviously used two arbitrary points that contradicted the method of deriving instantaneous acceleration.

Discriminator questions

From the common questions, items 1(c); 2(b); and 2(d) all provided good evidence for differentiating between student's performance.

From the component specific items, 4(c); 5(b); 5(c); 6(a) proved to be the best discriminators.

Summary

This paper demonstrated a balance of demand that made it accessible, yet still challenging for students with the greatest level of competencies. All aspects of the specification were assessed, and these covered the full range of assessment objectives. Aspects of the specification such as intersection points, using functions and speed-distance time were most accessible, although extra complications such as unit conversions proved to cause an obstacle. Establishing exponential equations still proves to be the least accessible part of the specification. On this particular paper students also struggled to be explicit in their interpretation and explanation of mathematical situations.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.