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# LEVEL 3 CERTIFICATE IN MATHEMATICAL STUDIES

1350/2B Paper 2B Critical Path and Risk Analysis  
Report on the Examination

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1350  
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## General

The paper was generally accessible to students, with questions being attempted at similar levels to earlier series. It was very rare for students to not attempt questions and there was little evidence of students running short of time.

As with previous series, students are generally very well prepared for this component. However, risk analysis, especially calculating expected values, remains a topic that is not well answered. The structure of this year's questions did enable more marks to be gained on this topic by prompting students to calculate probabilities. However, around a quarter of students still did not go on to use these probabilities to work out an expected value.

Students' calculations with percentages were less efficient than in recent series. Too often, inaccuracy was a side effect of these less efficient methods and resulted in marks being lost.

## Question 1

Over two thirds of students scored the opening mark, with most incorrect answers having the two parts of the ratio the wrong way around. Students should be reminded to read the order of ratios carefully, and would benefit from working more often with ratios whose first part is larger than the second.

Written working was generally well structured on part (b), but not all students interpreted the requirements correctly. The most common mistake was to calculate that 105 residents' spaces were required, by assigning each property with up to three bedrooms a single space rather than one space per bedroom. These students, however, generally gained the final mark for a correct conclusion based on their calculation. Nearly half of the students had a fully correct interpretation, including the need for visitors' spaces.

Most students also scored well on part (c), with over 90% of students gaining marks. The most common mistake was to find that 18.4 properties needed to be affordable and then round that down to 18. However, as the requirement was 'at least 23%' it was necessary to round this up to 19. Some students also failed to deduct 10 from their value (to account for the 1-bedroom flats), leading to answers of 19 and 21 (or 18 and 22) rather than 9 and 31.

## Question 2

As with recent series, students were well prepared to answer questions about the Preliminary Material.

Most students scored both marks on part (a), with two clear and distinct improvements given. It was extremely rare to see errors (rather than improvements) stated. Whilst credit was given for comments like 'include more increments on the  $y$ -axis' we did not accept 'make the  $y$ -axis bigger'. This meant that ambiguous comments like 'larger  $y$ -axis scale' also did not gain marks.

In part (b), confirming that the comments in *Morning Record* were true was the easier to verify. Generally this was done either by working out 70% and making a comparison to the value in the Preliminary Material, or by working out that the percentage was 70.9% and thus more than 70%.

A good variety of valid methods were used to show that the comment in the *Daily Bulletin Review* was true. Most of the eight alternative methods were seen in roughly similar proportions. However, many students were not able to gain the final mark, as they did not consider that their working showed the statement was valid. For example, a number of students reduced the ratio to 13 : 17.05 but said that this was not the same as 13 : 17, despite the use of the word 'about' in the newspaper's claim.

Continuing to part (c), most students gained full marks by using one of the two approaches shown in the mark scheme. Those students who dropped marks generally had not accounted for the fact that the cost of electricity was given in pence, and so ended up with a value that was one hundred times too large. Allowance was given to students working in standard form, but most failed to gain full marks because of working in pence and failing to make a valid comparison.

Part (d) was less well answered and was indicative of the lower levels of fluency when working with percentages that we saw in this series. Around 40% of the students did not score any marks. They typically increased or decreased the given value by 26.9% rather than working out what 100% would be if the given value was 26.9%.

Most students failed to see the crucial flaw with the calculation in part (e). This was the mistake of finding a simple arithmetic mean of four percentages, not accounting for the fact that the four percentages were based on very different total amounts. The quarter of students who gained the mark generally gave a very clear explanation as to the nature of the mistake.

### **Question 3**

Almost all students started part (a) well and correctly calculated the probability of being placed fourth or below.

On part (b), a greater proportion of students were able to calculate the expected value, or some components of the expected value, than in previous series. Nearly half of the students gained full marks on this part. Around 20% of the students left their final answer as £20.5 and so lost the final accuracy mark, which was awarded for correctly giving a pounds-and-pence answer to two decimal places.

Around a quarter of students showed no understanding of the concept of expected value, even in this lower-demand question. Generally, such students gave the answer £20, presumably since this was the outcome with the highest probability.

### **Question 4**

Risk analysis continues to be the topic on this paper that is least well answered. In this lower-demand question, most students were able to gain at least one mark by working out the probability of making a claim. However, around a third did not then go on to use this probability to work out an expected cost. It was also common for students to think that, if they made a claim on the insurance, they would also get the premium refunded.

Nearly half of all students correctly worked out the expected cost of the policy, but not all were able to interpret this cost to make the correct decision that, based on the expected cost, the policy was not worth taking up.

Most students did gain the mark in part (b). This was awarded based on their decision in part (a), even if incorrect. The most common answer that did not gain the mark was that the likelihood of making a claim was only 5% and so therefore it was too small to worry about. It would be useful for centres to stress the usefulness of insurance in low-probability, high-severity situations.

### Question 5

Students continue to be well prepared for critical-path analysis questions and coped well with the uncommon parts (a) and (e) of this question.

Around two thirds of students scored full marks for part (a), with almost all scoring at least one mark. Those that lost marks generally did so through small errors, for example with one duration incorrectly stated. For the predecessor activities, errors were most frequently seen for the first and last activities. Around 15% of the students incorrectly listed successor activities rather than predecessors.

As is typical, on part (b) the forward pass was almost always completed accurately. However, the usual error of choosing the smaller value at activities like H, with two predecessors, was sometimes seen. The backward pass was less well done, with otherwise perfect solutions often having 4 as the late event time of activity D (consequently making it critical).

Most students stated their critical path correctly in part (c). They were awarded the mark if their path was correct from their activity network, as long as it started at A or B and finished at M.

As with previous series, the modal mark for the Gantt chart in part (d) was three rather than four, because students missed off units on the horizontal axis label. One bar had been provided to help students establish an appropriate scale, which helped avoid the usual inaccuracies in plotting activities through a poor choice of scale. Most students were able to correctly plot their critical path on the diagram and so scored at least two marks.

Part (e) proved challenging, with only around a quarter of students gaining each mark. Interestingly, a significant proportion of those who correctly worked out the times had made significant mistakes in their activity network and Gantt chart. This suggests they worked from the original durations given.

### Question 6

Working with percentages proved challenging for around four in ten students, who gained no more than one mark on part (a). It was surprisingly common to see statements like “ $2.6\% \times 2\% = 5.2\%$ ”. Generally, those that converted the percentages to decimals were the most successful, although about 10% of students failed to convert 0.00052 back to 0.052% as required by the question.

Around half of students gained full marks on part (b) – typically the same students who did so on part (a). A small number of students failed to round their answer to a whole number of trains.

Only around a third of students gave a satisfactory example of an assumption in part (c). Most often, those that failed to gain the mark described their method, eg justifying the rounding step, rather than stating an assumption they had made. Those that gained the mark usually had identified that they were using UK statistics as representative of Scotland.

### **Question 7**

The increased structure of this risk-analysis question meant that more students made progress than in previous series.

The tree diagram in part (a) prompted complementary probabilities to be calculated and awarded 80% of students two marks – many more students in previous series failed to realise that it was necessary to make these calculations. We required fractions, decimals or percentages on the tree diagram. Some students assumed a certain number of employees at the company and instead completed a frequency tree. The mark scheme did not award marks for this approach.

Around a third of students were able to accurately work out the expected cost in part (b). A greater proportion, were unable to make a start on this question and did not demonstrate any understanding of the concept of an expected value. Around 10% of students were able to gain a mark or two here for working out probabilities of combined events, most often from their working alongside the tree diagram in part (a).

Only around 30% of students were able to make progress on part (c), with just 10% scoring full marks. The two most common approaches were to compare the expected payout to the premium cost, or to compare the expected value with and without insurance, for example by making a comparison to part (b).

Overall, students scored slightly higher on this question than is common for this topic, most likely because of the prompt in part (a) to work out probabilities. Centres should not assume that similar scaffolding will be provided in future series and should encourage students to work out expected values by multiplying appropriate probabilities with their corresponding costs/profits.

### **Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available on the [Results Statistics](#) page of the AQA Website.