



Level 3

Mathematical Studies

1350/2B Critical Path and Risk Analysis

Report on the examination

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Question 1

In **part a**, over 80% of student were able to identify the correct multiple-choice response, with the majority of incorrect responses selecting the incorrect denominator.

In **part b**, the majority of students scored, but only half obtained full marks. Use of time proved problematic for many. The misconception that calculations using time in minutes and seconds can be undertaken using a decimal point as a divider between these units was common. Doing so would unlock one of the ranges successfully as the numbers were forgiving, but not the other. Students who obtained both correct answers but chose to use a decimal point as their notation for time were not penalised for expressing their final answer in this format.

The explanation required for the critical analysis in **part c** was less well attempted. Less than half of students were able to put forward one of the many acceptable answers. The most common correct answer was the top explanation in the mark scheme (that a value had been used twice). Of those who did demonstrate adequate reasoning, more than half could also provide the ideal answer. Incorrect answers were either too vague (for example, stating a mean was calculated with no reference to data) or were contradictory to the data.

Question 2

Part a was very well attempted with over half of students scoring all three marks. Alternative method 1 was the most common correct response and providing the valid conclusion was not an obstacle. Incorrect answers would often stem from comparing irrelevant values from the preliminary material.

Students worked effectively on **part b**, narrowing down the potential clubs to test against $3 : 4 : 1$ to just those whose broadcasting bar was bigger than its commercial bar. A majority of students were able to determine that AC Milan was the required club and provide sufficient mathematical evidence to justify this decision. A common incorrect answer was Real Madrid. This was awarded 2 marks as long as appropriate calculations were seen. Alternative method 1 was the most popular and reliable route to full marks. Methods 2 and 3 also yielded success when fully executed. Although alternative method 4 attracted many attempts, students frequently omitted the intermediate calculation of $133 \div 44$, costing a method mark. Those choosing method 6 typically earned two marks but neglected the final ratio comparison to $3 : 4 : 1$.

Part c proved to be the most challenging of the critical analysis questions, with only around 15% of students showing a valid calculation and correct answer that would justify the stated assumption. The example calculation needed to sum to a value in the range [713.5, 714.5) but was often seen to sum to 715.

On **part d**, students often did not recognise that it was necessary to reverse the two stated percentage changes, eg incorrectly increasing by 16% rather than reversing an increase of 16%. When students did realise this was what was needed, it was common to see the 16% increase correctly reversed but mistakes were made when undoing the 6% decrease. Typically this was seen as $144 \times 1.06 = 152.64$ rather than the required $144 \div 0.94 = 153.19$

On average, around 75% of the available marks were scored on **part e**. The mark scheme for this question split the valid criticisms into three groups. Only one mark could be awarded from each of these groups. For example, “no x-axis label” and “no y-axis label” could only be awarded one mark as they were too similar to each other.

Only around half of students gained any marks on **part f i**, with many not understanding that the mean would be the ‘statistical measure’ that should be used to support the statement. Those that did work out the mean generally secured both marks, but some lost marks for not leaving the answer as a negative or stating that it was a loss. Other students lost marks by dividing their correct total by a number other than 8. Others only considered the four loss-making clubs.

On **part f ii**, around a third of students were able to state an acceptable reason. The most common correct answer was to identify Paris Saint-Germain FC as an outlier which has a large effect on the mean value. Incorrect answers often referred to the fact that not all clubs made a loss.

Question 3

Critical path analysis continues to be a topic that most students are able to carry out accurately.

Part a asked them to complete an activity network from a precedence table. 60% of students were able to score full marks on this question. Around half of those who did not score full marks only made a mistake on the backward pass, typically with a latest finish time of 9 or 18 been seen on task B. These students were able to score 2 or 3 marks depending on the number of errors made on the backward pass.

More than 80% of students correctly stated the critical path in **part b**. Credit was given to those students whose activity network was incorrect as long as the path they stated was indeed a critical path for their network.

Part c was less well answered, although more than half of students scored full marks. Those that lost marks often did so because of inaccurately plotting their activities on the grid.

Question 4

Over 80% of students scored full marks on **part a**. Unfortunately, some students, after getting the correct answer of 0.12, proceeded to multiply by 100 (to find the *number* of guests rather than a probability).

Less often we saw students divide by 100 and then write 0.12%. Both errors mean the accuracy mark could not be awarded.

Part b required students to first work out the probability that someone with skiing experience was planning to ski was 0.8. This was generally seen on the tree diagram, but not always in the correct place. The incorrect value of 0.6 was also frequently seen, possibly from doubling the probability of someone not having skiing experience.

Around two thirds of students were able to score all four available marks, with the vast majority of other students gaining at least some credit on this question.

Question 5

This question was posed the opposite way than students are most likely familiar with, asking for an activity network to be completed from a Gantt chart. Students performed very well, with most able to complete a fully correct activity network.

The most common problem seen was to incorrectly link the activities. Most often this was seen by task E being linked to task H. As the latest finish time for E was 8 weeks and the earliest start time for H was 12 weeks, H cannot directly depend on E and so should not have been linked.

As the Gantt chart directly implies the earliest start time and latest finish time of each activity, there was no need to use the algorithm of a forward pass then backward pass. We did see evidence of this being done which led to incorrect values if the links between activities were incorrect.

Question 6

Most students were able to make some progress on **part a** of this Venn diagram question, with about three quarters identifying that the probability that the first chosen student having completed all sections was $\frac{7}{30}$. However, fewer students then recognised that the second chosen student having completed all sections would be $\frac{6}{29}$ and so were capped at the first mark.

Almost a third of students got to the correct final answer. Unfortunately, some students then doubled (or, much more rarely, halved) this answer and therefore lost the final accuracy mark.

It was not uncommon to see a final answer of 0.05 which, by itself, would be too imprecise to be awarded marks. Thankfully, most students did provide sufficient working and a fractional answer before overly rounding. They were awarded full marks.

In **part b**, around a third of students did not correctly identify the required regions of the Venn diagram. Some missed the 5 outside the circular regions (representing those students who had not completed any sections); others used the 1, 2, 4 and 7 in the intersecting regions.

For many students, the premature rounding of $\frac{16}{30}$ as 0.53 (without the 3 recurring) led to an inaccurate final answer of 143, rather than 144, and so lost the final accuracy mark.

Question 7

Students performed better on this cost benefit analysis question than in previous seasons. Almost all students were able to make some progress, with around a quarter presenting a fully correct method to achieve full marks on **part a**.

A variety of methods were seen, with alternative methods 1 and 3 used most often.

Whilst less common than in previous seasons, many students ended their working with statements such as “there is a 40% chance of needing to drive 260 miles and a 60% chance of needing to drive 340”. It was unfortunate that they did not proceed to calculate an expected distance.

The two different prices for petrol (\$4.25 for Gold/Diamond, \$4.80 for Silver) were sometimes mixed up in an otherwise fully correct method.

Part b was less well done, with most students scoring zero marks. Many students unnecessarily re-calculated their Gold and Silver costs, despite getting them correct in part a. Around 10% of students scored the full 3 marks on this question. A small number of students did not make a comparison of their expected value with the \$51 fixed cost of Diamond and so lost the final accuracy mark.

Mark Ranges and Award of Grades

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