Junior Mathematical Olympiad 2019

Teachers are encouraged to distribute copies of this report to candidates.

Markers’ report

Olympiad marking

Both candidates and their teachers will find it helpful to know something of the general principles involved in marking Olympiad-type papers. These preliminary paragraphs therefore serve as an exposition of the ‘philosophy’ which has guided both the setting and marking of all such papers at all age levels, both nationally and internationally.

What we are looking for, essentially, is solutions to problems. This approach is therefore rather different from what happens in public examinations such as GCSE, AS and A level, where credit is given for the ability to carry out individual techniques regardless of how these techniques fit into a protracted argument. Such marking is cumulative; a candidate may gain 60% of the available marks without necessarily having a clue about how to solve the final problem. Indeed, the questions are generally structured in such a way as to facilitate this approach, divided into many parts and not requiring an overall strategy for tackling a multi-stage argument.

In distinction to this, Olympiad-style problems are marked by looking at each question synoptically and deciding whether the candidate has some sort of overall strategy or not. An answer which is essentially a solution, but might contain either errors of calculation, flaws in logic, omission of cases or technical faults, will be marked on a ‘10 minus’ basis. One question we often ask is: if we were to have the benefit of a two-minute interview with this candidate, could they correct the error or fill the gap? On the other hand, an answer which shows no sign of being a genuine solution is marked on a ‘0 plus’ basis; up to 4 marks might be awarded for particular cases or insights. It is therefore important that candidates taking these papers realise the importance of the rubric about trying to finish whole questions rather than attempting lots of disconnected parts.
General

Candidates should not use red ink!

Pupils should be encouraged to adopt the principle ‘New thought, new paragraph’ and not to shy away from using words in explanations—these always help the reader.

Note that a useful check (certainly at JMO level) is to ask yourself ‘have I used all the information given in the question?’

Section A was marked out of 10, as was each question on section B.

Section B

B1 Much good work, occasionally spoiled by lack of explanation, for example, explaining the effect $O = 5$ has on the tens column.

A number of candidates failed to mention their reasons for their chosen values of $J$ and some forgot that each letter stood for a different digit.

Markers tended to be generous with this first question.

B2 Markers were keen to reward mathematical thinking, so candidates who presented a correct solution with structured working scored most credit. Pupils lost credit if they failed to demonstrate why certain values of $8000 \times k$ were or were not squares.

Candidates who simply tested different values of $k$ without a systematic approach were penalised.

B3 Many students formulated and solved equations to find the length of the train. Failure to define variables correctly cost marks.

Some students used proportionality arguments to find the length of the train and considered the time the train would be completely inside the tunnel. This needed to be well-explained in order to gain significant credit.

Note that it is not enough to show that everything works when the length of the train is 60 metres; it is necessary to show that this is the only possibility.

B4 Much good work—well done!

A number of students forgot to simplify their final answer. If students used a similarity argument to find the length of BC and CD, a full explanation was required.

B5 Students had to present an analysis (not just lists of times) and distinguish between two types of hour readings. Overall, this question was completed to a good standard.

B6 This was a very challenging question and students were awarded highly if they managed to find a lower bound on the value of $n$. A good number of students found at least one infinite list of cases. Few students managed to justify the exclusion of $n = 2, 3$ and/or 5.

Alexandra Randolph, on behalf of the Marking Team