

Junior Mathematics Competition 2016

Report to Teachers

General Comments

This year, the competition had two relatively 'easy' questions (numbers 1 and 4) and every question was within the grasp of many students, but overall it seemed to be quite long. Students looking in future at the questions online may find them straightforward, but you try completing them in an hour and it's a different matter. Well done to those participants who came close! The winner at Year 11 completed everything (obviously not Question 1), only making a couple of small errors which he would have spotted given more time.

The number of students taking part in the competition in 2016 was 6103 (last year 6859). However, the number of schools taking part was up from 147 in 2015 to 154 this year. Obviously more schools with fewer students per school are taking part. There were 2850 students (2986 last year) in Year 9, 2198 (2453) in Year 10, and 1049 (1418) in Year 11. This year there was one student who scored zero (no attempt but nice doodles).

The planned date for next year's competition is **Wednesday April 5**.

Please **record** this date.

For the overall scores in 2016 see the table on page 3. This year, because so many students spent an inordinate amount of time on early questions (one student took over two pages attempting to answer 2(e) alone), it was possible to earn a Merit with good scores in only two questions. We repeat the advice (as we do every year) that concentrating on just three questions, while making sure that they are **fully** answered, is generally a better approach than attempting small pieces from four or five questions.

Cost

With decreasing number of students and rising costs, we have decided on the following options:

1. Absolutely no printing except certificates (all questions, answer booklets, reports etc. will be dispatched by email): \$4 per student.
2. No student report: \$4.50 per student, as at present.
3. Student report and certificate: \$5 per student, as at present.

In effect \$5 will get a student everything, as was the case this year, while \$4.50 can give the student everything but the printed model solutions. For those schools who do not wish to use pre-printed answer booklets, we will provide slips to attach to pad paper (or equivalent). The aim here is to give schools more flexibility. Note that next year the entry cut-off date will be for printed materials only, and schools wishing to enter without being supplied printed materials will be able to enter one week before the competition is sat. Please contact us if you have special requirements for sitting the competition.

Brief Comments on Individual Questions

Question 1 (Year 9 and below)

Fairly straight forward. 20/20 was again not uncommon this year. However, the notes at the end of the Student's Report should be read, because some absolutely ridiculous answers appeared. Common sense should be easy to develop, we hope (!)

One type of student which the manager finds particularly annoying should be mentioned. This is the student, usually from Year 9 (or below), who writes 1(a), 1(b) etc. through to 5(e) down the first page, one question per line. They then discover (!) that many answers in Mathematics take more than one line to write. Solution? Write small, sometimes cramming four lines of text into one line of booklet, with three whole pages left blank. This type of student almost certainly doesn't do well, partly because their tiny writing is practically illegible. Do not laugh. They're **common**, probably sitting in front of your next class.

Question 2

Disappointing. We thought that a question on leap years would be a gentle start for Year 10. It didn't work, mainly because students didn't read properly the information about 'divisible by 100 but not 400' and resorted to their own prior 'knowledge'. Reading is such a critical art, and many students glossed over the given information because they thought they already knew about the subject.

Still, it did seem to engage a number of students, compared to Question 3 which was often skipped over. Many students were caught up in (e), a deliberately difficult end to the question, and didn't leave themselves enough time to earn credit in later parts of the competition.

Question 3

This proved to be difficult, apart from (c). We are trying to set 'easy' starters to every question, but the starter here often proved to be too tricky. Constructing numbers from other numbers and operations (with order of operation thrown in for good measure) might be a good class activity.

Question 4

Here students often did well. We do try to make the last two questions more challenging, but this year's Question 4 could easily have been placed earlier. It was the best answered question among Years 10 and 11 students, and the second best (after Question 1) in Year 9. However, as mentioned in the Student report, the formula $A = \pi r^2$ is not known or handled confidently, even by many Year 11 students.

In part (d) for full credit students were expected to set up an equation and solve it. Many just figured out the answers 'in their head'. Some schools were consistently good in this regard – in others every student just gave the answer without first of all setting up an equation. Had we made the answers more 'difficult' to see at a glance, students who just depend on spotting the result would have come unstuck here.

Question 5

Not attempted by many, largely (we suspect) because of time. It wasn't too difficult, especially for many (not all) Year 11 students. Both, for example, (a)(i) and even (e) can be completed in a couple of lines if students just 'see' the answers and can then explain or show working. Some spent far too many lines on complicated working which led nowhere.

Obviously in this question there is a tendency among numerous students to round early. For example, in (a)(i) many students found the side lengths of the sides of the inner square to be $\sqrt{50}$, which they then approximated to, say, 7.07, which they then squared, confidently giving 49.9849 cm^2 as their final answer.

Why that wasn't then rounded to 50 is anybody's guess. Being able to multiply $\sqrt{50}$ by $\sqrt{50}$ to get 50 seems to be beyond many. Nobody reached 50.000000001, but if somebody had reached this answer, it's an even money bet that they would leave it as their final answer and not round it sensibly to 50.

Students should be told not to round **before** the final result but they should then give the final answer to both eight (or whatever) significant figures, and also to something sensible.

Student Names

Most schools send names electronically now, although some still need a reminder. Any work done at the start of the year will save you having to write names on blank certificates at the end. A reminder that scans are not 'electronic'.

This year two students failed to put neither name nor school at the front. Please check your papers before dispatching them. At least if we knew the school, we could send 'blank' certificates. We hope to fix the school name problem at least by pre-printing the school name on each answer booklet next year.

A Note on Calculators

Even if you deny students the use of a calculator in class, please tell them that if they have access to one, they can use it (perhaps just for the day) for the competition. Otherwise you are disadvantaging your own students. 'Simple' things like dividing 25 by 2 are so much easier with a calculator. Then there's $80 / 3.6$.

Percentiles

The percentiles at each level are given below. (The total possible marks for Year 9 candidates was 100, and for Years 10 and 11 candidates it was 80.) Note that the top papers (about 20% at each level) have been check-marked by experienced members of the Mathematics and Statistics Department of the University of Otago. This does use up considerable time in returning results, but we feel that the greater accuracy in final marks makes the check-marking justified.

2016	Year 9	Year 10	Year 11	2015	Year 9	Year 10	Year 11
Top 100	43	38	44	Top 100	48	41	46
Top 200	36	32	37	Top 200	44	36	42
Merit	31	28	36	Merit	38	31	41
70th %ile	26	22	32	70th %ile	33	26	34
60th %ile	23	19	28	60th %ile	29	23	31
50th %ile	21	17	24	50th %ile	27	21	28
25th %ile	15	12	16	25th %ile	20	15	20

A comparison with last year's percentiles (at the right) again shows that generally the marks this year were a little lower, meaning students found this year's competition a little harder. You should check the list of marks against the percentiles above. If there are any students who seem to be eligible for Merit Awards or above, but who do not appear to have received anything on the mark list, please contact us.

Explanation of the Symbols on the Mark-sheets

As usual, each question was marked out of a maximum of 20. The following symbols have been utilised on the mark sheets:

- (blank) No work presented.
- 0 Work presented, but ungradeable, or fundamentally incorrect.
- Minimal partial credit (1 – 5 marks).
- + Significant partial credit (6 – 13 marks).
- √ Near complete solution (14 – 17 marks).
- √√ Full, or near full credit (18 – 20 marks).

At the end of each row we have recorded the marker's estimate of the final score for each student.

Certificates

Many students have included these in their curriculum vitae when applying for employment. They should be named correctly and looked after. We have even heard of one student who included three Participation Certificates (no Merits or better) in her application. She got the job because of her persistence!

Material Enclosed in the Envelope

The following material is enclosed in the envelope to schools:

- a Participation Certificate for those students who did not gain Merit or better.
- a booklet of Answers and Comments for every student (plus a few spares) if they paid \$5. We also include one copy for the school to keep if desired.
- one copy of this Competition Report.
- the mark list showing each student's mark and awards (if appropriate), which has also been emailed to your school. If you do not have a copy please email us (jmc@maths.otago.ac.nz).
- miscellaneous items if applicable.
- Merit Certificates etc. At this stage we can only send electronic certificates for you to print out if any names are incorrect.
- Prizes, if any of your students were in the Top 30.

Our Website and email

Please remember to check our website (and our Twitter account) regularly for updates on the availability of results, as these will be typically available weeks before we sent out the results packs to schools. You should monitor the website before emailing us for information which is already on there. We have emailed results to all schools. Many thanks to those who continue to use email – we have found this to be the most effective form of communication by far, and has reduced our administrative burden no end.

International Entries

We're investigating opening entries to overseas schools. Such schools would operate in a different pool with potentially different prizes, and NZ schools would be unaffected. This proposal would have to be approved by the University if it is to proceed.

Final Comments

Don't forget to try the questions yourself (even before you look at the model solutions!), and then see if you can "tweak" them a little to help students' investigative and problem solving skills.

And remember to use the questions throughout the year, and not just in the days before the actual competition. As usual some of the questions would make good review or revision questions. You should also visit us at our website if you want to print off copies of questions and solutions from recent years.

Problem solving pervades the mathematics curriculum, crossing the various strands. We hope that this competition assists all of you to help fulfil this important aspect of mathematics education.

Warren Palmer
Competition Manager