



Department of Mathematics and Statistics

Junior Mathematics Competition 2017

Report to Teachers

General comments

This year the competition was the easiest it has been for some time. The 'first' students in Years 10 and 11 both scored 100%, and the first two students in Year 9 were very close to 'perfect', an impressive effort since they had to complete five questions within an hour. The second place getter in Year 9 was actually from Year 8, which was even more impressive.

Because of the 'easy' nature of most questions, which we will try to maintain because it does give almost every student something 'to get their teeth into', the organisers have decided that everybody will answer questions worth a total of 100 marks next year. This means that there will be eight questions next year. Questions 1, 2, 7, and 8 will be 'half' questions worth 10 marks each. Questions 3 to 6 will be 'full' length questions worth 20 each. Everybody will answer four questions worth 20 each, and two worth 10 each. So Year 9 (and below) will answer 1 to 6, Year 10 will answer 2 to 7, and Year 11 will answer 3 to 8.

This policy is not set in stone yet. Comments are welcome.

The number of students taking part in the competition in 2017 was 6118 (last year 6103), the first (slight) increase for some years. There were 2910 in Year 9 (2850 last year), 2202 in Year 10 (2198), and 1006 in Year 11 (1049). Unfortunately the number of Year 11 students sitting was so reduced that we could not give a 'Merit' (Top 15%) award at this level (the Top 200 award was already given to well over 15% of candidates). We are bemoaning the fact that so few Year 11s attempt the competition, for whatever reason, as we feel it provides useful practices in sitting exams.

The number of schools participating was 153, one less than in 2016.

The planned date for next year's competition is **Wednesday April 4**.

Please **record** this date.

For the overall scores in 2017 see the table on page 2. This year it was still possible to earn a Merit (or Top 200 award in Year 11) with very good scores in three questions, although Year 11 students probably needed some credit in a fourth question. 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 the number of students remaining flat and with rising costs we will have no choice but to raise prices next year.

We are still going through the process of determining our budget and our options so the price cost will be announced at the start of the year.

International students

We are investigating making the competition available to international students (digital entries only) in 2019. This will not impact on the New Zealand prize pool. We may very well ask schools with sister schools overseas if their sister school would be willing to take part.

Brief comments on individual questions

Question One (Year 9 and below)

Fairly straight forward. 20/20 was again not uncommon this year. The last part however proved difficult for some. Once again some inexplicable answers appeared. Also too many students have reached secondary school not being able to number their answers down the left column.

Students answering in red, green, and light pencil are beginning to creep in again. Teachers need to be vigilant and remind Year 9 entrants that these 'colours' are not acceptable.

Question Two

Well answered. Students do seem to like number work (primes), especially when they can spend so long 'playing' on their calculator. Persistence in attempting the questions was more evident this year.

One type of student should be mentioned. There are many students out there who believe that once they found the square root of the number they could ignore the 'decimal' part then test to see if the square root was prime. Example: Is 2021 prime? Well, $\sqrt{2021} = 44.9\dots$ Ignore the 'decimal'. Since 44 is even 2021 must not be prime. Not uncommon and a total misreading of the given information.

Question Three

Well answered, apart from the very last part. This proved to be too difficult for many to explain clearly. We were told many times that ' $1^2 = 1$, hence it's impossible for a two digit number beginning with 1 to be narcissistic' or that 'None of them work' with no facts written down to provide any evidence. Yet this question screamed out to have every case actually presented (there were only 10 simple cases), although quite a few students found satisfactory alternatives.

In the first part many students included 28 even though they were told not to. Reading remains an issue.

Question Four

It was noticeable the pleasing 'jump' between Years 9 and 11. Most Year 9 students struggled ('I haven't been taught this') while most Year 11 students made reasonable progress. Working out the x and y values proved difficult (e.g. $x = 25212 (= 11 \times 2292)$ was not uncommon in part (b)). As expected the inequalities in (e) caused problems, particularly the handling of negatives ($t < -176.3$ occurred often). Using the parameter (we didn't dare use the word) t to calculate x and y values, even if $t = 174, 175, 176$ had been found, proved to be challenging.

Yet some students at all levels seemed to have no difficulties and earned 20/20 in the minimum possible space.

Question Five

We feel that if possible 'simple' trigonometry problems should be introduced in Year 10, so that students already have some notion when it is repeated in Year 11. There were some schools where every Year 11 pupil had no idea, but some with very high levels of achievement. Most Year 9 (and 10) students could attempt parts (a), (b), and (c) only. This was the 'difficult' last question, although many Year 11 had no trouble except, rather surprisingly, with part (c).

Student names

Although some schools needed a reminder to send in names (no scans) the response rate was pretty good.

A note on calculators

Keep encouraging students to bring their calculator for the one day, even if they are not allowed one most of the time. This year one student without a calculator did gain a Merit. There may be others we didn't detect but it's a rare feat.

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.

2017	Year 9	Year 10	Year 11	2016	Year 9	Year 10	Year 11
Top 100	62	56	66	Top 100	43	38	44
Top 200	56	50	59	Top 200	36	32	37
Merit	48	45	–	Merit	31	28	36
70th %ile	40	37	54	70th %ile	26	22	32
60th %ile	35	34	49	60th %ile	23	19	28
50th %ile	32	31	45	50th %ile	21	17	24
25th %ile	22	23	33	25th %ile	15	12	16

A reminder that this year there were insufficient papers in Year 11 to award Merits. With only 1006 Year 11 students taking part, the 'Top 200' are already well over the 15% mark.

A comparison with last's year's results (on the right) shows that this year's competition was 'easy', especially for Year 11.

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.

Material enclosed in the envelope

The following material is enclosed in the envelope to schools (for those that receive physical results packs):

- 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. They are also on our website.
- 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. Please contact us if the name is 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 send 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.

For those of you using calendaring software, we will have the important dates for the 2018 competition in a file (in iCal format) on the website soon.

Final comments (my yearly 'rant')

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 web-site 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

Warren Palmer
Competition Manager