To whom it may concern,

I would like to raise several issues raised regarding the assessment of the MCAT (Achievement Standard 91027) for both 2015 and 2016. The MCAT examinations for 2015 and 2016 were much harder than in previous years, especially the 2016 papers. This was due to an imbalance in the number of problems set in a purely mathematical context (6 out of 17) versus a real-life context (11 out of 17) in 2015. Typically students find "mathematical context" questions more straightforward than "real-life context" questions. The balance was somewhat corrected in the 2016 examinations papers, although not completely. The Achievement Standard 91027 states that:

"*Problems are situations that provide opportunities to apply knowledge or understanding of mathematical concepts and procedures and methods. The situation will be set in a real-life or mathematical context."*

To my colleagues and me, this implies a balance between these two styles of question, not a heavy favouring of one over the other. This was compounded by having 3 out of 17 questions in the 2015 papers involving simultaneous equations. In the 2016 papers there were 10 out of 19 questions that involved the use of quadratic equations and expressions. Most students find such questions particularly difficult. The Achievement Standard 91027 Specification states that:

> *Students need to be familiar with procedures related to:*
>
> - *factorising*
> - *expanding*
> - *simplifying algebraic expressions involving exponents, such as* $(2x^4)^3$ *or* $\frac{12a^5}{8a^7}$
> - *substituting values into formulae*
> - *manipulating and simplifying expressions such as* $\frac{3x}{4}-\frac{x+2}{3}$ *or* $\frac{3x^2-12}{x-2}$
> - *rearranging formulae such as* $E=\frac{1}{2}mv^2$ *or* $\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$
> - *solving linear equations or inequations such as 5x + 12 = 3 - 2x or 3(x - 2) < 7*
> - *solving quadratic equations such as (8x + 3)(x - 6) = 0,* $x^2 + 5x – 6 = 0$, $3x^2 = 10x - 8$ *(completing the square and the quadratic formula are not required)*
> - *solving simple equations involving exponents such as* $x^3 = 8$, $5^x = 125$
> - *solving pairs of simultaneous linear equations with two unknowns.*

There was far too much weighting towards harder concepts like simultaneous equations, quadratics, and forming general solutions. Some of the more straight-forward concepts were not covered at all. Also, there were several questions relating to algebraic graphs in both the 2015 and 2016 papers, despite there being absolutely no mention of graphing in the Achievement Standard Specification.

The types of question detailed in bullet points 3, 5, 6, 7, 8 were far easier, compared to the 2015 and 2016 papers. Some examples of these questions are:

Solve $x^3 = 8$ in the Achievement Standard Specification verses ***Solve*** $320 = 5r^3$ in the 2015(A) MCAT paper, or ***for what values of p is*** $10 \times 2^{p-1} < 165$ **in the 2016(B) paper.**

Solve $x^2 + 5x - 6 = 0$ in the Achievement Standard Specification verses ***Factorise*** $3x^2 - 11 + 6$ in the 2015 MCAT(A) paper.

Rearrange $E = \frac{1}{2}mv^2$ in the Achievement Standard Specification verses $T = 2\pi\sqrt{\frac{L}{9.8}}$ in the 2016(A) MCAT paper.

Furthermore, some questions in both the 2015 and 2016 MCAT papers were essentially the same as the Level 2 90284 paper. Both the MCAT and Level 2 90284 paper graded these questions at the same level of Achieved. I have provided an example of this below.

Factorise $2x^2 - 15x + 18$ from the 2015(B) MCAT paper.

Factorise $6x^2 - 11x - 10$ from the Level 2 90824 paper.

Prior the 2015, the MCAT papers gave simpler quadratics to factorise or solve. Once again, I have provided some examples below.

Factorise $x^2 - 3x - 40$ from the 2014(A) MCAT paper.

Solve $x^2 + 4x - 12 = 0$ from the 2013(A) MCAT paper.

Factorise $x^2 - 3x - 28$ from the 2012(A) MCAT paper.

As a result of the points raised above, the sufficiency to gain an Achieved grade was reduced to only 3 correct answers out of 17 in total in the 2015 paper. In the 2016 papers it was 3 out of 19 correct answers for an Achieved grade. It was 6 correct answers in the 2013 and 2014 papers. No person would think that 3 out of 19 would be a passing grade. The bar had to be set so low due to the difficulty of the 2015 and 2016 papers; otherwise too many students would have failed. I recall there was a large teacher backlash over the 2015 paper being so difficult, yet this was only exacerbated in the 2016 paper despite reassurances by NZQA that the issues raised would not happen again. This shows a complete lack of understanding of the Achievement Standard Speciation for Achievement Standard 91027 by NZQA. This calls into question whether or not the 2015 and 2016 papers were moderated by a range of current mathematics teachers, and that moderation was taken on board by the NZQA. I have ever heard of second year calculus students and university lecturers struggling with questions in the 2016 papers.

I know that there has been much concern from mathematics teachers, principals, students, parents, and mathematics associations across New Zealand. The response from an NZQA representative was:

"The parts of the paper we've been told some students found more challenging than they expected relate to applying knowledge to use maths concepts and methods to solve algebraic problems, rather than answering straightforward skills questions (for example, being asked an open ended question and formulating a mathematic response which presents findings), Answering questions in this way is in line with the NCEA standard that the paper relates to and MCAT papers have increasingly been including questions of this nature over the last few years."

The statement above relates to the Excellence section of the Achievement Standard Specification only, yet nowhere does it mention the level of abstraction needed to answer the harder questions in the 2016 MCAT papers. The Achievement section of the Achievement Standard Specification simply states that students need to "Apply algebraic procedures in solving problems." The NZQA seem to have a very unique view of what an "algebra problem" is. The NZQA takes this definition as "an overly complex and often ambiguous word problem with no scaffolding". The internationally accepted definition of an "algebra problem" could be any one of the examples listed in the bullet points of the Achievement Standard Specification. Even if the NZQA's interpretation of an "algebra problem" is acceptable, questions should be more like the following example.

A number is multiplied by itself three times. The result is eight. What is this number?

Such a question is in line with the ninth bullet point in the Achievement Standard Specification. Instead, the NZQA came up with the following question from the 2016(A) paper.

For what values of n is $6\times 2^{n+1} > 123$

For the sake of the students across New Zealand, can the NZQA publicly acknowledge the obvious errors made in the MCAT over the past two years, and ensure that these errors will not happen in future? I look forward to hearing you reply.

Peter Webb,
Principal's Nominee and Concerned Mathematics Teacher,
Saint Patrick's College,
Wellington.