



Math matters

Grant Cairns

This “opinion piece” is on how I think Mathematics is travelling. The *Gazette* editors’ brief is to be “provocative”. The Australian scene isn’t uniform and the more modern universities like La Trobe are suffering more than others; in a time of student shortage, the sandstones take their fill first. It’s possible that our precarious state is colouring my view of the overall landscape and that this view is consequently biased; but that doesn’t seem entirely out of place in an “opinion piece”.

As I just pre-figured, I do think Mathematics is in trouble. How could I think otherwise: in my department, total student enrolments in mathematics units (including service units) have slowly fallen, more or less monotonically, for the past 15 years. Over this same period, funding has plummeted; even though the number of staff has fallen a good deal faster than the student enrolment, we now find ourselves with an annual salary bill some 60% higher than our teaching income; the immediate future has its challenges. One critical issue is pass rates. As student interest in science and IT falls, faculties chase enrolments down into unprecedentedly low entrance scores. Combine this with the drop in school mathematics levels and high failure rates are virtually unavoidable. This situation can’t be easily improved, at least not without fundamentally compromising a curriculum that has already been considerably watered down over the past two decades.

How did we get into this situation: an unsustainable budgetary situation and students who in many cases simply aren’t properly prepared to study mathematics at university? The drop in student numbers primarily reflects a gradual reduction in mathematics service teaching. This is partly due

to a general decline in traditional science enrolments. In part it is a consequence of the drop in standards of commencing students; as their mathematical abilities drop and their pass rates fall, their home departments are naturally inclined to drop or reduce the number of mathematics units that these students must take. But the drop in student numbers is only part of the story. The key factor in understanding our present budgetary situation has been the drop in government funding. Different people like to look for all sorts of obscure reasons to explain the difficulties of mathematics departments in Australia, but the main reason is without doubt the drop in government funding. Over the past two decades government funding of universities has dropped, in real terms, and has been instead supplemented by full fee paying overseas students. Mathematics does see some of these full fee paying students, but in fact, most full fee students are attracted to vocationally oriented programs, especially professional masters degrees. This change in the profile of university income has resulted in a fundamental shift in resources away from traditional disciplines like mathematics.

How bad is it? Well, the immediate future is rather bleak. Very few opportunities for teaching positions exist in our university mathematics departments; young mathematicians have precious little opportunity in Australia, and very little expectation that the situation will improve. As the incumbent teaching generation approaches retirement age, one has more the impression that the shop is being wound up, rather than the baton being passed on. An equally grave prognostic looms over school mathematics: the growing crisis in the provision of suitably trained mathematics teachers is a

major problem, amplified by the problems at the university level and destined to in turn further exacerbate the decline in school standards and the problems at university entrance; a loop of very negative feedback.

What can we do? I think we're already doing it. Generally speaking, departments are doing the right things: actively engaging with schools, promoting our courses, focusing on careers, dialoguing with industry. I don't believe our current predicament is the mathematical community's own doing, despite what some people may claim. There are plenty of people happy to push their own barrows and especially in Australia, lots of moral indignation about the shameful inaction of others. I guess this is not surprising in a time of shortage. However, the fact is that departmental initiatives have only marginal effect. In any business, advertisement and client relations are important and can't be ignored, but ultimately you have to have a product that people want to buy and a price you can work with. At La Trobe for example, our department has been active on many fronts. It is recognized in one of the university's 8 areas of research strength. It has a recognized history of dedication to teaching. In the latest national teaching survey, our department was ranked top of all La Trobe departments in "good teaching" and top amongst all Australian mathematics departments. This (robust) indicator is an honest reflection of the effort that the department has made: and yet despite this our student numbers continue to fall, the failure rates continue to rise, and our financial situation continues to deteriorate. There is little we can do against the anti-maths tide that we are not already doing with earnest.

Who can help? The situation differs from campus to campus, but the underlying problem is the same. Government support of mathematics is the only thing that will sustain our discipline in the coming years. It is natural to look to the university centres for assistance, but their pockets have finite

depth and we are not the only discipline in difficulty. At La Trobe, our Faculty and our neighbouring Departments have generously supported and subsidized us, and I take this opportunity to thank them. I hope their unselfish support will continue. But what we really need is for the federal government to support mathematics, by adjusting the cluster funding model, or by some other means; we need to look to the Australian government to sustain Australian mathematics through the current lean years.

The longer term future? It will be a long time before intellectual life is more important in Australia than sport, and the Australian economy is something significantly more than just retail sales. Mathematics in the broad Australian community has an enormous amount of inertia. I am talking here of the combined interest, appreciation, knowledge and regard for mathematics held by society at large, or more pertinently, the lack there-of. It is not easy to turn this around. However, the education sector has been moving ineluctably into the capitalist sphere. There is no doubt that universities will be even more demand driven in the future. This is causing big problems in the short term, but it may be very beneficial in the long run. It will be if mathematics really has something to offer. The future of secondary and tertiary mathematics lies in the way society sees the benefits of mathematical education. Mathematics will only be engaging and attractive for students when they see the worth of mathematics and its impact on society. At present this impact is diffuse and disorganized. We are all at pains to explain to students that mathematics careers are broad and diverse. I think we do a reasonable job with a difficult task; but we won't be really successful in recruiting students until the argument is unnecessary. The discipline of mathematics will not be secure until future applications of mathematics show the general community that mathematics is important and that a solid grounding in mathematics is useful for the

modern citizen and desirable from a career perspective. I think the long term future is very promising. It seems inevitable to me that the world of economics and finance will eventually see mathematical training as critical and demand a more serious education of their graduates. After all, numbers have a way of making themselves heard, especially when they have dollar signs in front. At present, medical science is strikingly disconnected from mathematics, but the future must surely be otherwise. Engineering departments continue to rely almost entirely on nineteenth century mathematics, but eventually modern mathematics must play a role.

There is no point pining for times gone by. For us, I think the problem is one of making mathematics more vocationally oriented. At present, mathematics is not a vocation. People don't become mathematicians and then get employed as such. The most we can say is that by studying mathematics, students can improve their employment possibilities. How can we make mathematics more vocationally significant? I believe that without compromising the discipline of pure mathematics, we need to strengthen and develop applied mathematics. Pure maths is a largely coherent, well articulated discipline with long established traditions. Applied maths is really an "emerging discipline", though it isn't

usually thought of in this sense. It is comprised of very different parts: traditional interests in light, heat, gas and fluids, modern applications from statistical mechanics, combinatorics, operations research, statistics, numerical analysis and computational mathematics, etc. etc., and purely theoretical applications to other disciplines (principally theoretical physics). One could imagine that in the future the various parts of applied mathematics might crystallise into separate vibrant disciplines and who knows, in a period of growth, perhaps even into separate departments. At present, the demarcation between these areas is not yet clear, and neither is the character of their graduate attributes. We make very little attempt to connect the training our students receive with the tasks they will eventually perform in the workplace. It is in Australia's interest that in particular, effective, socially useful real world mathematics be vigorously promoted; this is important for Australia and for the health of mathematics as a whole.

But I am getting carried away with speculation here. The problems we are presently facing are more pressing. Across Australia, how many more mathematics teaching staff will be lost in the coming years? Will the percentage of science students taking any mathematics continue to fall? Will mathematics pass rates be preserved through the further erosion of standards?

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