

COMMENTS ON THE REVISED ONTARIO HIGH SCHOOL MATHEMATICS CURRICULUM AND ITS IMPACT ON CALCULUS COURSES AT ONTARIO UNIVERSITIES

The new mathematics curriculum for Ontario secondary schools was implemented in September 2002 for students in Grade 12 and reflects the fact that the OAC courses are disappearing. Some of the material from the OAC Calculus course is covered in the new Grade 12 course called Calculus and Advanced Functions, but we need to be aware that certain topics are no longer covered. Of greater concern, however, is the omission of topics that used to be in the old Grade 12 course. The most serious omission is that of trigonometry, meaning that Ontario is the only province in Canada in which trigonometry is not covered in Grade 12. (Of course, it would be better to cover precalculus topics thoroughly and leave calculus to the universities, but it's somehow considered prestigious to teach calculus in the schools.)

Let me now discuss what you can expect entering students to know about trigonometry. The Grade 10 course introduces the sine, cosine, and tangent as ratios (not functions) and uses them to solve right triangles. The Law of Sines and the Law of Cosines are also covered. In Grade 11, radian measure is introduced and sin, cos, and tan are considered as functions. Their graphs are shifted and stretched and are used as models. Only the simplest identities, involving sin and cos, are discussed. Bear in mind that after the Grade 10 and 11 courses students will have an entire year without trigonometry and so they will have a rather dim and distant recollection of these topics.

Here are some of the topics that used to be in the Grade 12 course and are no longer covered in Ontario high schools: the reciprocal functions $\csc x$, $\sec x$, and $\cot x$; the addition and subtraction formulas for sin and cos and their consequences (including the double angle formulas); and the inverse trigonometric functions.

Of course this means that the limits and derivatives of trigonometric functions that used to be part of the OAC Calculus course are no longer taught. The other omissions from the OAC course (antiderivatives and areas) are not serious at all.

Despite the fact that trigonometry isn't in the Grade 12 curriculum, some publishers have (at my urging) included it in their textbooks anyway, and maybe some schools will teach it. (And of course some of the 2003 students will have taken the OAC Calculus course.) But the fact remains that we can't assume students know much trigonometry. So how do we cope with this fact?

It's clear that we need to teach some trigonometry near the beginning of university calculus courses—a quick review of the primary trigonometric functions (emphasizing their graphs) followed by the introduction of $\csc x$, $\sec x$, $\cot x$ and the identities that relate them; the addition formulas for sin and cos together with the double angle formulas; and some remedial practice solving right triangles (a useful skill throughout the course). This material could be taught either at the very beginning of the course or when the derivatives of the trigonometric functions are covered. Inverse trigonometric

functions could also be covered at the same time or when you are ready to differentiate them.

The old Ontario Mathematics Curriculum was in place for 15 years. Let's hope that it doesn't take 15 years to correct this flaw in the new curriculum.

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