

**Report of the  
Blue Ribbon Panel  
on the Review of  
Mathematics 30**

**March 1993**

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## Preface from The Alberta Teachers' Association

With growing concern about the state of Mathematics 30 this past fall, Provincial Executive Council sought to make a helpful contribution to the debate by establishing the Blue Ribbon Panel on the Review of Mathematics 30. Council asked the panel to review the Mathematics 30 situation independently, ie at arms length from the Association, and to report directly to education partners with recommendations to improve the situation.

Provincial Executive Council appointed the following persons to serve on the panel.

**Dr Art Jorgensen, chairman**, is one of Alberta's most distinguished teachers. His significant contribution to the profession and to the improvement of mathematics education has been felt locally, provincially and internationally. He has been selected by the Canadian Teachers' Federation to work with teachers in Jamaica, Zimbabwe, Liberia and Swaziland. In 1977, he was named "school administrator of the year" and was recognized as "mathematics educator of the year" in 1988. He is a life member of the National Council of Teachers of Mathematics. In 1991, Dr Jorgensen received The Alberta Teachers' Association's highest award, honorary membership, for his outstanding service to the teaching profession. He continues to reside in Edson.

**Bob Hart** teaches senior high school mathematics at Crescent Heights High School in Calgary. Mr Hart is currently president of the Mathematics Council of The Alberta Teachers' Association, an organization of over 800 Alberta mathematics teachers. He also serves on the Department of Education Mathematics 30 Diploma Examination Review Committee.

**Helen Stewart** teaches senior high school mathematics at Bishop Grandin High School in Calgary. Ms Stewart currently serves on the Mathematics 30 Diploma Examination Review Committee, providing advice to the Student Evaluation Branch of the Department of Education on the nature and structure of the Mathematics 30 diploma examination.

**Ken May** is assistant principal, Winston Churchill High School in Lethbridge. Mr May, who also teaches senior high school mathematics, served as a member of the Senior High School Mathematics Subject Advisory Committee, providing advice to the Curriculum Branch of the Department of Education on revisions to the previous mathematics program of studies. In this respect, Mr May participated in discussions about the newly introduced mathematics curriculum.

**Dr Tom Kieren** is a professor in the Department of Secondary Education at the University of Alberta. Among other assignments, he teaches mathematics teacher education courses. He has been recognized nationally and internationally as an outstanding mathematics teacher educator and participated in the development of the National Council of Teachers of Mathematics standards projects.

**Jean Phelps** is acting associate dean, Community Education, Division of Community Education and Instructional Development, Lethbridge Community College. Ms Phelps is the only panel member who is not a mathematician. For the purposes of the panel's work, her expertise is centred in her knowledge of postsecondary programs and associated prerequisites. Ms Phelps also serves as the colleges/institutes representative on the Department of Education Senior High School Program Coordinating Committee.

The Department of Education named **Florence Glanfield** to serve on the panel as the Department's representative. Ms Glanfield is the examination manager for Mathematics 30, working with the Student Evaluation Branch. She also serves as Department of Education representative on the Mathematics Council of The Alberta Teachers' Association.

The Alberta Teachers' Association is pleased to have funded the Blue Ribbon Panel on the Review of Mathematics 30 and sincerely thanks the panel for their outstanding work in reviewing secondary mathematics in this province.

## Introduction

In 1992 10, Provincial Executive Council of The Alberta Teachers' Association reviewed reports about the achievement of students in Mathematics 30 and concerns expressed from teachers about the state of secondary mathematics in Alberta. As a result of these concerns, Council established the Blue Ribbon Panel on the Review of Mathematics 30. The panel, including practising teachers and officials from the Department of Education, a university and a college, met four times. Its terms of reference were:

1. to review the results of recent Mathematics 30 diploma examinations;
2. to review the structure and nature of senior high school mathematics;
3. to identify concerns and expectations of education partners with respect to senior high school mathematics;
4. to make recommendations directly to education partners.

In its deliberations, the panel was guided by a number of assumptions:

1. the goal of teaching mathematics is to help all students develop mathematical power;
2. what students learn is connected to how they learn it;
3. all students can learn to think mathematically;
4. teaching is complex and cannot be reduced to recipes or prescriptions; there is no "best way" but there may be many "good ways";
5. learning mathematics in any depth takes time.

To assist the panel in its deliberations, a questionnaire was devised and distributed to all secondary schools (ie 1,057 schools with junior and/or senior high school programs). The questionnaire focused on the preparation and experience of mathematics teachers and provided an opportunity for teachers to comment on the current state of secondary mathematics. A total of 1,145 questionnaires were returned by the deadline.

The recommendations which follow arise out of the panel's deliberations. They are not to be taken as the results of either research projects by the committee nor are they the result of considerations of evidence in the form of presentations to a commission. They are the result of the panel's considered discussions and thought. In these deliberations, the panel received very cooperative input from a number of voluntary sources. The panel received written submissions from hundreds of teachers and from entire departments of mathematics in schools. The panel talked with students taking Mathematics 30, including students who had taken the course before. The panel received helpful input from persons in postsecondary institutions regarding both their perceptions of needed high school mathematics and various experiences working with persons who had taken Mathematics 30; the panel also received information about postsecondary prerequisites. Department of Education officials provided input to the panel. In addition, the panel received letters from concerned parents.

The recommendations below relate to several aspects of the K-12 mathematics program as the panel has been able to consider them in the limited time available. The panel believes that the recommendations point to important things to be considered in the context of helping students obtain the appropriate knowledge, skills and attitudes in mathematics in Alberta schools.

The panel has addressed these recommendations, both short and long term, to a number of different groups. The recommendations are very interrelated and should be looked at in that way. The recommendations are intended as a stimulus and guide to further action to improve the state of mathematics in Alberta.

The panel wishes to thank The Alberta Teachers' Association for providing the resources to conduct this review. The panel hopes that the recommendations will provide helpful direction for future action in improving mathematics education in Alberta.

## **Blue Ribbon Panel on the Review of Mathematics 30**

Art Jorgensen, Chairman

Bob Hart

Helen Stewart

Ken May

Tom Kieren

Jean Phelps

Florence Glanfield

1993 03 25, Edmonton

## Recommendations to the Department of Education

### 1. Review and revise the K-12 mathematics curriculum.

It is the panel's view that the entire mathematics curriculum should be reviewed. Changes are necessary at the secondary level but should not be undertaken without consideration of the elementary school context as well as postsecondary mathematics programs.

- **In the short term, the length of Mathematics 30 should be decreased by one unit.**

The most frequent comment made by secondary mathematics teachers in the questionnaire was that the Mathematics 30 course is too long. Action should be taken as soon as possible to remove one of the seven units from the course. Different interest groups would opt for different approaches in selecting the topic to be deleted. For example, the statistics unit could be redistributed between Mathematics 10 and 20; the permutations and combinations unit could be removed altogether or shifted to Mathematics 20; the sequences and series unit could be moved to Mathematics 31. By reducing the course from seven units to six, Mathematics 30 would be more manageable for teachers and students and time would be provided for a more focused and in-depth examination of the key concepts. In redistributing some components of Mathematics 30, attention should be paid to the resulting impact on the length of other mathematics courses. Changes to the length of the course should be implemented, with appropriate formal involvement of teachers, no later than 1994 09.

- **In the longer term, curriculum should be developed for Mathematics 30 that reflects the population taking the course.**

As outlined in the *Program of Studies*, "the Mathematics 10/20/30 sequence is designed for students with an interest and aptitude in mathematics, who are intending to pursue postsecondary studies at a university or in a mathematics-intensive program at a technical school or college." Although the course may be designed for this audience, many students enrolling in Mathematics 30 do not fit into these categories. More students than ever before are attempting the Mathematics 10/20/30 course sequence. Although about 30 percent of students go on to university or math-intensive areas of study in technical institutes, about 60 percent of students take Mathematics 30. In 1993 01, more than 11,100 students wrote the Mathematics 30 diploma examination; this is almost the same number of students who wrote the English 30 diploma examination. It is the panel's view that Mathematics 30 should be developed to reflect the population taking the course. The panel is emphatic in stating that this does not mean that Mathematics 10/20/30 should be "watered down" and made less rigorous.

- **The content in junior high mathematics should be improved and the minimum instructional time for junior high mathematics should be increased. There**

**should be more algebra; consideration should be given to polynomial algebra as well as trigonometry.**

At the present time, there is too much repetition in junior high mathematics. With less repetition, there would be time for additional mathematics concepts. There is need for more algebra in junior high; the program could be enriched by the addition of polynomial algebra, triangle trigonometry and actual informal geometry of the sections of the cone. Such initiatives would help prepare students better for senior high mathematics courses. These concerns are clearly reflected in the responses to the panel's questionnaire of secondary mathematics teachers.

- **Consider the *National Council of Teachers of Mathematics (NCTM) Curriculum and Evaluation Standards for School Mathematics* and the *NCTM Professional Standards for Teaching Mathematics* as a framework in the development, implementation and evaluation of mathematics curricula.**

In reviewing the mathematics curriculum, the NCTM standards should be considered. These standards help to provide a framework of what students can be expected to do (and how they can be evaluated) in mathematics at all levels of mathematics.

- **The mathematics curriculum review should ensure that there is articulation between elementary and junior high, junior high and senior high and senior high and postsecondary mathematics.**

Consideration should be given to the transition from division to division. The curriculum cannot be revised in isolation. The transition from senior high school to postsecondary mathematics is an important transition that should be carefully examined, as well.

- **The mathematics curriculum should reflect the recommendations of practising classroom teachers.**

In reviewing the mathematics curriculum, it is important that curriculum decision-making structures produce a curriculum that reflects the recommendations of practising teachers. The current Mathematics 30 course, with the exception of the quadratic relations unit, was produced based on the recommendations of practising classroom teachers. Many teachers felt the decision to further revise the quadratic relations unit was arbitrary. While the exploratory treatment of this topic was not thought to be inappropriate, the length of time allowed to do this well did not seem to be carefully considered. Further, both teacher and postsecondary sources suggest that the current approach is algebraically and analytically incomplete. The panel thinks this shows the problem with not fully using teacher expertise in curriculum-decision making.

## **2. Ensure that the diploma examination experience for students is appropriate.**

The Mathematics 30 diploma examination should adhere to the prescribed curriculum and be appropriate for students. The panel has a number of suggestions and observations.

- **The examination should build student confidence with increased level of difficulty for each topic.**
- **Consideration should be given to extending the time for the diploma examination.**
- **Consideration should be given to offering students a choice of written response questions.**

In the panel's view, the above suggestions would benefit students in writing the Mathematics 30 diploma examination. Panel members believe that more careful attention should be given to the order and nature of examination questions to ensure that students build confidence in their ability to do well on the examination. The panel had difficulty justifying the current time limit, questioning the extent to which time should be a controlling factor in completing the examination. By extending the current examination time by, say, one-half hour, students would be more relaxed in completing the examination. With more and more sophisticated examinations, the panel also felt that consideration should be given to offering students a choice of written response questions; this would also make the examination experience more satisfying.

- **The average mark on the Mathematics 30 diploma examination should be consistent with the average mark of other 30-level diploma examinations.**

The panel called into question the differences in average mark from diploma examination subject to diploma examination subject, noting that students tend to do consistently "better" in some subjects and "worse" in others. Although there is tremendous effort on the part of the Department of Education to ensure that each diploma examination is fair, more attention should be paid to what a typical grade twelve student taking 30-level subjects should be capable to do as a typical grade twelve student rather than as a student in Mathematics 30, English 30, Social Studies 30, etc. Are Alberta high school students always more capable in some subjects but not others or do these differences reflect a wide or even disparate range of standards or curricula that are inconsistent across disciplines?

3. **Develop a liaison, in conjunction with The Alberta Teachers' Association, with postsecondary institutions to review mathematics courses required as prerequisites to postsecondary education.**

One of the major concerns of the panel is the use of Mathematics 30 as an inappropriate screening device for postsecondary institutions. As noted in the postsecondary institutions section of this report, there are postsecondary programs that require Mathematics 30 for admission but another course, like Mathematics 20 or 33, would be a more appropriate prerequisite. This is one of the major factors in increasing the population of the Mathematics 30 course: selection of the course is, for some, driven by postsecondary prerequisites rather than ability or career considerations. The Department of Education has a responsibility, in the view of the panel, to work with postsecondary institutions to review prerequisite mathematics



courses to ensure that prerequisites are appropriate and fair; this activity should be conducted in conjunction with The Alberta Teachers' Association.

- 4. Resources should be developed and approved that accurately reflect the mathematics program philosophy and content and should be made available well before the implementation of any mathematics curriculum.**

Currently, there is no authorized text for Mathematics 30 which contains a unit on quadratic relations that is consistent with the program philosophy and content. The panel believes that future implementation of a revised program of studies can only be successful when resources are developed for the entire course, not parts of it, and made available well before the implementation date.

- 5. Steps should be taken to raise the credibility of the Mathematics 13/23/33 course sequence. While not suggesting that examinations are the most appropriate way either to guarantee quality of a course or to raise its status, one way of doing this might be to establish a diploma examination for Mathematics 33.**

By raising the credibility of the Mathematics 13/23/33 course sequence, it may be possible for more postsecondary institutions to recognize Mathematics 33 as an appropriate prerequisite for further studies. A diploma examination in Mathematics 33 might be one way to raise the status of the sequence. There is a diploma examination in both English 30 and 33 and English 30 is not a universal prerequisite in postsecondary programs; this suggests that a Mathematics 33 diploma examination could reduce the number of postsecondary programs that require Mathematics 30.

- 6. Standards for all mathematics courses need to be clearly defined and communicated to teachers and students.**

Although standards for the Mathematics 10/20/30 course sequence have been developed, standards have not been developed for Mathematics 13/23/33, Mathematics 14/24, and Mathematics 31 nor at other levels. Teachers must be formally involved in the development of standards across the entire mathematics curriculum.

- 7. Work with The Alberta Teachers' Association, postsecondary institutions, school boards and business and industry to promote the use of standards in mathematics courses and develop appropriate inservice programs for mathematics teachers.**

Professional development programs should accompany clear standards. An ongoing program of professional development can improve individual teaching practice.

- 8. Add a step to the diploma examination review process to validate the test by having a standing committee of practising Mathematics 30 teachers write the test and comment on it prior to its final consideration by the Mathematics 30 Examination Review Committee.**

Much work goes into the development of a diploma examination. Before the examination is approved by the Department of Education, the examination is

reviewed by an examination review committee (composed of six members, including two practising teachers). The panel believes the examination development and approval process would be improved if more teachers validated the examination. By having a standing committee of teachers actually write the proposed examination, a number of factors (including perceptions of difficulty and overall examination length) could be addressed.

**9. Promote and provide professional growth opportunities for all mathematics teachers in the province by instituting**

- a rotating advisory committee appointment policy;
- an examination marker selection process that is equitable and without prejudice.

Professional growth opportunities (eg teachers selected to give advice on curriculum changes or teachers identified as examination markers) should be spread around the province and not restricted to a small number of schools or school jurisdictions.

**10. In conjunction with other education partners, design an information campaign to provide students, parents and guidance counsellors with the information to assist students in selecting the appropriate mathematics courses in high school.**

Selecting an appropriate high school mathematics program is an important decision. The Department of Education, in conjunction with other education partners and with the assistance of guidance counsellors, should take on the responsibility of making students and parents better informed about the nature of the various mathematics programs.

**11. Convene a meeting of education partners to discuss the findings and recommendations of the Blue Ribbon Panel on the Review of Mathematics 30.**

By discussing the recommendations with the various education partners, positive changes can come about.

## **Recommendations to School Boards**

**12. Consider with care the assignment of teachers to various mathematics courses so as to provide teachers both interested in and knowledgeable about the courses they are to teach.**

- In the longer term, school boards should aim to hire senior high school mathematics teachers who possess the equivalent of five or more full university courses in mathematics, junior high school mathematics teachers who possess at least two full university courses in mathematics and at least one math specialist in each elementary school.

Although the panel does not endorse specialist teaching certificates for teachers nor suggest that non-specialists cannot prepare themselves to do an effective job of teaching mathematics, school boards should ensure that an appropriate number of mathematics specialists are hired and deployed.

- 13. Allocate funds for the professional development of mathematics teachers. In addition, ensure that time and resources are provided to assist teachers possessing limited mathematics backgrounds to upgrade their mathematics teaching skills.**

The ongoing professional development of teachers is important and should receive support from school boards. This is even more important for teachers who are teaching outside their specialty.

- 14. Work with The Alberta Teachers' Association, postsecondary institutions, the Department of Education and business and industry to promote the use of standards in mathematics courses and develop appropriate inservice programs for mathematics teachers.**

There is a need to promote standards and there is a need to develop inservice programs that meet teacher-identified PD needs.

- 15. Make available provincial curriculum and evaluation materials for teachers and to teachers.**

- 16. Provide the *NCTM Curriculum and Evaluation Standards* and the *NCTM Professional Teaching Standards* to mathematics teachers.**

The mathematics program of studies, teacher resource manuals, curriculum guides and evaluation specifications should be routinely provided to mathematics teachers by school boards. The NCTM materials should also be provided to encourage professional dialogue about mathematics curriculum, teaching and evaluation.

- 17. In conjunction with The Alberta Teachers' Association and the universities, provide a support system for beginning and experienced teachers of mathematics.**

Such a support system would provide beginning teachers with an opportunity to link up with veteran mathematics teachers as well as with university personnel and resources.

- 18. Make technology increasingly available for students (eg graphing calculators, computers, manipulatives).**

A number of teachers reported in their written responses to the questionnaire that school boards were not providing a suitable level of technological support for the mathematics curriculum. In Mathematics 30, for example, students should have access to a graphing calculator or computer to fulfill the objectives of the course. Some school jurisdictions have not provided the technological support needed to properly implement the curriculum and provide students with appropriate technological experiences.

- 19. Consider alternative ways of delivering Mathematics 30.**

One alternative to consider is to offer some full year Mathematics 30 courses. Students would then have the option to select a semestered Mathematics 30 course or a full year course (which would be offered at a different rate). A course could be developed, at the local level, to provide preparation for Mathematics 30.

## Recommendations to Teachers as Individuals

**20. Teachers should ensure their teaching and evaluation practices reflect an emphasis on reasoning with mathematical ideas.**

- Use a variety of instructional strategies in teaching mathematics to help students develop an understanding of mathematics concepts;
- Use a variety of assessment methods to determine students' understanding of mathematics;
- Use a variety of instructional materials and resources, including technology, in preparing and delivering lessons;
- Use technology as an instructional tool to assist students in developing an understanding of mathematics concepts.

Teachers need to consider the philosophical underpinnings of the mathematics program and use the resources available to prepare lessons that reflect these considerations.

**21. Teachers are responsible for keeping their skills and knowledge current and should take advantage of professional development opportunities including participation in mathematics professional organizations (eg Mathematics Council of The Alberta Teachers' Association, National Council of Teachers of Mathematics).**

This is a professional obligation of teaching. As mathematics teaching evolves more and more to include problem solving approaches, process skills and the utilization of technology, teachers need to prepare themselves to use different strategies.

**22. Mathematics teachers must be familiar with and use mathematics curriculum and evaluation documents.**

This is a professional responsibility. There is no excuse for being unfamiliar with the prescribed curriculum or evaluation practices.

**23. Teachers should consider *NCTM Curriculum and Evaluation Standards* and the *NCTM Professional Teaching Standards*.**

The NCTM materials are a highly recommended professional resource.

## Recommendations to The Alberta Teachers' Association

**24. Develop a liaison, in conjunction with the Department of Education, with postsecondary institutions, to review mathematics courses required as prerequisites for postsecondary education.**

As noted earlier, it is the panel's view that far too many postsecondary programs require Mathematics 30 for admission. In some cases, the link between the kind of math required to complete the postsecondary program and the kind of math required to gain entry to the program are inappropriate. The Association should assist the Department of Education in raising mathematics prerequisite issues with

postsecondary institutions. The appropriateness of some postsecondary prerequisites clearly needs to be addressed.

- 25. Continue to be a strong voice for teachers and students with respect to the mathematics program. Lobby the government to ensure that curriculum is properly designed and teachers properly equipped, informed and inserviced to deliver the program.**

The Association should remain vigilant to ensure that appropriate revisions to the mathematics program do occur. This includes the meaningful involvement of teachers in curriculum decision-making, appropriate implementation strategies and timelines, and the provision of adequate resources to deliver the program.

- 26. Utilize the ACCESS Network to provide a homework hotline for students enrolled in Mathematics 30. Videotapes of lessons could be made available to teachers and students.**

The Association's Homework Hotline program has been very successful. The panel believes that the Association should consider expanding the program in the weeks prior to diploma examinations. At that time, teachers could provide assistance to students in preparing for the examinations. Key concepts could be reviewed; concept review videotapes could be distributed and used by students in studying for the diploma examination.

- 27. Work with the Department of Education, postsecondary institutions, school boards and business and industry to promote the use of standards in mathematics courses and develop appropriate inservice programs for mathematics teachers.**

The Association, through the Mathematics Council, should assist in the promotion of mathematics standards and the development and provision of professional development activities for mathematics teachers.

- 28. Encourage the Department of Education to consider the *NCTM Curriculum and Evaluation Standards for School Mathematics* and the *NCTM Professional Standards for Teaching Mathematics* as a framework in the development, implementation and evaluation of mathematics.**

- 29. In conjunction with school boards and the universities, provide a support system for beginning and experienced teachers of mathematics.**

There are many possibilities in the provision of support for teachers. As a first step, the Association should consider various models of mentorship that might be appropriate in the development of a support system for beginning and experienced mathematics teachers.

- 30. The Association should bring pressure to bear on universities to provide the necessary courses for teacher upgrading. The Association must encourage teachers to enrol in courses to upgrade their teaching skills. The Association must encourage school boards to release teachers for the purpose of upgrading their teaching skills.**

A frequent comment of teachers was that they would take upgrading courses if such courses were made available by universities. Rural teachers noted the need to provide access to upgrading courses either by offering courses in their communities or through the provision of adequate resources to attend upgrading courses in urban centres.

**31. Focus the membership and the community on the changes in learning and teaching of mathematics.**

Some ways this recommendation could be accomplished include the use of ATA publications (including the Mathematics Council journal and newsletter), specialist councils and through community workshops.

**32. Distribute the panel's findings and recommendations to all schools and school jurisdictions in the province.**

This recommendation could be accomplished through a regularly scheduled school mailing.

**33. Reconvene the Blue Ribbon Panel on the Review of Mathematics 30 in 1994 02 for a single meeting with appropriate representatives from each of the parties to which recommendations have been directed to determine what action has been taken and is planned.**

A single meeting would provide an opportunity to assess the response of various education partners to the panel's recommendations.

## **Recommendations to Postsecondary Institutions**

### **Admission Requirements and Program Prerequisites**

**34. Review admission requirements to ensure that Mathematics 30 is not used solely as a screening device.**

**35. Review mathematics prerequisites for all programs and ask "which high school mathematics courses best prepare students for the program?"**

These recommendations result from what the panel sees as a serious problem with prerequisites for admission to various postsecondary programs. While it is clear that Mathematics 30 is a necessary prerequisite for a variety of programs, some institutions appear to use Mathematics 30 as a blunt screening device for students. This is inappropriate. Of course the panel agrees that all institutions want capable students, but is Mathematics 30 the necessary or best test for this quality? Should prospective nurses be required to present Mathematics 30 for admission to a nursing program or would Mathematics 20 or 33 be acceptable? Should a student enrolling in a college program in business administration require, as a prerequisite, Mathematics 30? In some college and institute programs, the panel felt that the mathematics completed as a part of the postsecondary program was unrelated and in some instances less rigorous than the mathematics required to be admitted at all.

(The mathematics content of one technical program focused almost entirely on fractions; yet, Mathematics 30 was the required prerequisite.) It is also the panel's view that the nature of the various mathematics courses and sequences, including the Mathematics 13/23/33 course sequence, may be misunderstood by some postsecondary institutions.

## **Mathematics Departments**

**36. Postsecondary mathematics departments should be encouraged in their efforts to increase the number of students who succeed in undergraduate mathematics by**

- thinking about how to teach as well as what to teach;**
- elevating the importance of undergraduate teaching;**
- engaging faculty in issues of teaching and learning mathematics;**
- teaching in a way that engages students;**
- teaching future teachers in the ways they will be expected to teach;**
- exploiting modern technology;**
- considering the transition between secondary and postsecondary mathematics programs and developing courses accordingly.**

The panel is aware of and applauds current efforts to consider some of the above recommendations and wishes to encourage the activity. As well as being consistent with what are seen to be good practices pursued in school mathematics, such considerations will aid in what appears to be a difficult transition from Mathematics 30 to university mathematics, provide for more effective users of mathematical ideas at the university level and provide for necessary quality of instruction in mathematics for current and future school mathematics teachers.

**37. Encourage postsecondary instructors to spend time in schools working with students and teachers.**

**38. Collaborate and cooperate with schools, teachers and other institutions to provide professional development activities.**

The goal of the current school mathematics curriculum is to help more students to understand and use mathematics. Occasional contact with persons associated with mathematical pursuits at the postsecondary level would aid in this goal. Further, postsecondary personnel would gain a better understanding of the current school mathematics standards and students.

**39. Reconsider policies on the use of calculators and technology.**

The use of technology in high school classrooms is encouraged; first year mathematics students at university should not be denied access to such technology.

## **Teacher Preparation Programs**

**40. The curriculum as it stands requires that teachers view themselves as persons who reason and problem solve in mathematics; therefore, preservice and inservice courses should offer experiences in the preparation of mathematics teachers that allow them to**

- become independent learners, capable of doing and learning mathematics on their own;**
- develop an understanding of the interrelationships within mathematics and an appreciation of its unity;**
- explore the connections that exist between mathematics and other disciplines;**
- develop skills in both written and oral communication of mathematical concepts and technical information**
- work with mathematical models to analyze real-world situations;**
- use calculators and computers as tools to represent mathematical concepts (including function graphers, curve fitters, and symbolic manipulators).**

These are important considerations and directions in shaping the preparation of mathematics teachers.

**41. Use various new standards-related NCTM materials in developing and preparing preservice and inservice programs.**

**42. Provide flexible and alternative methods for continuing education to support ongoing learning of mathematics and mathematics education.**

**43. Provide preservice and inservice opportunities in the use of technology, in methods of assessment and in writing and marking of open-ended questions.**

In written responses to the questionnaire, teachers indicated a desire to enrol in upgrading courses. Such courses should be delivered across the province to provide maximum opportunity for teachers to attend. The integration of technology as well as student evaluation issues were high on the list of needs reported by teachers.

**44. Work with The Alberta Teachers' Association, Department of Education, school boards and business and industry to promote the use of standards in mathematics courses and develop appropriate inservice programs for mathematics teachers.**



## **Recommendations to Students and Parents (including Guardians)**

- 45. Students and parents must be committed to the education of the student.**
- 46. Before students enrol in any high school mathematics course sequence, students and parents should determine whether or not the course sequence is appropriate for student postsecondary plans or careers.**
- 47. Students and parents must realize that Mathematics 30 requires a significant amount of work and dedication.**
- 48. Parents are responsible for providing students with the tools necessary to do mathematics.**
- 49. Students are responsible to commit a reasonable amount of time to the subject out of school hours.**

Mathematics teachers certainly need to fulfill their responsibilities. For students to be successful, however, parents and students must also accept their responsibilities.

## **Recommendations to Business and Industry**

- 50. As employers, recognize that students are responsible for committing a reasonable amount of time to mathematics out of school hours; in particular, Mathematics 30 requires a significant amount of dedication.**

For some employers, students are an important part of the workforce. Recognition of student's academic work is important and flexible work schedules and even paid time for studying would be helpful contributions; after all, the attitude should be that student's academic work comes first.

- 51. Provide scholarships or awards to encourage achievement and careers in mathematics.**
- 52. Provide secondments or internships in mathematics related business and industry to stimulate teachers' professional growth.**

Such initiatives would improve the linkages between teaching and business and industry.

- 53. Work with The Alberta Teachers' Association, postsecondary institutions, school boards and the Department of Education to promote the use of standards in mathematics courses and develop appropriate inservice programs for mathematics teachers.**

Business and industry has a role in these activities.

**For further information about the work of the Blue Ribbon Panel on the Review of Mathematics 30, please feel free to contact panel members directly:**

Dr Art Jorgensen, Chairman  
4411 Fifth Avenue, Edson T7E 1B7; (res) 723-5370

Bob Hart, Crescent Heights High School  
1019 First Street NW, Calgary T2M 2S2; (sch) 276-5521

Helen Stewart, Bishop Grandin High School  
111 Haddon Road SW, Calgary T2V 2Y2; (sch) 252-7541

Ken May, Winston Churchill High School  
18 Street and 15 Avenue N, Lethbridge T1H 1W4; (sch) 328-4723

Jean Phelps, Acting Associate Dean, Community Education Division  
Lethbridge Community College  
3000 College Drive S, Lethbridge T1K 1L6; (ofc) 320-3200

Dr Tom Kieren, Professor  
Department of Secondary Education  
Faculty of Education, University of Alberta  
341 Education South, Edmonton T6G 2G5; (ofc) 492-3673

Florence Glanfield  
Examination Manager, Mathematics 30  
Student Evaluation Branch, Department of Education  
11160 Jasper Avenue, Edmonton T5K 0L2; (ofc) 427-2948

**For additional copies of the report, please contact:**

The Alberta Teachers' Association  
11010 142 Street  
Edmonton, Alberta  
T5N 2R1

**Telephone:**  
Edmonton area 453-2411;  
Calgary area 263-4774;  
elsewhere in Alberta 1-800-232-7208