This document was written primarily for:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>✓</td>
</tr>
<tr>
<td>Teachers</td>
<td>✓  of <em>Mathematics 30–1</em></td>
</tr>
<tr>
<td>Administrators</td>
<td>✓</td>
</tr>
<tr>
<td>Parents</td>
<td></td>
</tr>
<tr>
<td>General Audience</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>

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Please note that if you cannot access one of the direct website links referred to in this document, you can find diploma examination-related materials on the Alberta Education website.
Introduction

The purpose of this bulletin is to provide students and teachers of Mathematics 30–1 with information about the diploma examinations scheduled for the 2018–2019 school year. This bulletin should be used in conjunction with the current Mathematics 30–1 Program of Studies, the Mathematics 30–1 Assessment Standards and Exemplars document, and the Mathematics 30–1 Written-Response Information document to ensure that the curriculum and standards are addressed.

This bulletin includes descriptions of the Mathematics 30–1 diploma examinations that will be administered in November 2018 and in January, April, June, and August 2019; descriptions of the acceptable standard and the standard of excellence; and subject-specific information.

Teachers are encouraged to share the contents of this bulletin with students.

For further information about program implementation, refer to the Alberta Education website.

Course Objectives

The Mathematics 30–1 course contains topics and outcomes, as specified in the program of studies, that will provide students with the knowledge base, mathematical understandings, and critical-thinking skills identified for entry into post-secondary programs that require the study of calculus. In Mathematics 30–1, algebraic, numerical, and graphical approaches are used to solve problems. Technology is used to enable students to explore and create patterns, examine relationships, test conjectures, and solve problems.

Students are expected to communicate solutions clearly and effectively when solving both routine and non-routine problems. Students are also expected to develop both conceptual and procedural understandings of mathematics and apply them to real-life problems. It is important for students to realize that it is acceptable to solve problems in different ways, using a variety of strategies.
Performance Expectations

Curriculum Standards

Provincial curriculum standards help to communicate how well students need to perform in order to be judged as having achieved the learning outcomes specified in the Mathematics 30–1 Program of Studies. The specific statements of standards are written primarily to inform Mathematics 30–1 teachers of the extent to which students must know the Mathematics 30–1 curriculum and demonstrate the required skills in order to pass the examination.

Performance Standards

Acceptable Standard

Students who attain the acceptable standard but not the standard of excellence will receive a final course mark between 50 percent and 79 percent, inclusive. Typically, these students have gained new skills and a basic knowledge of the concepts and procedures relative to the general and specific outcomes defined for Mathematics 30–1 in the program of studies. They demonstrate mathematical skills, as well as conceptual understanding, and they can apply their knowledge to familiar problem contexts.

Standard of Excellence

Students who attain the standard of excellence will receive a final course mark of 80 percent or higher. Typically, these students have gained a breadth and depth of understanding regarding the concepts and procedures, as well as the ability to apply this knowledge and conceptual understanding to a broad range of familiar and unfamiliar problem contexts.

Assessment Standards and Exemplars

The Assessment Standards and Exemplars document that describes acceptable standard and standard of excellence for the Mathematics 30–1 Program of Studies can be found on the Alberta Education website. This document also contains notes and exemplars to assist teachers and students with the interpretation of curricular outcomes in the program of studies.

Changes to the Assessment Standards and Exemplars Document

Alberta Education staff made minor revisions to the standards document in the spring of 2018. Teachers should view the revised Assessment Standards and Exemplars document as posted.
**Explanation of Cognitive Levels**

**Procedural**

The assessment of students’ knowledge of mathematical procedures should involve recognition, execution, and verification of appropriate procedures and the steps contained within them. The use of technology can allow for conceptual understanding prior to specific skill development or vice versa. Students must appreciate that procedures are created or generated to meet specific needs in an efficient manner and thus can be modified or extended to fit new situations. Assessment of students’ procedural knowledge will not be limited to an evaluation of their proficiency in performing procedures, but will be extended to reflect the skills presented above.

**Conceptual**

An understanding of mathematical concepts goes beyond a mere recall of definitions and recognition of common examples. Assessment of students’ knowledge and understanding of mathematical concepts should provide evidence that they can compare, contrast, label, verbalize, and define concepts; identify and generate examples and counter-examples, as well as properties of a given concept; recognize the various meanings and interpretations of concepts; and defend procedures and personal strategies. Students who have developed a conceptual understanding of mathematics can also use models, symbols, and diagrams to represent concepts. Appropriate assessment provides evidence of the extent to which students have integrated their knowledge of various concepts.

**Problem Solving**

Appropriate assessment of problem-solving skills is achieved by allowing students to adapt and extend the mathematics they know and by encouraging the use of strategies to solve unique and unfamiliar problems. Assessment of problem solving involves measuring the extent to which students use these strategies and knowledge and their ability to verify and interpret results. Students’ ability to solve problems develops over time as a result of their experiences with relevant situations that present opportunities to solve various types of problems. Evidence of problem-solving skills is often linked to clarity of communication. Students demonstrating strong problem-solving skills should be able to clearly explain the process they have chosen, using appropriate language and correct mathematical notation and conventions.


**Mathematical Processes**

The seven mathematical processes are critical aspects of learning, doing, and understanding mathematics. Students must encounter these processes regularly in a mathematics program in order to achieve the goals of mathematics education.

The *Mathematics 30–1 Program of Studies* incorporates the following interrelated mathematical processes. They are to permeate the teaching and learning of mathematics.

Students are expected to:

- **Communication [C]**  
  - use *communication* in order to learn and express their understanding

- **Connections [CN]**  
  - make *connections* among mathematical ideas, other concepts in mathematics, everyday experiences, and other disciplines

- **Mental Mathematics and Estimation [ME]**  
  - demonstrate fluency with *mental mathematics and estimation*

- **Problem Solving [PS]**  
  - develop and apply new mathematical knowledge through *problem solving*

- **Reasoning [R]**  
  - develop mathematical *reasoning*

- **Technology [T]**  
  - select and use *technology* as a tool for learning and solving problems

- **Visualization [V]**  
  - develop *visualization* skills to assist in processing information, making connections, and solving problems

For further details about each of these processes, refer to the *Mathematics Grades 10–12 Program of Studies.*
Commentary on the Mathematics 30–1 Diploma Examinations

Introduction

Mathematics 30–1 diploma examinations were administered in November 2017, January 2018, April 2018, June 2018, and August 2018. January and June 2018 were large-scale administrations of the examination for the Mathematics 30–1 Program of Studies, 2008. This section is intended to provide teachers with information concerning the sixth year of these diploma examinations. In general, feedback from teachers indicates a high degree of satisfaction with the Mathematics 30-1 examinations in terms of fidelity to, and support of, the program of studies.

Overview of Diploma Examination Development Process and Standards Confirmation

Throughout the diploma examination development process, Alberta Education makes every effort to ensure examinations reflect the standards of the programs of study. Before implementing the current Mathematics 30–1 Program of Studies, seven province-wide consultations involving over 120 teachers were held to discuss the blueprint for the Mathematics 30–1 diploma examinations. Teachers were also involved in developing items (exam questions) and performance-standard descriptors.

The November 2017 and January, April, June, and August 2018 Mathematics 30–1 diploma examinations were built to the published blueprint specifications, based on the program of studies outcomes. To help ensure this, teachers, post-secondary representatives, and Alberta Education staff were extensively involved in the validation process. The January 2018 and June 2018 exam marks were equated to the baseline exam that was selected in 2017. Fairness to students and student success will continue to be the focus of any changes to provincial assessments.
Students’ Strengths and Areas for Improvement

Relations and Functions

- Students are able to interpret transformation equations involving stretches, reflections, and translations to determine the coordinates of a transformed point or the position of a transformed graph.

- Students are able to describe the impact of a change in value of a parameter in the equation of a function on the characteristics of the graph of the function.

- Students continue to have difficulty using multiple laws of logarithms to simplify an expression into a single logarithm.

- Stronger students are able to use exponential equations to determine the value of a related logarithm expression, but weaker students continue to find this difficult.

- Students have difficulty solving contextual problems involving exponential and logarithmic functions.

- Students continue to perform well on questions that involve identifying the characteristics of the graph of rational functions.

Trigonometry

- Students continue to perform well on problems involving arc length, radius, and an angle measure.

- Students are able to relate the characteristics of a graph of a sinusoidal function to the parameters in the corresponding equation of the function.

- Students have shown improvement in creating the general solution to a trigonometric equation given a list of solutions, but many continue to have difficulty with identifying the number of solutions to a trigonometric equation in a restricted domain given an equation with parameters.

- Weaker students have difficulties identifying the non-permissible values for the angle in a trigonometric identity.

Permutations, Combinations, and Binomial Theorem

- Stronger students are able to solve permutations problems that involve one or two constraints, but weaker students continue to find this difficult.

- Students are able to solve combination problems involving multiple constraints.

- Students are able to solve problems involving patterns in the expansion of a binomial expression, but weaker students have difficulty when the binomial contains non-linear terms.
2018–2019 Diploma Examination Specifications and Design

Each Mathematics 30–1 diploma examination is designed to reflect the content outlined in the Mathematics 30–1 Program of Studies. The percentage weightings shown below will not necessarily match the percentage of class time devoted to each topic. The diploma examination will be developed to be completed in 2.5 hours.

Specifications

The format and content of the Mathematics 30–1 diploma examinations in the 2018–2019 school year are as follows:

<table>
<thead>
<tr>
<th>Question Format</th>
<th>Number of Questions</th>
<th>Emphasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine Scored</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Multiple Choice</td>
<td>24</td>
<td>75%</td>
</tr>
<tr>
<td>• Numerical Response</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Written Response</td>
<td>3</td>
<td>25%</td>
</tr>
</tbody>
</table>

Note: The three written-response questions are equally weighted.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Emphasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relations and Functions</td>
<td>53%–58%</td>
</tr>
<tr>
<td>Trigonometry</td>
<td>27%–33%</td>
</tr>
<tr>
<td>Permutations, Combinations, and Binomial Theorem</td>
<td>14%–18%</td>
</tr>
</tbody>
</table>

Procedural, conceptual, and problem-solving cognitive levels are addressed throughout the examination. The approximate emphasis of each cognitive level is given below.

<table>
<thead>
<tr>
<th>Cognitive Level</th>
<th>Emphasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procedural</td>
<td>30%</td>
</tr>
<tr>
<td>Conceptual</td>
<td>34%</td>
</tr>
<tr>
<td>Problem Solving</td>
<td>36%</td>
</tr>
</tbody>
</table>
Machine-scored Questions

Information required to answer multiple-choice and/or numerical-response questions is often located in a box preceding the question. The questions that require the use of the information given in the box will be clearly stated above the box: e.g., “Use the following information to answer questions 5 and 6.”

For multiple-choice questions, students are to choose the correct or best possible answer from four alternatives.

The numerical-response questions are interspersed throughout the multiple-choice questions, according to content topic.

For some numerical-response questions, students are required to calculate a numerical answer and then record their answer in a separate area of the answer sheet. When the answer to be recorded cannot be a decimal value, students are asked to determine a whole-number value (e.g., the number of people is _____; the number of different routes is _____). If the answer can be a decimal value, then students are asked to record their answer to the nearest tenth or nearest hundredth, as specified in the question. Students should retain all decimals throughout the question, and rounding should occur only in the final answer.

Other numerical-response questions require students to record their understanding of a concept. Examples of these types of questions are shown on the next page.
### Correct-order Question and Solution

**Four Expressions**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$5 \times 4 \times 3$</td>
</tr>
<tr>
<td>2</td>
<td>$5C_2$</td>
</tr>
<tr>
<td>3</td>
<td>$5!$</td>
</tr>
<tr>
<td>4</td>
<td>$5P_2$</td>
</tr>
</tbody>
</table>

When the expressions above are arranged in ascending order, their order is ___, ___, ___, and ____.

(Record the answer in the numerical-response section on the answer sheet.)

Value to be recorded: 2413

Record 2413 on the answer sheet

### Calculation Question and Solution

If $f(x) = 2x^2 + 3x + 5$ and $g(x) = x^2 + 2x - 3$, then $f(x) + g(x)$ can be expressed in the form $ax^2 + bx + c$.

In the expression above, the value of

- $a$ is ________ (Record in the first column)
- $b$ is ________ (Record in the second column)
- $c$ is ________ (Record in the third column)

(Record the answer in the numerical-response section on the answer sheet.)

Value to be recorded: 352

Record 352 on the answer sheet

### Any-order Question and Solution

The zeros of the polynomial function $P(x) = x^3 - 8x^2 + 19x - 12$ are ___, ___, and ____.

(Record all three digits of your answer in any order in the numerical-response section on the answer sheet.)

Digits to be recorded: 314

Record 314 on the answer sheet
Written-response Questions

The written-response component is designed to assess the degree to which students can draw on their mathematical experiences to solve problems, explain mathematical concepts, and demonstrate their algebraic skills. A written-response question may cover more than one specific outcome and will require students to make connections between concepts. Each written-response question will consist of two parts and will address multiple cognitive levels. Students should be encouraged to try to solve the problems in both parts as an attempt at a solution may be worth partial marks.

Students may be asked to solve, explain, or prove in a written-response question. Students are required to know the definitions and expectations of directing words such as algebraically, compare, determine, evaluate, justify, and sketch. A list of these directing words and their definitions can be found on page 18.

The following instructions will be included in the instructions pages of all mathematics diploma exam booklets.

- Write your responses in the test booklet as neatly as possible.
- For full marks, your responses must address all aspects of the question.
- All responses, including descriptions and/or explanations of concepts, must include pertinent ideas, calculations, formulas, and correct units.
- Your responses must be presented in a well-organized manner. For example, you may organize your responses in paragraphs or point form.
**General Scoring Guides**

The General Scoring Guides, developed in consultation with teachers and Alberta Education staff, describe the criteria and performance level at each score-point value. These General Scoring Guides will be used to develop specific scoring descriptions for each written-response question.

In scoring the written-response questions, markers will evaluate how well students

- demonstrate their understanding of the problem or the mathematical concept
- correctly apply mathematical knowledge and skills
- use problem-solving strategies and explain their solutions and procedures
- communicate their solutions and mathematical ideas

### General Scoring Guide for a 2-mark Part

<table>
<thead>
<tr>
<th>Score</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>No response is provided.</td>
</tr>
<tr>
<td>0</td>
<td>In the response, the student does not address the question or provides a solution that is invalid.</td>
</tr>
<tr>
<td>0.5</td>
<td>In the response, the student demonstrates basic mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.</td>
</tr>
<tr>
<td>1</td>
<td>In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.</td>
</tr>
<tr>
<td>1.5</td>
<td>In the response, the student demonstrates good mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.</td>
</tr>
<tr>
<td>2</td>
<td>In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.</td>
</tr>
<tr>
<td>2.5</td>
<td>In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.</td>
</tr>
<tr>
<td>3</td>
<td>In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.</td>
</tr>
</tbody>
</table>

### General Scoring Guide for a 3-mark Part

<table>
<thead>
<tr>
<th>Score</th>
<th>General Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>No response is provided.</td>
</tr>
<tr>
<td>0</td>
<td>In the response, the student does not address the question or provides a solution that is invalid.</td>
</tr>
<tr>
<td>0.5</td>
<td>In the response, the student demonstrates minimal mathematical understanding of the problem by applying an appropriate strategy or some relevant mathematical knowledge to complete initial stages of a solution.</td>
</tr>
<tr>
<td>1</td>
<td>In the response, the student demonstrates good mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.</td>
</tr>
<tr>
<td>1.5</td>
<td>In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.</td>
</tr>
<tr>
<td>2</td>
<td>In the response, the student demonstrates good mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a partial solution.</td>
</tr>
<tr>
<td>2.5</td>
<td>In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.</td>
</tr>
<tr>
<td>3</td>
<td>In the response, the student demonstrates complete mathematical understanding of the problem by applying an appropriate strategy or relevant mathematical knowledge to find a complete and correct solution.</td>
</tr>
</tbody>
</table>

Specific Scoring Guides for each written-response question will provide detailed descriptions to clarify expectations of student performance at each benchmark score of 0, 1, 2, and 3. A student response that does not meet the performance level of a benchmark score may receive an augmented score of 0.5, 1.5, or 2.5. Descriptions of these augmented scores will be determined with teachers at each marking session and are not an exhaustive list. Each part will be scored separately and the scores will be combined for a total of 5 marks.
**Time Limits on Diploma Examinations**

All students may now use extra time to write diploma exams. This means that all students now have up to 6 hours to complete the Mathematics 30–1 Diploma Examination, if they need it. The examination is still designed so that the majority of students can comfortably complete it within 3 hours. The examination instructions state both the original time and the total time now available.

Extra time is available for diploma examinations in all subjects, but the total time allowed is not the same in all subjects. For more information about accommodations and provisions for students, please refer to the *General Information Bulletin*.

**Maintaining Consistent Standards over Time on Diploma Examinations**

A goal of Alberta Education is to make examinations directly comparable from session to session, thereby enhancing fairness to students across administrations.

To achieve this goal, a number of questions, called anchor items, remain the same from one examination to another. Anchor items are used to find out whether the student population writing in one administration differs in achievement from the student population writing in another administration. Anchor items are also used to find out whether the unique items (questions that are different on each examination) differ in difficulty from the unique items on the baseline examination (the first examination to use anchor items). A statistical process, called equating or linking, adjusts for the differences in examination-form difficulty. Examination marks may be adjusted slightly upward or downward, depending upon the difficulty of the examination written relative to the baseline examination. The resulting equated or linked examination scores have the same meaning regardless of when and to whom the examination was administered. Equated or linked diploma examination marks will be reported to students. More information about equating is available [here](#).

Because of the security required to enable fair and appropriate assessment of student achievement over time, Mathematics 30–1 diploma examinations will be fully secured and will not be released at the time of writing.
Diploma Examinations: Multiple Forms

As part of Alberta Education’s commitment to fairness to students and flexibility in the writing of diploma examinations, there are two distinct forms (versions) of diploma examinations in some subjects during major administrations (January and June). The two forms are equated to baseline examinations to ensure that the same standard applies to both forms. Both forms adhere to the established blueprint specifications and are thoroughly reviewed by a technical review committee.

To facilitate the analysis of school-level results, each school receives only one examination form per subject. In subjects offering a translated French-language examination, both forms are administered in English and in French.

For more information, contact

Deanna Shostak
Director, Diploma Programs
780-422-5160 or Deanna.Shostak@gov.ab.ca

or

Pascal Couture
Director, Exam Administration and Production
780-492-1462 or Pascal.Couture@gov.ab.ca

Using Calculators

The Mathematics 30–1 Diploma Examination requires the use of an approved graphing calculator. The calculator directives, expectations, criteria, and keystrokes required for clearing approved calculators can be found in the General Information Bulletin under the Using Calculators section.

Examination Security

All Mathematics 30–1 diploma examinations will be held secure until released to the public by the Minister. No secure diploma examination is to be previewed, copied, or discussed. For the January and June examinations, teachers will be allowed access to a Teacher Perusal Copy for review purposes 1 hour after the examination has started.

For more information about teacher perusal copies and examination security, please refer to the General Information Bulletin on the Alberta Education website.
Teacher Involvement in the Diploma Examination Process

High-quality diploma examinations are the product of close collaboration between classroom teachers and Alberta Education. Classroom teachers from across Alberta are involved in many aspects of diploma examination development, including the development of raw items; the building, reviewing, administering, and marking of field tests; the reviewing of diploma examination drafts; and the marking of diploma examinations.

The development of test items from their initial construction to their appearance on an examination takes at least one year. The writers of all items on diploma examinations are Mathematics 30–1 teachers from across Alberta. Items are field tested to ensure their reliability and validity. Diploma examinations are reviewed by editors; a technical advisory working group composed of mathematics experts from post-secondary institutions, teachers, and curriculum staff; translators; and a French validation working group.

Alberta Education values the involvement of teachers and annually asks school jurisdictions for the names of teachers who are interested in being involved in any of the diploma examination development processes. Teachers who are interested in developing raw items, building field tests, or reviewing examinations are encouraged to talk to their principal about how to be approved to participate in these working groups. Although the approval of these names occurs in early fall, teachers are welcome to have their names submitted at any time.

Other opportunities to be involved, such as field testing and marking, have specific closing dates. General dates to be aware of include:

- **October 2018**: Marker nomination deadline for January 2019 Diploma Examinations
- **November 2018**: Registration deadline for year-end paper field tests to be administered in December 2018 or January 2019
- **March 2019**: Marker nomination deadline for June 2019 Diploma Examinations
- **April 2019**: Registration deadline for year-end paper field tests to be administered in May or June 2019

For more information regarding marker nominations and requests for field tests, please refer to the General Information Bulletin.
Field Testing

Field tests for Mathematics 30–1 in the 2018–2019 school year will be offered in digital and paper formats. The digital field tests will contain machine-scored items only. The paper field tests will contain both machine-scored and written-response items.

In both semesters, Mathematics 30-1 is offering year-end field tests that are 50 and 65 minutes in length. Two of these field tests, one digital format and one paper format, will be translated into French. In addition, a 32-question year-end field test that is 140 minutes in length will be offered each semester, in digital format only, and a three-question written-response year-end field test that is 40 minutes in length will be offered in paper format only.

For paper-format field tests, teachers will have the opportunity to peruse a validation copy while a field test supervisor is administering the exam. The supervisor will mark the multiple-choice and numerical-response items before leaving the examination room. Teachers may view the machine-scored portion and have the option of marking student responses to the written-response questions while the supervisor is present. A draft scoring guide will be provided for the written-response items. Teachers may use this scoring guide, or they may apply their own scoring criteria.

For digital-format field tests, teachers have a 24-hour window to peruse the tests and are provided with data about how their students performed. These data include the proportion of students who chose each alternative on multiple-choice items and the proportion who left a numerical-response item blank. Test items are blueprinted to program of studies outcomes. This allows teachers to use field test results to learn more about their students’ strengths and weaknesses.

Once logged into the digital field test, teachers have the same length of time to peruse the test as their students did to write it. Teachers might choose to log into the field test, submit the confidentiality form, and then log out of the test so that they can finish perusing the test after receiving their students’ data.

It is important to note that the security of field test items remains vital to the administration of diploma examinations. Participating teachers must commit to maintaining the security of field-test items. Only teachers whose students are writing a particular field test may examine its contents. Discussion of field test items after their administration must be limited to a review of the concepts being assessed rather than to details of specific items.

Students should use a paper formula sheet for all mathematics field tests. The formula sheet will also appear in the online delivery system. Students may also have scrap paper, which may be accessed and downloaded from the Teacher Resources section on the home page of the Field Test Request System. All paper formula sheets or scrap paper with markings must be securely shredded at the end of the field test administration.
Further Information

Teachers requesting field tests must have a Public Authentication System (PAS) account. All requests are made through the Field Test Request System. Further information, including the closing dates to request a field test, may be obtained by contacting Field.Test@gov.ab.ca or from the General Information Bulletin. Practice tests are available online.

For more information, contact

Deanna Shostak
Director, Diploma Programs
780-422-5160 or Deanna.Shostak@gov.ab.ca

or

Pascal Couture
Director, Exam Administration and Production
780-492-1462 or Pascal.Couture@gov.ab.ca

Special-format Practice Tests

To provide students an opportunity to practise diploma examination-style questions and content in Braille, audio, large print, or coloured print versions, Alberta Education is making special-format practice tests available. Tests are offered in all subjects with a corresponding diploma examination. Alberta schools with registered Alberta K-12 students may place orders for these tests. Braille tests are available in English and, by request, in French. All tests are provided free of charge, but limits may be placed on order volumes to ensure access for everyone.

For more information or to place an order, contact

Laura LaFramboise
Distribution Coordinator, Exam Administration
780-492-1644 or Laura.LaFramboise@gov.ab.ca
Publications and Supporting Documents

The following documents are produced to provide teachers with information about the Mathematics 30–1 diploma examination:

- *Mathematics 30–1 Assessment Standards and Exemplars*
- *Mathematics 30–1 Written-Response Information*
- *School Reports and Instructional Group Reports*

Website Links

- *Mathematics Grades 10–12 Program of Studies*
- *General Information Bulletin*
- *Using Calculators*
- *Using Computers*
- *Quest A+*
- *Mathematics Directing Words*
- *FAQs for Educators*
- *Released Materials*
**Draft Mathematics Directing Words**

In Provincial Assessment Sector use, mathematics directing words have the following definitions, which students are required to know. These words will be bolded in the written-response questions.

<table>
<thead>
<tr>
<th>Directing Words</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algebraically</td>
<td>Using mathematical procedures that involve variables or symbols to represent values</td>
</tr>
<tr>
<td>Analyze</td>
<td>Make a mathematical examination of parts to determine the nature, proportion, function, interrelationships, and characteristics of the whole</td>
</tr>
<tr>
<td>Classify</td>
<td>Arrange items or concepts in categories according to shared qualities or characteristics</td>
</tr>
<tr>
<td>Compare</td>
<td>Examine the character or qualities of two things by providing characteristics of both that point out their mutual similarities and differences</td>
</tr>
<tr>
<td>Conclude</td>
<td>Make a logical statement based on reasoning and/or evidence</td>
</tr>
<tr>
<td>Describe</td>
<td>Give a written account of a concept</td>
</tr>
<tr>
<td>Design/Plan</td>
<td>Construct a detailed sequence of actions for a specific purpose</td>
</tr>
<tr>
<td>Determine</td>
<td>Find a solution, to a specified degree of accuracy, to a problem by showing appropriate formulas, procedures, and/or calculations</td>
</tr>
<tr>
<td>Evaluate</td>
<td>Find a numerical value or equivalent for an equation, formula, or function</td>
</tr>
<tr>
<td>Explain</td>
<td>Make clear what is not immediately obvious or entirely known; give the cause of or reason for; make known in detail</td>
</tr>
<tr>
<td>Illustrate</td>
<td>Make clear by giving an example. The form of the example will be specified in the question: e.g., a word description, sketch, or diagram</td>
</tr>
<tr>
<td>Interpret</td>
<td>Provide a meaning of something; present information in a new form that adds meaning to the original data</td>
</tr>
<tr>
<td>Justify</td>
<td>Provide valid reasons, evidence, and/or facts that support a position</td>
</tr>
<tr>
<td>Model</td>
<td>Represent a concept or situation in a concrete or symbolic way</td>
</tr>
<tr>
<td>Predict</td>
<td>State in advance on the basis of logic</td>
</tr>
<tr>
<td>Prove</td>
<td>Establish the truth or validity of a statement by giving factual evidence or logical argument</td>
</tr>
<tr>
<td>Sketch</td>
<td>Provide a drawing that represents the key features or characteristics of an object or graph</td>
</tr>
<tr>
<td>Solve</td>
<td>Give a solution to a problem</td>
</tr>
<tr>
<td>Verify</td>
<td>Establish, by substitution for a particular case or by geometric comparison, the truth of a statement</td>
</tr>
</tbody>
</table>
Mathematics 30–1 Formula Sheet

For \( ax^2 + bx + c = 0, \)
\[
x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}
\]

Relations and Functions

Graphing Calculator Window Format
\[
x: [x_{\text{min}}, x_{\text{max}}, x_{\text{sel}}]
\]
\[
y: [y_{\text{min}}, y_{\text{max}}, y_{\text{sel}}]
\]

Laws of Logarithms
\[
\log_b(M \times N) = \log_b M + \log_b N
\]
\[
\log_b \left( \frac{M}{N} \right) = \log_b M - \log_b N
\]
\[
\log_b(M^n) = n \log_b M
\]
\[
\log_b c = \frac{\log_a c}{\log_a b}
\]

Growth/Decay Formula
\[
y = ab^p
\]

General Form of a Transformed Function
\[
y = af[b(x - h)] + k
\]

Permutations, Combinations, and the Binomial Theorem
\[
n! = n(n - 1)(n - 2) \ldots 3 \times 2 \times 1,
\]
where \( n \in N \) and \( 0! = 1 \)
\[
_nP_r = \frac{n!}{(n-r)!}
\]
\[
_nC_r = \frac{n!}{(n-r)!r!} = \binom{n}{r}
\]

In the expansion of \((x + y)^n\), written in descending powers of \(x\), the general term is \( t_{k+1} = \binom{n}{k} x^{n-k} y^k \).

Trigonometry

\[
\theta = \frac{a}{r}
\]
\[
\tan \theta = \frac{\sin \theta}{\cos \theta} \quad \cot \theta = \frac{\cos \theta}{\sin \theta}
\]
\[
\csc \theta = \frac{1}{\sin \theta} \quad \sec \theta = \frac{1}{\cos \theta}
\]
\[
\cot \theta = \frac{1}{\tan \theta}
\]
\[
\sin^2 \theta + \cos^2 \theta = 1
\]
\[
1 + \tan^2 \theta = \sec^2 \theta
\]
\[
1 + \cot^2 \theta = \csc^2 \theta
\]
\[
\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta
\]
\[
\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta
\]
\[
\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta
\]
\[
\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta
\]
\[
\tan(\alpha + \beta) = \frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta}
\]
\[
\tan(\alpha - \beta) = \frac{\tan \alpha - \tan \beta}{1 + \tan \alpha \tan \beta}
\]
\[
\sin(2\alpha) = 2 \sin \alpha \cos \alpha
\]
\[
\cos(2\alpha) = \cos^2 \alpha - \sin^2 \alpha
\]
\[
\cos(2\alpha) = 2 \cos^2 \alpha - 1
\]
\[
\cos(2\alpha) = 1 - 2 \sin^2 \alpha
\]
\[
\tan(2\alpha) = \frac{2 \tan \alpha}{1 - \tan^2 \alpha}
\]
\[
y = a \sin[b(x - c)] + d
\]
\[
y = a \cos[b(x - c)] + d
\]
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