This document was written primarily for:

<p>| | |</p>
<table>
<thead>
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<th></th>
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<tbody>
<tr>
<td>Students</td>
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</tr>
<tr>
<td>Teachers</td>
<td>✓ of Mathematics 30–2</td>
</tr>
<tr>
<td>Adminstrators</td>
<td>✓</td>
</tr>
<tr>
<td>Parents</td>
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<tr>
<td>General Audience</td>
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</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
</tbody>
</table>

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Special permission is granted to Alberta educators only to reproduce, for educational purposes and on a non-profit basis, parts of this document that do not contain excerpted material.
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 teachers of Mathematics 30–2 with information about the diploma examinations scheduled in the 2018–2019 school year. This bulletin should be used in conjunction with the current Mathematics 30–2 Program of Studies, the Mathematics 30-2 Written-Response Information document, and the Mathematics 30–2 Assessment Standards and Exemplars document to ensure that the curriculum and standards are addressed.

This bulletin includes descriptions of the Mathematics 30–2 Diploma Examinations that will be administered in January, April, June, and August of 2019; descriptions of the acceptable standard and the standard of excellence; and subject-specific information. The mark awarded to a student on the Mathematics 30–2 Diploma Examinations in the 2018–2019 school year will account for 30% of the student’s final blended mark, and the school-awarded mark will account for the remaining 70%.

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

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

Course Objectives

The Mathematics 30–2 course is made up of outcomes, as specified in the program of studies, and emphasizes the mathematical understandings and critical thinking skills for daily life, direct entry into the workforce, and post-secondary studies in programs that do not require the study of calculus. In Mathematics 30–2, algebraic, numerical, and graphical methods are used to solve problems. Technology, such as a graphing calculator, is also used to enable students to explore and create patterns, examine relationships, test conjectures, model, and solve problems.

Students are expected to communicate solutions to problems clearly and effectively when solving both routine and non-routine problems. Students are also expected to apply mathematical concepts and procedures to meaningful life problems. It is important to realize that it is acceptable for students to solve problems in different ways and that solutions may vary depending upon how the problem is understood.

The program of studies is available online at education.alberta.ca.
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 objectives specified in the Mathematics 30–2 Program of Study. The specific statements of standards are written primarily to inform Mathematics 30–2 teachers of the extent to which students must both know the Mathematics 30–2 content and demonstrate the required skills in order to pass the diploma 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% and 79% 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 30–2 in the program of studies. They demonstrate mathematical skills as well as conceptual understanding and 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% 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

A document that describes acceptable standard and standard of excellence performance levels appropriate to the Mathematics 30–2 Program of Studies can be found on the Alberta Education website. This document also contains assessment exemplars to assist teachers and students with the interpretation of curricular outcomes in the program of studies.

Examples of Written-response Questions

A document that contains examples of written-response questions, sample responses, and scoring rationales as they relate to the general scoring guide can be found here. The purpose of this document is to help teachers and students understand the intent of the written-response component of the diploma examination, provide information about how the scoring guide is applied to specific questions, and encourage the use of the general scoring guide in class assignments. Teachers and students should note that directing words are bolded in written-response questions on diploma examinations. A list of these directing words and their definitions can be found on page 19.


**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.
Examination Specifications and Design

Each Mathematics 30–2 Diploma Examination is designed to reflect the core content outlined in the Mathematics 30–2 Program of Studies. The examination is limited to those outcomes that can be measured by a paper-and-pencil test. Therefore, the percentage weightings shown below will not necessarily match the percentage of class time devoted to each topic. The diploma examination was developed to be completed in 2.5 hours.

The format and content of the Mathematics 30–2 Diploma Examinations in the 2018–2019 school year are as follows.

*NEW Specifications

<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>2</td>
<td>25%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Diploma Examination Content by Topic</th>
<th>Emphasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logical Reasoning</td>
<td>15%–20%</td>
</tr>
<tr>
<td>Probability</td>
<td>30%–35%</td>
</tr>
<tr>
<td>Relations and Functions</td>
<td>45%–55%</td>
</tr>
<tr>
<td>Research Project</td>
<td>0%</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>Multiple Choice, Numerical Response, and Written Response</th>
<th>Emphasis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conceptual</td>
<td>34%</td>
</tr>
<tr>
<td>Procedural</td>
<td>30%</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 listed above the box: e.g., “Use the following information to answer questions 3 and 4.”

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

For some numerical-response questions, students are to calculate a numerical answer and 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 degree of this polynomial 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. The following are examples of these types of questions.

Correct-order Question and Solution

The digits 1 through 6 are arranged in the puzzle below so that the sum of each horizontal row is 7.

<table>
<thead>
<tr>
<th></th>
<th>a</th>
</tr>
</thead>
<tbody>
<tr>
<td>b</td>
<td>2</td>
</tr>
<tr>
<td>c</td>
<td>4</td>
</tr>
</tbody>
</table>

In the puzzle 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 your answer in the numerical-response section on the answer sheet.)

Answer: 653

Record 653 on the answer sheet

6 5 3
An exponential regression function in the form $y = a \cdot b^t$ can be used to model investment data. The four exponential functions shown below model the current value of four different investments, $A$, after $t$ years.

<table>
<thead>
<tr>
<th>Investment</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$A = 2300(1.09)^t$</td>
</tr>
<tr>
<td>2</td>
<td>$A = 5000(1.16)^t$</td>
</tr>
<tr>
<td>3</td>
<td>$A = 3500(1.24)^t$</td>
</tr>
<tr>
<td>4</td>
<td>$A = 1600(1.06)^t$</td>
</tr>
</tbody>
</table>

When these four functions are arranged in order from the lowest $b$ value to the highest $b$ value, the order is 

___, ___, ___, and ___.

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

Answer: 4123
Any-order Question and Solution

The elements in sets $A$ and $B$ are defined below.

\[ A = \{2, 3, 4, 5, 7, 8, 9\} \]
\[ B = \{1, 2, 5, 6, 8\} \]

The three elements that are in Set $A$ and Set $B$ are ___, ___, and ___.

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

Answer: 582 (in any order)

Record 582 on the answer sheet

\[5 \ 8 \ 2\]
**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 will cover more than one specific outcome and will require students to make connections between concepts.

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 19.

Students should be encouraged to try to solve all problems, as an attempt at a solution may be worth partial marks. The two written-response questions each consist of four parts and will address multiple cognitive levels. Each question is scored with a 7-mark scoring rubric; it will begin with a 1-mark part followed by three 2-mark parts. Students should note that their solution to all written-response questions should include appropriate use of units and appropriate rounding.

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

- Write your responses in the examination 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.

<table>
<thead>
<tr>
<th>Score</th>
<th>1-mark Part</th>
<th>General Scoring Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>No response is provided.</td>
<td></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>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td>In the response, the student applies appropriate mathematical knowledge to find a complete and correct solution.</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>In the response, the student applies appropriate mathematical knowledge to find a complete and correct solution.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Score</th>
<th>2-mark Part</th>
<th>General Scoring Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>NR</td>
<td>No response is provided.</td>
<td></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>
<td></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>
<td></td>
</tr>
<tr>
<td>1</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>
<td></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>
<td></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>
<td></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, and 2. A student response that does not meet the performance level of a benchmark score may receive an augmented score of 0.5 or 1.5. Descriptions of these augmented scores will be determined with teachers at each marking session and are not an exhaustive list.
Commentary on the Mathematics 30–2 Diploma Examinations

Introduction

The 2017–2018 school year was the sixth year for the Mathematics 30–2 Diploma Examination. This section is intended to provide teachers with information concerning these diploma examinations. In general, feedback from teachers has indicated a high degree of satisfaction with the examinations in terms of fidelity to, and support of, the program of studies.

Overview of Diploma Examination Development Process

Throughout the diploma examination development process, Alberta Education makes every effort to ensure that examinations reflect the content of new programs. Prior to implementation in 2013, seven province-wide consultations, involving over 120 teachers, were held to discuss the blueprint for the Mathematics 30–2 diploma examinations. During these consultations and other development work, teachers were involved in developing items, determining performance standard descriptors, and developing the blueprint. After implementation, teachers continue to be involved in developing items, reviewing field tests, and validating diploma examinations.

The January 2018 Mathematics 30-2 Diploma Examination and the June 2018 Mathematics 30–2 Diploma Examination were built to the published blueprint, which reflects the program of studies. To help ensure this, teachers, post-secondary representatives, and staff from Programs of Study and Resources as well as French Language Education Services were extensively involved in the validation processes.

Final adjustments were made to the Assessment Standards to further refine the examples. Fairness to students and student success continue to be the focus of any changes to provincial assessments.
Students’ Strengths and Areas for Improvement

Logical Reasoning
- Students continue to perform well on puzzles and games involving numerical and logical reasoning.
- Students have shown improvement in their ability to organize and analyze two sets within a universal set, including the operation of two sets that involve complements.
- Weaker students continue to have trouble organizing and interpreting information that involves three sets, but they tend to perform better when a diagram is provided.

Probability
- Students are able to convert probability to odds and vice versa, but weaker students continue to find this difficult.
- Students continue to have difficulty differentiating between mutually exclusive and non-mutually exclusive events, and they also have difficulty calculating the probability of non-mutually exclusive events.
- Students continue to have difficulty calculating probability when there is more than one case to consider.
- Students perform well on permutation questions that involve one restriction, as well as combination questions that involve a single case.
- Some students continue to express probability as a percent, rather than a value in the range of 0 to 1. This is of particular concern in numerical-response questions.

Relations and Functions
- Students can perform regressions, but they need to pay special attention to the use of non-rounded values in the resulting regression function to predict an unknown value.
- Students have difficulty solving exponential equations that cannot be written as powers with a common base.
- Students have shown improvement in simplifying logarithmic expressions using the laws of logarithms.
- Students are becoming more proficient in multiplying and dividing rational expressions, but continue to have difficulty in adding and subtracting rational expressions.
- Students continue to have difficulty in solving rational equations, especially when the rational equation simplifies to a quadratic equation.
- Students continue to have difficulty solving contextual problems when the equation, table of values, or graph is not provided.

NOTE: Students need to attend to specified rounding in numerical-response questions.
**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 if 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 if 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 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 30–2 Diploma Examinations will be fully secured and will not be released at the time of writing.
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 30–2 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 time limits of other examinations may differ. For more information about universal supports, please refer to the General Information Bulletin.

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, Examination Administration and Production
780-492-1462 or Pascal.Couture@gov.ab.ca
Examination Development and Teacher Involvement

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 and validating of diploma examinations; and the marking of diploma examinations.

The development of test items from when they are written until when they appear on an examination takes at least one year, if not longer. The writers of all items on Mathematics 30–2 diploma examinations are Mathematics 30–2 teachers from across Alberta. After the first year of provincial implementation, 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 the teachers and annually asks school jurisdictions for the names of teachers who are interested in being involved in all of the development processes for diploma examinations. Teachers who are interested in developing raw items, constructing field tests, or reviewing and validating examinations are encouraged to talk to their principals about how they can submit their names for approval to be involved in these processes. Although the call for submission 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**

**Paper Field Testing**

Year-end paper field tests are available this school year and include machine-scored and written-response questions. Paper field tests are shipped to, and administered by, an Alberta Education field supervisor.

**Online Field Testing**

All machine-scored only field tests are offered through the Quest A+ online delivery system. Students should use paper formula sheets for all mathematics field tests. These resources will also appear in the online delivery system. Students should 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.

Teachers have a 24-hour window to peruse the digital field test and are provided with data on 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.

Finally, online administration enables every school, large or small, to participate. Historically, it was impractical to send field-test administrators to remotely located schools, or schools with small classes. Now, all Alberta schools can participate in field tests.

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.
Benefits of Field Tests

How do field tests help teachers and students?

Teachers receive each student’s score promptly, gaining useful, immediate information about their students’ levels of expertise and knowledge. Students also benefit from writing a test that duplicates some of the experience of writing a diploma examination. Field tests provide students and teachers with good examples of the style and content of questions that may appear on diploma examinations. Finally, because of field testing, students, teachers, and parents can be reassured that the questions on diploma examinations have undergone a rigorous process of development, improvement, and validation.

Why are field tests necessary?

Field testing is an absolutely essential stage in the development of fair, valid, and reliable provincial examinations. Field testing is basically a process of “testing a test” and “testing questions” before they become part of a diploma examination. Potential diploma examination questions are administered to students in diploma courses throughout the province to determine their difficulty level and appropriateness. Ideally, each field test requires a large student sample to provide the examination developers with reliable information (statistical data and written validation comments from teachers and students).

How are field test data used?

The data received from field tests show the reliability of each question. Sometimes, after one field test round, it is clear that certain questions work very well in terms of fairness, validity, and appropriateness to course content. These questions then move into the diploma examination bank to be used at a future date.

Other questions or sets of questions may not perform as well as we require. These questions are subject to revision and review, and retested in a second or third field test with the aim of generating questions that meet our standards. These changes are influenced by the written comments of students and teachers, who provide valuable advice about the appropriateness of the questions, adequacy of writing time limits, test length, text readability, artwork/graphics clarity and suitability, and question difficulty.

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 machine-scored items are available online.
Using Calculators

The Mathematics 30–2 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 on the Alberta Education website.

Examination Security

All Mathematics 30–2 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 more information about examination security, please refer to the General Information Bulletin.

Publications and Supporting Documents

The following documents are produced to provide teachers with information about the Mathematics 30–2 Diploma Examination:

- **Mathematics 30–2 Assessment Standards and Exemplars**
- **Mathematics 30–2 Practice Questions**
  Some practice questions have been released for Mathematics 30–2. The January 2013 Diploma Examination and the August 2013 Diploma Examination have both been released. The practice questions and both diploma examinations are available on Quest A+.
- **Mathematics 30-2 Written-Response Information**
- **School Reports and Instructional Group Reports**
  Detailed statistical information on provincial, group, and individual student performance on the entire examination is available here.
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.

This 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 for 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, please refer to the Conceptual Framework for Grades 10–12 Mathematics found in the *Mathematics Grades 10–12 Program of Studies*.
### 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 Word</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Algebraically</strong></td>
<td>Using mathematical procedures that involve variables or symbols to represent values</td>
</tr>
<tr>
<td><strong>Analyze</strong></td>
<td>Make a mathematical examination of parts to determine the nature, proportion, function, interrelationships, and characteristics of the whole</td>
</tr>
<tr>
<td><strong>Classify</strong></td>
<td>Arrange items or concepts in categories according to shared qualities or characteristics</td>
</tr>
<tr>
<td><strong>Compare</strong></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><strong>Conclude</strong></td>
<td>Make a logical statement based on reasoning and/or evidence</td>
</tr>
<tr>
<td><strong>Describe</strong></td>
<td>Give a written account of a concept</td>
</tr>
<tr>
<td><strong>Design/Plan</strong></td>
<td>Construct a detailed sequence of actions for a specific purpose</td>
</tr>
<tr>
<td><strong>Determine</strong></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><strong>Evaluate</strong></td>
<td>Find a numerical value or equivalent for an equation, formula, or function</td>
</tr>
<tr>
<td><strong>Explain</strong></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><strong>Illustrate</strong></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><strong>Interpret</strong></td>
<td>Provide a meaning of something; present information in a new form that adds meaning to the original data</td>
</tr>
<tr>
<td><strong>Justify</strong></td>
<td>Provide valid reasons, evidence, and/or facts that support a position</td>
</tr>
<tr>
<td><strong>Model</strong></td>
<td>Represent a concept or situation in a concrete or symbolic way</td>
</tr>
<tr>
<td><strong>Predict</strong></td>
<td>State in advance on the basis of logic</td>
</tr>
<tr>
<td><strong>Prove</strong></td>
<td>Establish the truth or validity of a statement by giving factual evidence or logical argument</td>
</tr>
<tr>
<td><strong>Sketch</strong></td>
<td>Provide a drawing that represents the key features or characteristics of an object or graph</td>
</tr>
<tr>
<td><strong>Solve</strong></td>
<td>Give a solution to a problem</td>
</tr>
<tr>
<td><strong>Verify</strong></td>
<td>Establish, by substitution for a particular case or by geometric comparison, the truth of a statement</td>
</tr>
</tbody>
</table>
Relations and Functions

Graphing Calculator Window Format

\[ \begin{align*}
  x: & \quad [x_{\text{min}}, x_{\text{max}}, x_{\text{sclo}}] \\
  y: & \quad [y_{\text{min}}, y_{\text{max}}, y_{\text{sclo}}] 
\end{align*} \]

Exponents and Logarithms

\[ y = a^x \leftrightarrow x = \log_a y \]

\[ \log_b c = \frac{\log_a c}{\log_a b} \]

Laws of Logarithms

\[ \log_b (M \cdot N) = \log_b M + \log_b N \]
\[ \log_b \left( \frac{M}{N} \right) = \log_b M - \log_b N \]
\[ \log_b (M^n) = n \log_b M \]

Exponential functions

\[ y = a \cdot b^x \]

Logarithmic functions

\[ y = a + b \cdot \ln x \]

Sinusoidal functions

\[ y = a \cdot \sin(bx + c) + d \]

Period = \( \frac{2\pi}{b} \)

Quadratic equations

For \( ax^2 + bx + c = 0 \)

\[ x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]

Probability

\[ n! = n(n - 1)(n - 2) \ldots 3 \cdot 2 \cdot 1, \quad \text{where} \quad n \in \mathbb{N} \quad \text{and} \quad 0! = 1 \]

\[ n^P_r = \frac{n!}{(n-r)!} \]

\[ n^C_r = \frac{n!}{(n-r)!r!} \]

\[ n^C_r = \binom{n}{r} \]

\[ \begin{align*}
  P(A \cup B) & = P(A) + P(B) \\
  P(A \cup B) & = P(A) + P(B) - P(A \cap B) \\
  P(A \cap B) & = P(A) \cdot P(B) \\
  P(A \cap B) & = P(A) \cdot P(B \mid A) 
\end{align*} \]

Logical Reasoning

\[ A' \quad \text{Complement} \]
\[ \emptyset \quad \text{Empty set} \]
\[ \cap \quad \text{Intersection} \]
\[ \subset \quad \text{Subset} \]
\[ \cup \quad \text{Union} \]
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