

Information
Bulletin

Applied
Mathematics

30

2011 – 2012 Diploma Examinations Program

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Alberta ■

Freedom To Create. Spirit To Achieve.

This document was written primarily for:

Students	✓
Teachers	✓ of Applied Mathematics 30
Administrators	✓
Parents	
General Audience	
Others	

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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](http://education.alberta.ca) at education.alberta.ca.

At the home page, click on the link *Teachers*, then click on the link *Provincial Testing*. Next click on *Diploma Examinations* and then one of the specific links listed under the *Diploma Examinations* heading.

Introduction

The purpose of this bulletin is to provide students and teachers of Applied Mathematics 30 with information about the diploma examinations scheduled in the 2011–2012 school year. This bulletin should be used in conjunction with the current Applied Mathematics Program of Studies to ensure that the curriculum and standards are addressed.

This bulletin includes descriptions of the Applied Mathematics 30 Diploma Examinations that will be administered in January, June, and August of 2012; descriptions of the *acceptable standard* and the *standard of excellence*; and subject-specific information. The mark awarded to a student on the Applied Mathematics 30 Diploma Examinations in the 2011–2012 school year will account for 50% of the student's final blended mark, and the school-awarded mark will account for the remaining 50%.

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

For further information regarding program implementation, refer to the [Alberta Education website](http://education.alberta.ca) at education.alberta.ca.

Course Objectives

The Applied Mathematics 30 course is made up of outcomes, as specified in the Program of Studies, and emphasizes the application and relevance of mathematics in daily life. In Applied Mathematics, numerical and geometric methods are used to solve problems. Algebraic constructs are taught as needed during classroom investigations or data analysis. Tools such as graphing calculators and spreadsheet applications are commonly used to solve problems.

Students are expected to communicate solutions to problems clearly and effectively when solving both routine and non-routine problems. Technology is to be used for exploration, modelling, and problem solving. Students are also expected to apply mathematical concepts and procedures to meaningful life problems.

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, and administering of field tests; the reviewing of diploma examination drafts.

Alberta Education values the involvement of the teachers and often asks school jurisdictions for the names of teachers who are interested in being involved. Teachers who are interested in developing raw items or building and/or reviewing field tests are encouraged to ask their principals to submit their names, through proper channels, to Action on Curriculum – Assessment. The list of teachers interested in these aspects of the development process remains open all year long, and teachers are welcome to have their names submitted at any time.

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

September 2011	Registration for year-end field digital tests to be administered in December 2011 or January 2012.
February 2012	Registration for year-end digital field tests to be administered in May or June 2012.

Online Field Testing

Applied Mathematics 30 field tests will only be available in digital format in 2011–2012. Requests for all field tests should be made by the field test coordinator at the school using the appropriate forms. Further information about field testing may be obtained by contacting Field.Testing@gov.ab.ca. [Practice tests](https://questaplus.alberta.ca/) are available at <https://questaplus.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 learnings specified for Applied Mathematics 30. The specific statements of standards are written primarily to apprise Applied Mathematics 30 teachers of the extent to which students must both know the Applied Mathematics 30 content 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* in Applied Mathematics 30 will receive a final course mark between and including 50% and 79%. Typically, these students have gained new skills and knowledge in mathematics, and they can apply mathematical concepts and procedures to find a solution to routine problems. They have demonstrated mathematical skills and knowledge in the six topics of the Applied Mathematics 30 curriculum and exhibit an ability to apply a broad range of problem-solving skills to these content strands.

Standard of Excellence

Students who attain the *standard of excellence* will receive a final course mark of 80% or higher. Such students have demonstrated their ability and interest in mathematics, and have confidence in their mathematical skills. These students can choose the most efficient method for solving problems. They can also find more than one solution and can solve non-routine problems.

Examples of Questions

This bulletin contains an appendix with examples of selected written-response questions from previous diploma examinations, sample student responses, and scoring rationales as they relate to the general scoring guide. For more examples of questions, please refer to the [Applied Mathematics 30 Archived Information Bulletin](#) on the Alberta Education website at education.alberta.ca by following this pathway *Teachers > (Additional Programs and Services) Diploma Exams > Information Bulletins*.

Projects

Teachers are encouraged to access past [projects](#) that can be found on the Alberta Education website at education.alberta.ca via the pathway *Teachers > (Additional Programs and Services) Diploma Exams > Projects for Pure and Applied Mathematics 30*. These projects are designed to be completed in three to five hours of student time. Use of these projects is optional, and teachers may choose to use them as part of their assessment. A sample solution and scoring rubric is provided for each project.

Examination Specifications and Design

NEW

Please note that the format of some diploma examination booklets has changed slightly. The instructions pages now begin on the inside front cover, and the side, top and bottom page margins are narrower than before to allow more content on each page.

The changes are not a misprint. They are part of an effort to lessen the environmental impact of the examinations by reducing the total amount of paper used by several tons per year.

Note that the format changes do not apply to all diploma examination booklets. French-language booklets, Part A booklets, and Readings booklets still use the old format. Also, the size of the print and the font are unchanged in all booklets.

Each Applied Mathematics 30 Diploma Examination is designed to reflect the core content outlined in the *Applied Mathematics 30 Program of Studies*. The examination is limited to those expectations that can be measured by a machine-scored paper-and-pencil test. Therefore, the percentage weightings shown below will not necessarily match the percentage of class time devoted to each unit. The diploma examination will be two hours, with an additional half-hour if needed.

The content for the Applied Mathematics 30 Diploma Examinations in the 2011–2012 school year is emphasized as follows.

Specifications

<i>Question Format</i>	<i>Number of Questions</i>	<i>Percentage Emphasis</i>
Multiple Choice	33	82
Numerical Response	7	18

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

<i>Multiple Choice and Numerical Response</i>	<i>Percentage Emphasis</i>
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Procedures	35
Concepts	30
Problem Solving	35

<i>Diploma Examination Content</i>	<i>Percentage Emphasis</i>
------------------------------------	----------------------------

Matrices and Pathways	17
Finance and Spreadsheets	17
Statistics and Probability	17
Vectors	18
Cyclic, Recursive, and Fractal Patterns	18
Design	13

Machine-Scored Questions

Information required to answer **multiple-choice** and/or **numerical-response questions** is often located in a box preceding the question. The number of 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 the next two questions.”

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 conceptual idea. The following is an example of such a question.

Use the following information to answer the next question.

$$2 \begin{bmatrix} 1 & 0.5 \\ 1.5 & 4 \end{bmatrix} = \begin{bmatrix} a & b \\ c & 8 \end{bmatrix}$$

Numerical Response

6. In the equation 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: 213

Record 213 on the answer sheet →

2	1	3	
○	○	○	○
○	○	○	○
○	●	○	○
●	○	○	○
○	○	●	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○
○	○	○	○

Using Calculators

The Applied Mathematics 30 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 at education.alberta.ca via the pathway *Teachers > (Additional Programs and Services) Diploma Exams > Diploma General Information Bulletin > Using Calculators & Computers*.

Examination Security

All Applied Mathematics 30 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. However, for the January and June 2011 examinations, teachers will be allowed access to a *Teacher Perusal Copy* for review purposes one hour after the respective examination has started. Representative portions of previous diploma examinations will be released, along with an *Assessment Highlights Document*, early in the autumn of 2011.

Publications and Supporting Documents

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

- [*Applied Mathematics 30 Released Items*](#) available at education.alberta.ca, via the pathway *Teachers > (Additional Programs and Services) Diploma Exams > Released Materials*
- [*Applied Mathematics 30 Assessment Highlights*](#) available at education.alberta.ca, via the pathway *Teachers > (Additional Programs and Services) Diploma Exams > Assessment Highlights*
- [*Applied Mathematics 30 Information Bulletin*](#) available at education.alberta.ca, via the pathway *Teachers > (Additional Programs and Services) Diploma Exams > Information Bulletins*
- [*School Reports and Instructional Group Reports*](#) for January and June Diploma Examinations available on the extranet at <https://phoenix.edc.gov.ab.ca/login/default.asp>

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 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.

Because of the security required to enable fair and appropriate assessment of student achievement over time, both Parts A and B of some diploma examinations may have to be fully secured on occasion and will not be released at the time of writing. Please check the [General Information Bulletin](#) (education.alberta.ca, via the pathway *Teachers > (Additional Programs and Services) Diploma Exams > Diploma General Information Bulletin*) or the information bulletins for each diploma subject you teach to determine which, if any, examinations are fully secured. For more information about [equating or linking](#), please refer to the Alberta Education website at education.alberta.ca, via the pathway *Teachers > (Additional Programs and Services) Diploma Exams > Initiative to Maintain Consistent Standards on Diploma Examinations*.

Explanation of Cognitive Levels

Procedural, conceptual, and problem-solving cognitive levels are addressed throughout the examination. The emphasis of each cognitive level will be approximately equal.

Procedures

The assessment of students' knowledge of mathematical procedures should involve recognition, defence, execution, and verification of appropriate procedures and the steps contained within them. 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. The use of technology can allow for conceptual understanding prior to specific skill development. 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.

Certain types of procedural execution cannot be tested on diploma examinations because of restrictions in technology. This procedural execution is, however, an integral part of the *Program of Studies* and should be tested in the classroom.

Concepts

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 non-examples as well as properties of a given concept; and recognize the various meanings and interpretations of concepts. Students who have developed a conceptual understanding of mathematics can also use models, symbols, and diagrams to represent concepts. Appropriate assessment will also provide 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 develop an ability to solve problems over time as a result of their experience 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 clear language and appropriate mathematical notation and conventions.

Mathematical Processes

Communication (C)

Students need to communicate mathematical ideas clearly and effectively. In communicating answers, students must be aware of the degree of accuracy required as well as the appropriate units involved.

Problem Solving (PS)

Problem solving is the focus of mathematics at all grade levels. The development of each student's ability to solve problems is essential. Students develop a true understanding of mathematical concepts and procedures when they solve problems in meaningful contexts. Approximately one-third of the machine-scored questions will be related to a problem-solving context. Students are expected to be able to select an appropriate problem-solving strategy to find the solution to a given problem or to model meaningful problem situations.

Students should not expect questions on a particular concept to be asked in the same manner every time. They must be able to adapt to changes in the format, which will help to improve their problem-solving skills.

Connections (CN)

When mathematical ideas are connected to each other through concrete, pictorial, and symbolic representations, students begin to view mathematics as an integrated whole. Students need numerous and varied experiences to appreciate the usefulness of mathematics. They must explore connections between different areas of mathematics, and between mathematics and other disciplines. The "connections process" also includes relating mathematics to their own daily experiences.

The connections process is often linked with problem solving and reasoning as it is an application of these other processes.

Reasoning (R)

Students need to develop confidence in their ability to reason and to justify their thinking within and outside of mathematics. The power of reasoning helps students to make sense of mathematics, to be logical in their thinking, and to convince others.

Inductive reasoning helps students explore and make conjectures from activities that allow generalizations from a pattern of observations.

Deductive reasoning helps students test conjectures and build arguments that serve to validate thinking. Deductive reasoning builds a structured body of knowledge.

Reasoning allows students to interpret mathematics and aids in the choice of appropriate problem-solving strategies. Students may be asked to demonstrate logical reasoning when judging the validity of arguments, testing conjectures, and constructing valid arguments.

Technology (T)

“Electronic technologies—calculators and computers—are essential tools for teaching, learning, and doing mathematics. They furnish visual images of mathematical ideas, they facilitate organizing and analyzing data, and they compute efficiently and accurately. They can support investigation by students in every area of mathematics, including geometry, statistics, algebra, measurement, and number. When technological tools are available, students can focus on decision making, reflection, reasoning, and problem solving.... Technology should not be used as a replacement for basic understandings and intuitions; rather, it can and should be used to foster those understandings and intuitions.” (*Principles and Standards for School Mathematics, NCTM 2000, pages 24 to 25*)

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Applied Mathematics 30 Formula Sheet

Cost and Design

Perimeter

Circle $C = 2\pi r$

Area

Circle $A = \pi r^2$

Triangle $A = \frac{b \times h}{2}$

Parallelogram $A = b \times h$

Trapezoid $A = h \left(\frac{b_1 + b_2}{2} \right)$

Surface Area

Sphere $SA = 4\pi r^2$

Cylinder $SA = 2\pi r^2 + 2\pi rh$

Cone $SA = \pi r^2 + \pi rs$

Volume

Sphere $V = \frac{4}{3}\pi r^3$

Cylinder $V = \pi r^2 h$

Prism $V = B \cdot h$, where B is the area of the base

Cone $V = \frac{1}{3}\pi r^2 h$

Pyramid $V = \frac{B \cdot h}{3}$, where B is the area of the base

Graphing Calculator Window Format

x : $[x_{\min}, x_{\max}, x_{\text{scl}}]$

y : $[y_{\min}, y_{\max}, y_{\text{scl}}]$

Trigonometry and Vectors

In degree mode:

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

Statistics and Probability

$$\mu = np$$

$$\sigma = \sqrt{np(1-p)}$$

$$z = \frac{x - \mu}{\sigma}$$

$$95\% \text{ C.I.: } \mu \pm 1.96 (\sigma)$$

$$P(A \text{ or } B) = P(A) + P(B)$$

$$P(A \text{ and } B) = P(A) \cdot P(B)$$

$$P(A \text{ and } B) = P(A) \cdot P(B|A)$$

Regression Models

In radian mode:

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

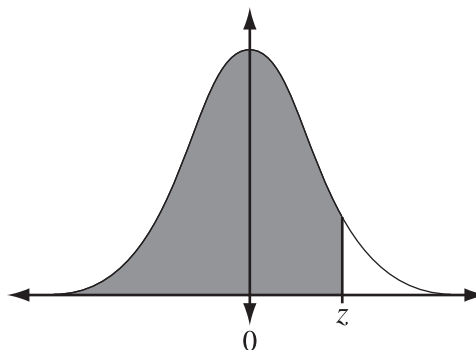
$$\text{period} = \frac{2\pi}{b}$$

$$y = ax^2 + bx + c$$

$$y = ax + b$$

$$y = a \cdot b^x$$

$$z = \frac{x - \mu}{\sigma}$$



Areas Under the Standard Normal Curve

<i>z</i>	0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.00
-3.4	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
-3.3	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005
-3.2	0.0005	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007
-3.1	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010
-3.0	0.0010	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013
-2.9	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0019
-2.8	0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026
-2.7	0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035
-2.6	0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047
-2.5	0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062
-2.4	0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082
-2.3	0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107
-2.2	0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139
-2.1	0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179
-2.0	0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228
-1.9	0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287
-1.8	0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359
-1.7	0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446
-1.6	0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548
-1.5	0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668
-1.4	0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808
-1.3	0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968
-1.2	0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151
-1.1	0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357
-1.0	0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587
-0.9	0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841
-0.8	0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119
-0.7	0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420
-0.6	0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743
-0.5	0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085
-0.4	0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446
-0.3	0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821
-0.2	0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207
-0.1	0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602
-0.0	0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000

Areas Under the Standard Normal Curve

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

Website Links

Publication— Applied Mathematics Program	Website
General Information Bulletin	education.alberta.ca, via the pathway <i>Teachers > (Additional Programs and Services) Diploma Exams > Diploma General Information Bulletin</i>
Applied Mathematics 30 Bulletins	education.alberta.ca, via the pathway <i>Teachers > (Additional Programs and Services) Diploma Exams > Information Bulletins</i>
Writing Diploma Examinations Using Calculators	education.alberta.ca, via the pathway <i>Teachers > (Additional Programs and Services) Diploma Exams > Information Bulletins > Using Calculators and Computers</i>
Projects	education.alberta.ca, via the pathway <i>Teachers > (Additional Programs and Services) Diploma Exams > Projects for Pure and Applied Mathematics 30</i>
Mathematics and Science Directing Words	education.alberta.ca, via the pathway <i>Teachers > (Additional Programs and Services) Diploma Exams > Information Bulletins > Mathematics and Science Directing Words</i>
Assessment Highlights	education.alberta.ca, via the pathway <i>Teachers > (Additional Programs and Services) Diploma Exams > Assessment Highlights</i>
Released Items	education.alberta.ca, via the pathway <i>Teachers > (Additional Programs and Services) Diploma Exams > Released Materials</i>
Previously Released Diploma Examinations and Answer Keys	education.alberta.ca, via the pathway <i>Teachers > (Additional Programs and Services) Diploma Exams > Previous Diploma Examinations and Answer Keys</i>
Applied Mathematics 10, 20, and 30 Program of Studies	education.alberta.ca, via the pathway <i>Teachers > (Programs of Study) Mathematics > Educators > Programs of Study</i>
Quest A⁺	https://questaplus.alberta.ca/
Publication— Revised Mathematics Program of Studies	Website
Mathematics Grades 10–12 Program of Studies	education.alberta.ca, via the pathway <i>Teachers > (Programs of Study) Mathematics > Educators > Programs of Study</i>
The High School Information Package	education.alberta.ca, via the pathway <i>Teachers > (Programs of Study) Mathematics > Educators > Fact Sheets and Useful Links</i>
FAQs for Educators	education.alberta.ca, via the pathway <i>Teachers > (Programs of Study) Mathematics > Educators > FAQs for Educators</i>
Approved Calculators for Mathematics 30–1, Mathematics 30–2 and Science Diploma Examinations in 2012–2013	education.alberta.ca, via the pathway <i>Teachers > (Programs of Study) Mathematics > Educators > Support Materials</i>

Revised Mathematics Program of Studies Implementation

NEW

The revised [*Mathematics 10-12 Program of Studies \(2008\)*](#) will be implemented according to the following schedule:

September 2011 – Mathematics 20-2

September 2012 – Mathematics 30-2

The Program of Studies can be downloaded at <http://education.alberta.ca/media/655889/math10to12.pdf>. If you cannot access the revised Program of Studies using this link, you can find curriculum-related materials on the Alberta Education website at education.gov.ab.ca. At the home page, click on the link *Teachers*; then under Programs of Study click on *Mathematics* and then on *Information for Educators*. The revised *Mathematics 10-12 Program of Studies (2008)* is listed under the **Programs of Study** heading.

The *Mathematics 30-2 Information Bulletin 2012-2013* will contain the following information:

- Standards appropriate to Mathematics 30-2 in the revised *Mathematics 10-12 Program of Studies*, as developed by teachers from across Alberta in cooperation with Alberta Education
- Notes for teachers
- Standards statements for the acceptable standard as well as the standard of excellence
- The examination design in terms of percentage weightings by topic, number and type of questions, and percentage weightings by mathematical understanding
- Sample questions
- The formula sheet

A draft version of the *Mathematics 30-2 Information Bulletin 2012-2013* will be available in the spring of 2012. If you have any questions about the diploma examination program for Mathematics 30-2, please contact Deanna Shostak at Deanna.Shostak@gov.ab.ca or toll free at 310-0000 then 780-427-0010.

Grandfathering of Old Program of Studies

Starting with the 2012-2013 school year, schools can no longer offer Applied Mathematics 30. The last regular administration of the Applied Mathematics 30 Diploma Examination will be August 2012. The Applied Mathematics 30 Diploma Examination will be available until August 2014 **only** for those students who wish to re-write the examination or who began the course using distributed learning materials prior to the end of August 2012.

Appendix: Other Assessment Samples for Classroom Use

Introduction

Open-ended questions provide a way in which to assess mathematics as a common human activity. They allow students to communicate a response by asking them to explain their reasoning, explain their solution, describe mathematical situations, write directions, create new problems, create new strategies, generalize a mathematical situation, and formulate hypotheses.

Although written-response questions are no longer part of the Applied Mathematics 30 Diploma Examination, written-response and open-ended questions should be used in classroom assessment. This way there can be a broad-based assessment of all the outcomes in the program of studies.

In scoring written-response questions, teachers can evaluate how well students

- understand the problem or the mathematical concept
- correctly apply mathematical knowledge and skills
- use problem-solving strategies and explain their final answers and solution procedures
- communicate their solutions and mathematical ideas

This section provides examples of selected written-response questions, sample student questions, sample student responses, and scoring rationales as they relate to the general scoring guide. These examples are intended to inform teachers and students of how the scoring guide was applied to specific diploma examination questions and to encourage the use of the general scoring guide in class assignments.

General Scoring Guide

Student responses to written-response questions were previously scored against specific question-scoring rubrics based on the *General Scoring Guide*. Credit was given to students who appropriately demonstrated unusual insight in addressing the question.

A “five” need not be a perfect paper!

This scoring guide reflects a mark based on four dimensions:

- mathematical understanding
- clarity of communication
- application of processes
- use of technology

GENERAL SCORING GUIDE	
1 mark	<p>In the response, the student</p> <ul style="list-style-type: none"> • applies some relevant mathematical knowledge to explore the initial stages of the problem; however, the response reflects a misunderstanding of the problem • uses a relevant strategy, mathematical process, or problem-solving technique to explore the initial stages of the problem • communicates very little relevant information and lacks clarity • uses technology inappropriately or the use of technology is not evident
2 marks	<p>In the response, the student</p> <ul style="list-style-type: none"> • applies some relevant mathematical knowledge to find partial solutions to the problem; however, the response reflects a minimal understanding of the problem • uses relevant strategies, mathematical processes, or problem-solving techniques to find a partial solution to the problem • communicates strategies in a manner that lacks clarity or is incomplete • uses technology where appropriate; however, errors are evident
3 marks	<p>In the response, the student</p> <ul style="list-style-type: none"> • applies mathematical knowledge to find partial solutions to the problem and reflects a basic understanding of the problem • uses appropriate strategies, mathematical processes, and problem-solving techniques to find partial solutions to the problem • communicates strategies and solutions in an organized manner; however, errors, inconsistencies, and omissions affect clarity • uses technology appropriately; however, there are inconsistencies in their application
4 marks	<p>In the response, the student</p> <ul style="list-style-type: none"> • applies appropriate mathematical knowledge to find a complete solution to the problem and reflects a good understanding of the problem • uses appropriate strategies, mathematical processes, and problem-solving techniques to find a complete solution to the problem; however, the solution contains an error that hinders understanding of the response • communicates strategies and solutions in an organized manner; however, errors or omissions may affect clarity • uses technology appropriately
5 marks	<p>In the response, the student</p> <ul style="list-style-type: none"> • applies appropriate mathematical knowledge to find a complete and correct solution to the problem, and reflects an excellent understanding of the problem • uses appropriate strategies, mathematical processes, and problem-solving techniques to find a complete, correct solution; the solution may have a minor error, but it does not hinder the understanding of the response • communicates strategies and solutions in a clear, complete, and organized manner that reflects a thorough understanding of the problem • uses technology effectively

Scoring Written-Response Questions

Sample 1

Use the following information to answer the next question.

The owner of a hot-air balloon and blimp company obtained a loan for \$50 000 to buy a new hot-air balloon. The following spreadsheet shows some entries in the repayment schedule.

	A	B	C	D	E
1		Repayment Schedule			
2					
3		Amount Borrowed	\$50 000.00		
4		Monthly Payment	\$1 556.00		
5		Period of the Loan (Months)	36	3 years	
6		Interest Rate (%/a)	7.5%		
7		Compounding Periods per Year	12		
8					
9	Month	Opening Balance	Interest Charged	Monthly Payment	Closing Balance
10	1	\$50 000.00	I	\$1 556.00	\$48 756.50
11	2	\$48 756.50	\$304.73	\$1 556.00	\$47 505.23
12	3	\$47 505.23	\$296.91	\$1 556.00	\$46 246.14
43	34	\$4 583.06	\$28.64	\$1 556.00	\$3 055.70
44	35	\$3 055.70	\$19.10	\$1 556.00	\$1 518.80
45	36	\$1 518.80	\$9.49	\$1 528.29	\$0.00

Written Response—15%

3. a. Calculate the value for I in cell C10 in the spreadsheet above.

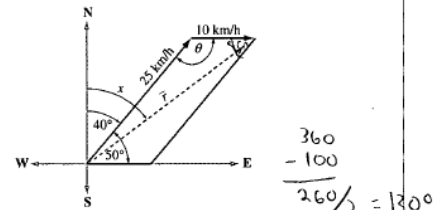
$$\frac{7.5\%}{12} = 0.00625\% \quad \frac{\$50000.00}{12} = 4166.67 \quad I = \$312.50$$

- Explain why the final monthly payment is \$1 528.29 instead of \$1 556.00.

There is only \$1528.29 left owing on the air balloon. The owner paid \$1 556.00 then he would have paid \$27.71 too much.

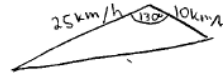
Use the following additional information to answer the next part of the question.

A blimp is flying with an airspeed of 25 km/h on a bearing of 40° . The path of the blimp is being affected by a wind blowing from the west at 10 km/h, as shown in the diagram below.



- b. The measure of angle θ in the diagram above is 130° .

- c. Determine the magnitude, r , of the resultant velocity of the blimp. Round your answer to the nearest tenth of a kilometre per hour.



$$\begin{aligned} a^2 &= b^2 + c^2 - 2bc \cdot \cos A \\ a^2 &= 25^2 + 10^2 - 2(25)(10) \cdot \cos(130) \\ a^2 &= 908.65 \\ a &= \sqrt{908.65} \\ a &= 30.1 \text{ km/h} \end{aligned}$$

- Determine the bearing, x , of the actual path of the blimp. Round your answer to the nearest degree.

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

$$\cos C = \frac{30.1^2 + 25^2 - 10^2}{2(30.1)(25)}$$

$$\cos C = 0.9508$$

$$C = \cos^{-1}(0.9508)$$

$$C = 0.3148^\circ$$

$$x = 40^\circ + 0.3^\circ$$

$$x = 40.3^\circ$$

The blimp has a bearing of 40.3°

Score – 4

Rationale

The student applied appropriate strategies, mathematical processes, and problem-solving techniques to find a complete solution to the problem; however, the solution contains an error that hinders understanding of the response. In part c, the student's calculator was in radian mode instead of degree mode; therefore, the strategies the student applied to solve this part of the problem are correct, but the solutions obtained from these strategies are incorrect. The solutions to parts a and b were correct and clearly communicated.

Sample 2

Use the following information to answer the next question.

The owner of a hot-air balloon and blimp company obtained a loan for \$50 000 to buy a new hot-air balloon. The following spreadsheet shows some entries in the repayment schedule.

	A	B	C	D	E
1		Repayment Schedule			
2					
3		Amount Borrowed	\$50 000.00		
4		Monthly Payment	\$1 556.00		
5		Period of the Loan (Months)	36		
6		Interest Rate (%/a)	7.5%		
7		Compounding Periods per Year	12		
8					
9	Month	Opening Balance	Interest Charged	Monthly Payment	Closing Balance
10	1	\$50 000.00	I	\$1 556.00	\$48 756.50
11	2	\$48 756.50	\$304.73	\$1 556.00	\$47 505.23
12	3	\$47 505.23	\$296.91	\$1 556.00	\$46 246.14
	*	*	*	*	*
	*	*	*	*	*
	*	*	*	*	*
	*	*	*	*	*
43	34	\$4 583.06	\$28.64	\$1 556.00	\$3 055.70
44	35	\$3 055.70	\$19.10	\$1 556.00	\$1 518.80
45	36	\$1 518.80	\$9.49	\$1 528.29	\$0.00

Written Response—15%

3. a. • Calculate the value for I in cell C10 in the spreadsheet above.

$$50\,000 - 1556 = 48\,444 - 48\,756.5 = -312.5$$

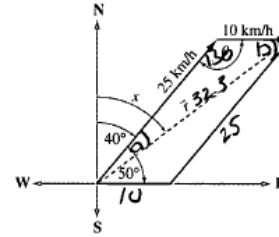
$$I = 312.5$$

- Explain why the final monthly payment is \$1 528.29 instead of \$1 556.00.

because that is all that is left to be paid. $1518.80 + 9.49 = 1528.29$

Use the following additional information to answer the next part of the question.

A blimp is flying with an airspeed of 25 km/h on a bearing of 40° . The path of the blimp is being affected by a wind blowing from the west at 10 km/h, as shown in the diagram below.



- b. The measure of angle θ in the diagram above is 130°.

$$50 + 50 - 360 = 260 / 2 = 130$$

- c. • Determine the magnitude, r , of the resultant velocity of the blimp. Round your answer to the nearest tenth of a kilometre per hour.

$$a^2 = b^2 + c^2 - 2bc \cdot \cos A$$

$$a^2 = 25^2 + 10^2 - 2(25)(10) \cdot \cos 130$$

$$\sqrt{a^2} = \sqrt{1046.393805}$$

$$a = 32.34801083 \quad r = 32.3 \text{ km/h}$$

- Determine the bearing, x , of the actual path of the blimp. Round your answer to the nearest degree. SOH CAH TOA

$$\tan^{-1}\left(\frac{10}{25}\right)$$

$$\angle a = 21.8$$

$$\angle a = 22.9$$

$$x = 40^\circ + 22^\circ$$

$$x = 62^\circ$$

Score – 3

Rationale

The student used appropriate strategies, mathematical processes, and problem-solving techniques to find partial solutions to the problem. The student correctly answered part a, but an oblique triangle was given in parts b and c, so the use of right-angled trigonometry was not an appropriate strategy to solve these parts of the problem. Therefore, the response reflects a basic understanding of the problem.

Sample 3

Use the following information to answer the next question.

Six students from a particular class are travelling by airplane to Europe. They are each allowed to take two suitcases, and no suitcase should have a mass over 32 kg. Any suitcase with a larger mass is classified as overweight, and an extra charge is applied.

At check-in, the mass of each suitcase is determined. The table below lists the mass of each suitcase.

Name	Mass	
	First Suitcase (kg)	Second Suitcase (kg)
Robin	29	24
Terri	27	41
Brianna	31	27
Chantey	34	23
Charlotte	26	30
Mireille	35	28
Total mass of all suitcases		355 kg

Written Response—10%

2. a. Calculate, to the nearest tenth of a kilogram, the mean and standard deviation of the masses of all 12 suitcases.

Mean = 30.3 kg

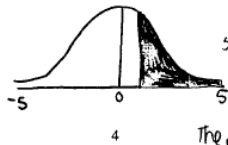
Standard deviation = 3.3 kg

- The airline knows that suitcase masses model a normal distribution. Using your answers from the previous bullet, determine the percentage, to the nearest whole number, of all suitcases that the airline can estimate will be over 32 kg.

$$z = \frac{x - \mu}{\sigma}$$

$$= \frac{32 - 30.3}{3.3}$$

$$z = 0.52$$



$\text{shadnorm}(0.52, 5) = 0.3015$
 $0.3015 \times 100 = 30\%$

The airline can estimate that 30% of suitcases will be over 32kg

Use the following additional information to answer the next part of the question.

The students do not want to leave anything behind or pay extra charges for overweight suitcases, so they decide to repack some of the suitcases. They decide that those students with overweight suitcases will first move items from one of their suitcases to the other. If a student still has an overweight suitcase, she must then move some items into another student's suitcase.

- b. Complete the following table to show how the students could rearrange their items in the suitcases so that there are no overweight suitcases.

Name	Mass	
	First Suitcase (kg)	Second Suitcase (kg)
Robin	29	28
Terri	32	32
Brianna	31	27
Chantey	32	25
Charlotte	26	30
Mireille	32	31
Total mass of all suitcases		355 kg

- added 4 kg from Terri to Robin's second suitcase
 - added 5 kg from Terri's second suitcase to her first
 - added 2 kg from first suitcase to second suitcase
 - added 3 kg from first case to second suitcase

- c. Explain how repacking the suitcases may affect the mean and standard deviation of the masses of all 12 suitcases. Justify your answer.

The mean stays the same but the standard deviation went down to 2.2 because the weight is more evenly distributed and closer to the mean.

Score – 3

Rationale

The student's response reflects a basic understanding of the problem. Part a, bullet 2, was done correctly based on incorrect values from bullet 1; therefore, the student was given credit for this part of the problem. The student's response to part b was correct and clearly explained, but in part c, the student did not justify the change to the mean. This omission affected the clarity of the response for this part of the problem.

Sample 4

Use the following information to answer the first question.

A homeowner has a budget of \$3 000 to renovate the bathtub area of a bathroom. The table below shows the cost of everything required in the renovation except for the cost of replacing the tiles surrounding the bathtub.

Item	Quantity	Unit Price	Total Price
Jet Tub	1	\$2 200	\$2 200
Faucets (set)	1	\$ 150	\$ 150
Plumbing Costs	N/A	N/A	\$ 200
Tiles			
Total Cost			\$3 000

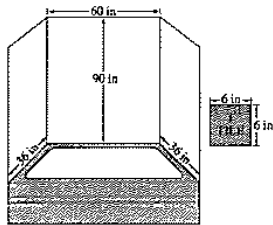
All prices include GST.

Written Response—10%

- L a. If the homeowner must stay within his budget, then the amount of money that he can spend on tiles is \$ 400.

Use the following additional information to answer the next part of the question.

The diagram at the right shows the measurements of the three walls that will have tiles. The tiles that the homeowner will use are 6 in by 6 in.



- b. Determine the maximum price per tile that the homeowner can spend in order to stay within the budget. Assume that no tiles break.

$$\begin{aligned}
 A &= 60 \times 90 = 5400 & 5400 + 3240 + 3240 &= 11880 \\
 A &= 36 \times 90 = 3240 & 6 \times 6 &= 36 \\
 A &= 36 \times 90 = 3240 & \frac{11880}{36} &= 330 \\
 & & \frac{400}{330} &= 1.36 \\
 & & \text{maximum price per tile should be} & \\
 & & & \text{\$1.36}
 \end{aligned}$$

Use the following additional information to answer the next part of the question.

The homeowner decides to spend extra money to paint the bathroom walls. He measures the walls and determines that there is 110 ft^2 to paint. There is currently oil-based paint on the walls, but he wants them painted with latex paint. He must choose one of the following two options.

Option A: Paint the walls with 1 coat of primer. Then, paint the walls with 1 coat of latex paint. The primer and the latex paint each cost \$9.33 per 945 mL can. Each can will cover 90 ft^2 .

Option B: Paint the walls with a different brand of latex paint that is specifically designed to go directly over oil-based paint. The homeowner will need to apply 2 coats of this paint. A 945 mL can of this paint costs \$13.78 and will cover ~~$87.5 \text{ ft}^2$~~ 112.5 ft^2 .

All prices include GST. Primer and paint are sold only in full cans.

- c. Which option should the homeowner choose if he wishes to minimize costs? Justify your answer mathematically.

$$\begin{aligned}
 \text{Option A} &= 9.33 + 9.33 = 18.66 \\
 90 \text{ ft}^2 + 90 \text{ ft}^2 &= 180 \text{ ft}^2
 \end{aligned}$$

$$\begin{aligned}
 &18.66 \\
 &- 13.78 \\
 &\hline
 &4.88
 \end{aligned}$$

The homeowner should choose option B, because it is cheaper. It also covers 87.5 ft^2 to 112.5 ft^2 .

$$\text{Option B} = \$13.78 + \$13.78 = 27.56$$

$$\begin{aligned}
 \text{Option A} &= \begin{matrix} \text{primer} \\ 9.33 \end{matrix} + \begin{matrix} \text{latex} \\ 9.33 \end{matrix} = 9.33 + 9.33 = 37.32 \\
 &\downarrow \quad \downarrow \\
 &90 \text{ ft}^2 \quad 90 \text{ ft}^2 \\
 &\downarrow \\
 &\text{not enough} \\
 &\text{to cover} \\
 &110 \text{ ft}^2
 \end{aligned}$$

Score – 3

Rationale

The student's response reflects a basic understanding of the problem rather than a good understanding as a result of an omission. The student correctly answered parts a and b, but in part c, neglected to address the cost associated with the range of area coverage possible for the option B paint. Option B is cheaper only if each can covers 112.5 ft^2 . Since the student did not clearly state this, the response contains an omission that affects clarity, and the student earned 3 marks out of a possible 5.

Sample 5

Use the following information to answer the first question.

A homeowner has a budget of \$3 000 to renovate the bathtub area of a bathroom. The table below shows the cost of everything required in the renovation except for the cost of replacing the tiles surrounding the bathtub.

Item	Quantity	Unit Price	Total Price
Jet Tub	1	\$2 200	\$2 200
Faucets (set)	1	\$ 150	\$ 150
Plumbing Costs	N/A	N/A	\$ 200
Tiles			
Total Cost			\$3 000

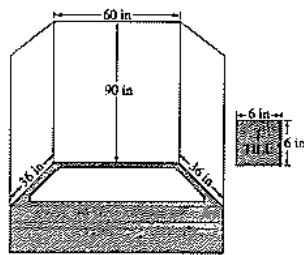
All prices include GST.

Written Response—10%

1. a. If the homeowner must stay within his budget, then the amount of money that he can spend on tiles is \$ 450.

Use the following additional information to answer the next part of the question.

The diagram at the right shows the measurements of the three walls that will have tiles. The tiles that the homeowner will use are 6 in by 6 in.



- b. Determine the maximum price per tile that the homeowner can spend in order to stay within the budget. Assume that no tiles break.

$$\begin{aligned} 36 \times 90 &= 3240 \\ 36 \times 90 &= 3240 \\ 60 \times 90 &= 5400 \end{aligned} \left. \begin{array}{l} \\ \\ \end{array} \right\} \begin{array}{l} 11880 \text{ in}^2 \\ 6 \times 6 = 36 \text{ in}^2 \end{array} = 330 \text{ tiles}$$

$$\frac{330}{450} = .73 \text{ cents per tile}$$

Use the following additional information to answer the next part of the question.

The homeowner decides to spend extra money to paint the bathroom walls. He measures the walls and determines that there is 110 ft^2 to paint. There is currently oil-based paint on the walls, but he wants them painted with latex paint. He must choose one of the following two options.

Option A: Paint the walls with 1 coat of primer. Then, paint the walls with 1 coat of latex paint. The primer and the latex paint each cost \$9.33 per 945 mL can. Each can will cover 90 ft^2 .

Option B: Paint the walls with a different brand of latex paint that is specifically designed to go directly over oil-based paint. The homeowner will need to apply 2 coats of this paint. A 945 mL can of this paint costs \$13.78 and will cover 87.5 ft^2 to 112.5 ft^2 .

All prices include GST. Primer and paint are sold only in full cans.

- c. Which option should the homeowner choose if he wishes to minimize costs? Justify your answer mathematically.

$$\begin{aligned} \text{Option A: } & \$9.33 \text{ primer} = 90 \text{ ft}^2 \\ & \$9.33 \text{ Latex} = 90 \text{ ft}^2 \\ & \$9.33 \text{ primer} = 60 \text{ ft}^2 \text{ rest} \\ & \$9.33 \text{ latex} = 60 \text{ ft}^2 \text{ rest} \\ & \hline & \$37.32 \end{aligned}$$

$$\begin{aligned} \text{Option B: } & 13.78 \text{ 1st coat} \\ & 13.78 \text{ 2nd coat} \\ & \hline & \$27.56 \end{aligned}$$

\$27.56 will be cutting it close for amount of paint that the Home owner has if the Home owner decides to buy another can of paint because he doesn't have enough; it will be \$41.34 the Homeowner should go with option A because the range on option B is to far apart and the maximum use for option B is just what he needs to cover the walls

Score – 4

Rationale

In the response, the student showed a good understanding of the problem and applied appropriate strategies. In part c, the student addressed the range of paint coverage in option B and clearly communicated why he or she would recommend option A. Since the student made a calculation error in part b, he or she earned 4 marks out of a possible 5.

Sample 6

Use the following information to answer the next question.

Regression models can be used to predict the increase that occurs in a particular population of birds that results from the hatching of eggs and the decrease in their population that results from death. The predictions for a particular bird population are shown below.

Increase in population at end of breeding season 130%

Decrease in population as a result of death 60%

Year	Initial Population	Increase (130%)	Population at End of Breeding Season	Decrease (60%)	Total Population at End of Year
0	N/A	N/A	N/A	N/A	200
1	200	260	460	-276	184
2	184	239	423	-253	170
3	170	221	391	-235	156

Written Response—10%

2. a. Complete the row for year 3 in the table above. Round each value to a whole number of birds.
- b. Perform an exponential regression on the data in the table shown below, and state your regression equation in the form $y = a \cdot b^x$. Round the value of a to the nearest whole number and the value of b to the nearest hundredth.

Year	Total Population at End of Year
0	200
1	184
2	170

$$a = 100$$

$$b = 0.92$$

Use the following additional information to answer the next part of the question.

For a different species of bird, the predicted total population at the end of each year can be modelled by the exponential regression equation

$$y = 200(1.05)^x$$

- Is the total population of these birds increasing or decreasing over time? Justify your answer mathematically.

$$200(1.05)^1 = 210$$

$$200(1.05)^2 = 221$$

$$200(1.05)^3 = 232$$

Use the following additional information to answer the next part of the question.

The mass of each adult bird in a different population was measured. The masses form a normal distribution with a mean of 1.24 kg and a standard deviation of 0.08 kg.

- c. Determine the probability, to the nearest hundredth, that a bird in a sample of 200 birds from this population has a mass less than 1.20 kg.

$$\text{Normalcdf}(-10^{99}, 1.20, 1.24, 0.08) = 0.31$$

- Determine how many birds out of the 200 birds in this sample are expected to have a mass less than 1.20 kg.

$$200 \times 0.31 = 62 \text{ birds}$$

Score – 4

Rationale

In the response, the student showed a good understanding of the problem and used appropriate strategies, mathematical processes, and problem-solving techniques to find a complete solution to the problem. Although the student did not state a regression equation in the first bullet in part b, this is not considered an error that hinders understanding because the student stated the appropriate values to be used in the form of the equation that was given in the question. In bullet 2 of part b, the student calculated the population of birds over certain time intervals; however, since these time intervals were not consecutive, the student did not clearly justify or state whether the population of birds is increasing or decreasing over time.

Sample 7

Use the following information to answer the next question.

Regression models can be used to predict the increase that occurs in a particular population of birds that results from the hatching of eggs and the decrease in their population that results from death. The predictions for a particular bird population are shown below.

Increase in population at end of breeding season	130%
Decrease in population as a result of death	60%

Year	Initial Population	Increase (130%)	Population at End of Breeding Season	Decrease (60%)	Total Population at End of Year
0	N/A	N/A	N/A	N/A	200
1	200	260	460	-276	184
2	184	239	423	-253	170
3	170	221	391	-234	157

Written Response—10%

2. a. Complete the row for year 3 in the table above. Round each value to a whole number of birds.
- b. • Perform an exponential regression on the data in the table shown below, and state your regression equation in the form $y = a \cdot b^x$. Round the value of a to the nearest whole number and the value of b to the nearest hundredth.

Year	Total Population at End of Year
0	200
1	184
2	170

EXPREG

0 200
1 184
2 170
3 157

$y = 199.76 \cdot 0.92^x$ (0, 1, 2, 3 etc)

Use the following additional information to answer the next part of the question.

For a different species of bird, the predicted total population at the end of each year can be modelled by the exponential regression equation

$$y = 200(1.05)^x$$

- Is the total population of these birds increasing or decreasing over time? Justify your answer mathematically.

x } $\begin{array}{r} 1 \ 210 \\ 2 \ 220.5 \\ 3 \ 231.5 \end{array}$

$200(1.05)^x$
THE TOTAL POPULATION OF THESE BIRDS ARE INCREASING OVER TIME.

Use the following additional information to answer the next part of the question.

The mass of each adult bird in a different population was measured. The masses form a normal distribution with a mean of 1.24 kg and a standard deviation of 0.08 kg.

- c. • Determine the probability, to the nearest hundredth, that a bird in a sample of 200 birds from this population has a mass less than 1.20 kg.
- Determine how many birds out of the 200 birds in this sample are expected to have a mass less than 1.20 kg.

Score – 3

Rationale

The student applied mathematical knowledge to find a partial solution to the problem by correctly completing parts a and b. In the first bullet of part b, the student did not correctly round the values for a and b in the regression equation; however, this was a minor error that did not hinder the understanding of the response, so the student was not penalized.

Sample 9

Use the following information to answer the next question.

The chart below illustrates the number of movies on VHS tape and the number on DVD that each of three stores ordered from the same wholesale company in a particular month.

Store Name	Number of VHS tapes	Number of DVDs
Future Depot	240	135
World of Movies	200	100
Kat's Movies	310	200

The wholesale price and selling price of VHS tapes and of DVDs are shown in the chart below. The selling price of the VHS tapes and the selling price of the DVDs were the same in each store.

	Wholesale Price	Selling Price
VHS tapes	\$5.00	\$15.00
DVDs	\$8.00	\$25.00

Written Response—15%

3. a. Calculate the total wholesale cost of all the VHS tapes purchased by Future Depot.

$$\text{Future Depot } [240, 135] \begin{matrix} \text{VHS} & \text{DVD} \\ \text{tapes} & \text{discs} \end{matrix} = \$1200$$

$$\text{DVD } 135 \times \$8 = \$1080$$

The wholesale cost for VHS is \$1200, for DVD it's \$1080.

- b. Each store sold all of its VHS tapes and all of its DVDs. Using matrix multiplication, determine the total wholesale cost and the total revenue for each store. Label the rows and columns of your resulting matrix.

3 (2x2) 2 ✓

result is 3x2
the rows display the movie stores and the columns display the wholesale selling prices.

Using Matrix A - Matrix B the resulting matrix shows the total wholesale and total revenue for the 3 movie stores.

Matrix A	Matrix B	resulting Matrix
$\begin{bmatrix} \text{Future Depot} & 240 & 135 \\ \text{World of Movies} & 200 & 100 \\ \text{Kat's Movies} & 310 & 200 \end{bmatrix}$	$\begin{bmatrix} \text{VHS} & \$5.00 & \$15.00 \\ \text{DVD} & \$8.00 & \$25.00 \end{bmatrix}$	$\begin{bmatrix} \text{Future Depot} & \$1200 & \$6975 \\ \text{World of Movies} & \$1000 & \$5000 \\ \text{Kat's Movies} & \$2480 & \$11200 \end{bmatrix}$

- c. Describe how you can use the product matrix from part b to determine Kat's Movies profit. Your answer should make reference to particular entries in the matrix.

To determine the profit of Kat's Movies you take the value \$9650 (row 3, column 2) and subtract \$3150 (row 3, column 1) from it. The result profit from the sales in Kat's Movies would be \$6500.

Use the following additional information to answer the next part of the question.

The following month, the wholesale company increased the wholesale price of VHS tapes and the wholesale price of DVDs by 5%. All three stores also increased their selling prices by 5%. Each store ordered the same number of VHS tapes and DVDs, and again each store sold all of them.

- d. Using matrix operations, determine the new wholesale price and the new selling price of each type of movie. Label the rows and columns of your resulting matrix.

$$\begin{bmatrix} \$2250 & \$6975 \\ \$1000 & \$5000 \\ \$2480 & \$11200 \end{bmatrix} \cdot 1.05 = \begin{matrix} \text{Future Depot} \\ \text{World of Movies} \\ \text{Kat's Movies} \end{matrix} \begin{matrix} \text{Total Wholesale} \\ \text{Total Revenue} \end{matrix} \begin{bmatrix} \$2362.50 & \$7323.75 \\ \$1050 & \$5250 \\ \$2604 & \$11760 \end{bmatrix}$$

- As a result of the 5% increases, will Kat's Movies profit also increase by 5%? Justify your answer mathematically.

Yes, the profit will also increase by 5% because both the former wholesale cost and revenue have increased by 5%. The Total revenue is a different number making the 5% increase or it fluctuate differently as well.

eg. $9650 - 3150 = 6500$ $10,172.50 - 3307.50 = 6865$ $6500 \cdot 1.05 = 6825$

Score – 4

Rationale

The student applied appropriate mathematical knowledge to find a complete solution, and the response reflects a good understanding of the problem. The student used matrix operations and labelled the rows and columns of the resulting matrix. However, the student incorrectly answered part d, bullet 1, which hindered understanding of the response.

Suggested Mathematics and Science Directing Words

Discuss	The word “discuss” should not be used as a directing word on mathematics and science classroom assessments because it is not used consistently to mean a single activity. <i>The following words are specific in meaning.</i>
Algebraically	Using mathematical procedures that involve letters or symbols to represent numbers
Analyze	To make a mathematical, chemical, or methodical examination of parts to determine the nature, proportion, function, interrelationship, etc. of the whole
Compare	Examine the character or qualities of two things by providing characteristics of both that point out their mutual <i>similarities</i> and <i>differences</i>
Conclude	State a logical end based on reasoning and/or evidence
Contrast/Distinguish	Point out the <i>differences</i> between two things that have similar or comparable natures
Criticize	Point out the <i>merits</i> and <i>demerits</i> of an item or issue
Define	Provide the essential qualities or meaning of a word or concept; make distinct and clear by marking out the limits
Describe	Give a written account or represent the characteristics of something by a figure, model, or picture
Design/Plan	Construct a plan, i.e., a detailed sequence of actions, for a specific purpose
Determine	Find a solution, to a specified degree of accuracy, to a problem by showing appropriate formulas, procedures, and calculations
Enumerate	Specify one by one or list in concise form and according to some order
Evaluate	Give the significance or worth of something by identifying the good and bad points or the advantages and disadvantages
Explain	Make clear what is not immediately obvious or entirely known; give the cause of or reason for; make known in detail
Graphically	Using a drawing that is produced electronically or by hand and that shows a relation between certain sets of numbers

How	Show in what manner or way, with what meaning
Hypothesize	Form a tentative proposition intended as a possible explanation for an observed phenomenon; i.e., a possible cause for a specific effect. The proposition should be testable logically and/or empirically
Identify	Recognize and select as having the characteristics of something
Illustrate	Make clear by giving an example. The form of the example must be specified in the question; i.e., word description, sketch, or diagram
Infer	Form a generalization from sample data; arrive at a conclusion by reasoning from evidence
Interpret	Tell the meaning of something; present information in a new form that adds meaning to the original data
Justify/Show How	Show reasons for or give facts that support a position
Model	Find a model (in mathematics, a model of a situation is a pattern that is supposed to represent or set a standard for a real situation) that does a good job of representing a situation
Outline	Give, in an organized fashion, the essential parts of something. The form of the outline must be specified in the question; i.e., lists, flow charts, concept maps
Predict	Tell in advance on the basis of empirical evidence and/or logic
Prove	Establish the truth or validity of a statement for the general case by giving factual evidence or logical argument
Relate	Show logical or causal connection between things
Sketch	Provide a drawing that represents the key features of an object or graph
Solve	Give a solution for a problem; i.e., explanation in words and/or numbers
Summarize	Give a brief account of the main points
Trace	Give a step-by-step description of the development
Verify	Establish, by substitution for a particular case or by geometric comparison, the truth of a statement
Why	Show the cause, reason, or purpose

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