

Grade 12 Mathematics Standards Test

Information Bulletin



GRADE 12 MATHEMATICS
STANDARDS TESTS

Information Bulletin

Manitoba Education Cataloguing in Publication Data

Grade 12 mathematics standards tests :
information bulletin [electronic version]

ISBN 978-0-7711-4898-9

1. Mathematics—Examinations, questions, etc.
2. Mathematics—Study and teaching (Secondary)—Manitoba.
 - I. Manitoba. Manitoba Education.
510.76

Copyright © 2011, the Government of Manitoba, represented by the Minister of Education.

Manitoba Education
School Programs Division
Winnipeg, Manitoba, Canada

Every effort has been made to acknowledge original sources and to comply with copyright law. If cases are identified where this has not been done, please notify Manitoba Education.

Websites are subject to change without notice.

Ce document est disponible en français.

The *Grade 12 Mathematics Standards Tests: Information Bulletin* provides an overview of testing procedures, dates, and features of the Grade 12 Applied Mathematics, Consumer Mathematics, and Pre-Calculus Mathematics Standards Tests. This information is helpful for school personnel as they prepare themselves and students for upcoming provincial testing, and as they communicate this information to parents.

The *Information Bulletin* is one of a series of documents:

- *Policies and Procedures for Standards Tests*
- ***Grade 12 Mathematics Standards Tests: Information Bulletin***
- *Administration Manuals*
- *Information for Local Marking*

These documents prepare teachers and administrators for the administration of the Grade 12 mathematics standards tests. Please use this document in conjunction with the other documents in the series to gain a full understanding of the procedures associated with the testing program at Manitoba Education (“the Department”).

The print versions of the *Information Bulletin* and the other documents in the series are distributed to schools and school divisions. The documents are also available on the Manitoba Education website at <www.edu.gov.mb.ca/k12/assess/s_tests/index.html>.

INQUIRIES

Applied Mathematics

Barbara Riou, Assessment Consultant
Telephone: 204-945-4035
Toll-Free: 1-800-282-8069, ext. 4035
Email: barbara.riou@gov.mb.ca

Consumer Mathematics

Chris Carman, Assessment Consultant
Telephone: 204-945-3411
Toll-Free: 1-800-282-8069, ext. 3411
Email: chris.carman@gov.mb.ca

Pre-Calculus Mathematics

Allison Potter, Assessment Consultant
Telephone: 204-945-7590
Toll-Free: 1-800-282-8069, ext. 7590
Email: allison.potter@gov.mb.ca

Look for changes.



CONTENTS

Introduction	1
Schedule for Standards Tests Administration	1
Procedures for Standards Tests Administration	1
General Description of the Grade 12 Mathematics Standards Tests	2
Item Types	3
The Marking Process	4
Reporting Test Results	4
Using and Interpreting Test Results	5
<hr/>	
Applied Mathematics	7
Grade 12 Applied Mathematics Standards Test	9
Schedule for Test Administration	10
Test Specifications	10
Instructions to Teachers	11
Marking Guidelines	12
Use of Classroom Resources	13
Exemplar Package	15
Related Guides	29
Sample of Instructions to Students: Applied Mathematics	31
<hr/>	
Consumer Mathematics	33
Grade 12 Consumer Mathematics Standards Test	35
Schedule for Test Administration	36
Test Specifications	37
Use of Classroom Resources	37
Related Guides	39
Consumer Mathematics: Project Scoring Rubric	41
Project Scoring Sheet	42
Consumer Mathematics: Portfolio Scoring Rubric	43
Portfolio Scoring Sheet	44
Marking Guidelines for the Written Test	45

Pre-Calculus Mathematics	49
Grade 12 Pre-Calculus Mathematics Standards Test	51
Schedule for Test Administration	51
Test Specifications	52
Item Types	52
Formula Sheet	53
Helpful Hints	53
Graphing	53
Instructions to Teachers	54
Instructions to Students	56
Marking Guidelines	56
Use of Classroom Resources	56
Calculator Use on Grade 12 Pre-Calculus Mathematics Standards Test	57
Related Guides	59
Formula Sheet: Pre-Calculus Mathematics	61
Helpful Hints: Pre-Calculus Mathematics	62
Marking Guidelines: Pre-Calculus Mathematics	63
Sample of Instructions to Students: Pre-Calculus Mathematics	65

Introduction

As outlined in *Policies and Procedures for Standards Tests*, students enrolled in the following Grade 12 mathematics courses are required to write the corresponding Grade 12 mathematics standards test as part of the provincial requirements for completing the course:

- Applied Mathematics
- Consumer Mathematics
- Pre-Calculus Mathematics

All Grade 12 mathematics standards tests are to be marked locally. These tests count for 30% of each student's final grade in the course. The Department will provide assistance to school jurisdictions in preparing for local marking.

For Applied Mathematics and Pre-Calculus Mathematics, the Department will centrally mark a sample of the locally marked test booklets to provide feedback to jurisdictions on their local marking. For Consumer Mathematics, there will not be central marking of a sample of locally marked test booklets. The Department will, however, scan the *Answer/Scoring Sheets* of all three tests for all jurisdictions and provide them with result summaries for the school division and for individual schools.

Schedule for Standards Tests Administration

Semester	Applied Mathematics	Consumer Mathematics	Pre-Calculus Mathematics
1	January 25–26, 2012*	Portfolio: prior to January 24, 2012 Project: between November 28 and December 5, 2011 Written Test: January 24, 2012*	January 23, 2012*
2	June 11–12, 2012*	Portfolio: prior to June 13, 2012 Project: between April 23 and April 30, 2012 Written Test: June 13, 2012*	June 14, 2012*

* Please note that students must write the Grade 12 mathematics standards tests between 8:30 a.m. and 12:30 p.m. Please refer to the test-specific sections for the duration of each test.

Procedures for Standards Tests Administration

Approximately one month prior to the test administration dates, the test-specific administration manual will be sent to schools so that teachers and administrators can familiarize themselves with specific administration procedures and the requirements of each test.

Test materials will be mailed two to three weeks prior to the test dates. Once test materials are in the school, the school principal will be responsible for ensuring that they are kept secure until test administration and are only accessed by authorized personnel.

All shrink-wrapped student booklets are not to be opened until the day of the test and all marking guides are not to be opened until the test administration has been completed.

In order to ensure that the test results are reliable and valid, tests must be administered strictly according to the procedures prescribed in the test-specific administration manual.

Policies on student absenteeism during the test, late arrivals, and other circumstances for missing a standards test are provided in the document *Policies and Procedures for Standards Tests*, which is sent to all Grade 12 schools at the beginning of each school year and available online at <www.edu.gov.mb.ca/k12/assess/docs/pol_proc/index.html> (see sections 4.1 and 4.2). This document also describes the policies and procedures regarding cheating and plagiarism (see section 7.0). Detailed instructions regarding the marking and reporting of standards test results for students who miss part of a standards test are provided in the respective test administration manuals and with marking materials sent to schools for local marking, as applicable.

Adaptations for standards tests are available for students with special needs, including, for example, Braille versions of tests and the use of a scribe. More detailed information about adaptations is provided in section 3.3 of the document *Policies and Procedures for Standards Tests*. In the event that an adaptation affects how a test is scored, detailed instructions are provided in adaptation-related correspondence and with marking materials sent to schools for local marking.

General Description of the Grade 12 Mathematics Standards Tests

The Grade 12 mathematics standards tests are developed provincially. They are administered in school jurisdictions toward the end of the school year or semester to students registered in any of the following courses: Applied Mathematics, Consumer Mathematics, and Pre-Calculus Mathematics.

Design and development

Standards tests are developed by a committee. Each test development committee consists of an assessment consultant and a number of classroom teachers. The selection of teachers having varied experience in teaching is made in order to form a committee representative of the province: men and women from urban and rural regions, and teaching in the English, French Immersion, or Français programs.

The role of the test development committee is to ensure that the standards test is as congruent as possible with the curriculum within the parameters of large-scale testing. Using the established curriculum, committee members design questions to assess as many outcomes as possible, and develop marking keys and scoring rubrics to go along with the test. At this point, the curriculum consultants (one from the Bureau de l'éducation française and one from the Instruction, Curriculum and Assessment Branch) are invited to comment on the test content.

Piloting process

The newly-created standards test is then pilot tested. This process allows for an examination of the test itself and a verification of the marking keys and scoring rubrics.

The pilot test is designed to simulate the real testing situation. Schools from a balance of programs (English, French Immersion, and Français) are invited to participate in the pilot testing process. To ensure precise feedback, pilot tests are administered consistently across the province.

Once the pilot test has been administered, the students' responses are analyzed to determine the strengths and weaknesses of the test. Additionally, feedback is solicited from classroom teachers, departmental test supervisors, markers, and students to determine what worked and what did not. After this information has been reviewed, changes are made to the test in an attempt to make it as strong as possible in terms of reliability, validity, and fairness to students.

Item Types

Multiple-choice items

For these items, students select the correct answer from the four suggested answers and record their choices on an answer sheet. Each multiple-choice item is worth 1 mark. There is no penalty for guessing.

Constructed-response items

Items in this category require students to generate the answer rather than select it from a set of suggested answers. The different types of constructed-response items are:

Restricted-response items

To answer this type of item, the student may carry out several steps (arithmetical, diagrammatical, or graphical) in accordance with procedures that have been practised and are recognized as being appropriate strategies for the item. For these items, there is **only one correct answer**, although various equally-valid strategies can lead to the answer.

Restricted-response with explanation items

These items are similar to restricted-response items, except that the student must provide an **explanation of concepts** or **justification** for his or her answer. This could be done through labelled diagrams, in words, by showing mathematical operations to verify answers, or by referring to a software or calculator program.

Open-response items

These items are designed to allow a variety of answers at all levels of performance. They are also designed to allow students to communicate their reasoning. There is **more than one correct answer** for this type of item or, conversely, **various equally-valid strategies** leading to the answer.

The Marking Process

The Grade 12 mathematics standards tests are marked locally. In preparation for local marking, the Department will provide local marking training sessions and/or training materials that focus on how to score tests using marking guides and/or scoring rubrics. Materials will be provided that contain sample student responses (i.e., exemplars) assessed according to the marking guide or scoring rubric and accompanied by explanations justifying the score obtained. Divisions are encouraged to conduct training sessions locally so that all markers become familiar with the marking guides and scoring rubrics before the marking of the test.

For Applied Mathematics and Pre-Calculus Mathematics, the Department will request a random sample of locally-marked tests (there is no such request for Consumer Mathematics standards tests). Immediately upon completion of local marking, schools must send all scoring sheets and the randomly-selected test booklets to the Department. These tests are then marked centrally using a chain-marking system established by the Department. To provide feedback on the local marking process, a report is made available for each individual jurisdiction based on test scores allocated in the jurisdiction and those allocated centrally by the Department.

Teachers receive the marking guides containing the marking keys, scoring rubrics, exemplars, and rationales to mark students' tests on the last day of the test administration.

Reporting Test Results

Grade 12 standards tests count for 30% of the student's final grade.

Schools will report standards test results to students immediately after local marking. **Schools must report individual student results on provincial standards tests separately from term marks when showing final grades on report cards and in school files.** Teachers can also provide additional information to students and parents, such as the production of student profiles.

Using and Interpreting Test Results

It is expected that Grade 12 mathematics teachers will use test results, along with other information about student learning, to identify specific strengths and weaknesses in student performance. Teachers are encouraged to plan instruction for the coming year based on pertinent information drawn from standards tests results and from other assessments of student performance. As well, schools must share the results with parents.

It is understood that student performance on tests reflects cumulative growth and achievement as a result of mathematics instruction from previous years, not only from instruction received in Grade 12 mathematics. Superintendents and school principals should ensure that information from standards test results is shared with other staff members so that all staff concerned is involved in aligning school programs to meet student needs.

Plans should be made to share information from standards test results with Advisory Councils for School Leadership and other parent council structures so that strategies to improve learning opportunities may be discussed. School administrators and classroom teachers are encouraged to develop strategies for involving parents and the community in order to help students meet the provincial standards and to support schools in the maintenance of their programs.



APPLIED MATHEMATICS

- Grade 12 Applied Mathematics Standards Test
- Schedule for Test Administration
- Test Specifications
- Instructions to Teachers
- Marking Guidelines
- Use of Classroom Resources
- Exemplar Package
- Related Guides
- Sample of Instructions to Students: Applied Mathematics

Grade 12 Applied Mathematics Standards Test

The Grade 12 Applied Mathematics Standards Test is based on two documents: *Senior 4 Applied Mathematics: A Foundation for Implementation* (2000), which includes the 2002 update for Unit E: “Variability and Statistical Analysis,” and *Senior 4 Mathematics: Manitoba Curriculum Framework of Outcomes and Senior 4 Standards* (2001).

The test includes two parts: an Inquiry Task and a Written Test. The two parts will be administered in two sessions and on two consecutive days between 8:30 a.m. and 12:30 p.m. English and French versions of the test are available.

Inquiry Task

The Inquiry Task includes questions from two curriculum units. The two units assessed by the Inquiry Task for this school year are **Design and Measurement** and **Vectors**. See “Exemplar Package” beginning on **page 15** for more information.

The maximum time for completing the Inquiry Task is two hours. This part counts for approximately 25% of the final mark of the Grade 12 Applied Mathematics Standards Test. Students will require the use of technology, such as a graphing calculator or a computer, depending on the tools for instruction used in the classroom. They can write their answers in the space provided in the test booklet, or they can print their answers from the computer.

The main characteristic of the Inquiry Task is the investigative nature of the questions, which requires the student to engage in some reflection in order to solve problems. It includes constructed-response questions that may be restricted-response, restricted-response with explanation, or open-response. There are no multiple-choice questions in the Inquiry Task.

Written Test

The Written Test includes questions from the six other curriculum units.

The maximum time for completing the Written Test is two and a half hours. This part counts for approximately 75% of the final mark of the Grade 12 Applied Mathematics Standards Test. Students will require the use of technology, such as a graphing calculator or a computer, depending on the tools used in the classroom for instruction. They can write their answers in the space provided in the test booklet, or they can print their answers from the computer.

The Written Test includes multiple-choice questions as well as constructed-response questions.

Schedule for Test Administration

Semester	Date	Part	Duration
1	January 25, 2012*	Inquiry Task	2 hours
	January 26, 2012*	Written Test	2.5 hours
2	June 11, 2012*	Inquiry Task	2 hours
	June 12, 2012*	Written Test	2.5 hours

* Please note that students must write the Grade 12 Applied Mathematics Standards Test between 8:30 a.m. and 12:30 p.m.

Test Specifications

The following table indicates the approximate percentage of test marks according to each unit of the curriculum.

Table 1 Approximate Percentage by Unit	
Unit	Approximate Percentage (%)
A: Matrices	12.5
B: Vectors	12.5
C: Personal Finance	12.5
D: Probability	12.5
E: Variability and Statistical Analysis**	12.5
F: Design and Measurement	12.5
G: Periodic Functions	12.5
H: Sequences	12.5

** An update to the *Senior 4 Applied Mathematics: A Foundation for Implementation (2000)* document dealing with the Variability and Statistical Analysis unit was sent to schools in December 2002. On page E-30 it states: "A theoretical approach to the study of binomial distributions is not required for this course. Students should be able to recognize binomial situations and to apply the formulas required to give the mean and standard deviation for predicting the results in binomial situations."

Please be aware that students may require certain formulas to complete some test questions related to the unit on Variability and Statistical Analysis that were not explicitly demonstrated in the December 2002 update. To find the mean (μ) and the standard deviation (σ) in binomial distributions, the formulas are:

$$\mu = np \quad \sigma = \sqrt{npq} \quad \text{where } n \text{ is the number of pieces of data, } p \text{ is the probability of success, and } q \text{ is the probability of failure } (1 - p = q).$$

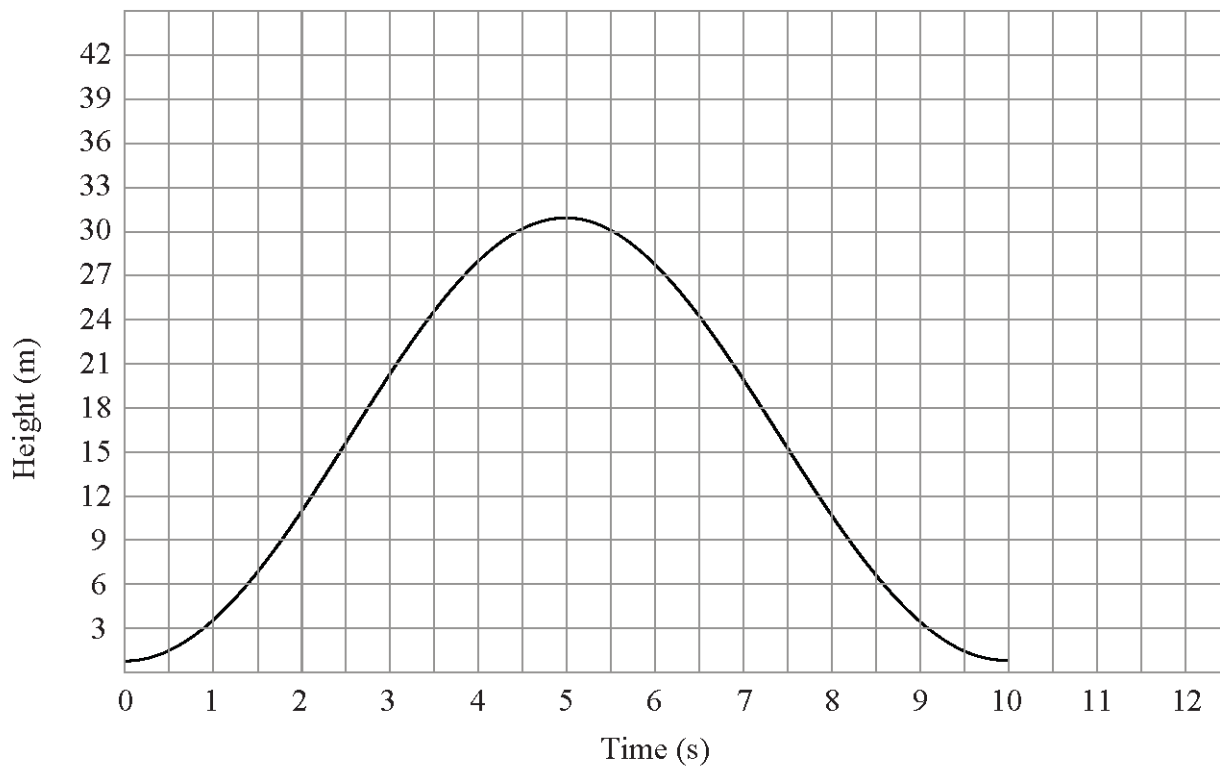
The Grade 12 Applied Mathematics Standards Test includes two main categories of questions. Table 2 indicates the approximate distribution of questions by category and by type.

Table 2 Approximate Distribution of Questions by Category and by Type		
Question Category	Question Type	Approximate Percentage (%)
Selected response	Multiple choice	12
Constructed response	Restricted response	30
	Restricted response with explanation	20
	Open response	38

Instructions to Teachers

- A clearly labelled graph will include the following:
 - labels with units on both axes; for example, time (s) and height (m)
 - an indication of scales on both axes
 - an appropriate shape (whether it is straight or curved)

Example:



- A sample space must include the final outcomes.
- Graphing calculators must be set in degree mode for the Vectors unit and in radian mode for the Periodic Functions unit.
- It is necessary for students to round their final answers to the nearest two decimal places.

Marking Guidelines

In addition to the general marking instructions, the following marker notes appear in the marking guide and indicate possible 0.5 mark deductions with respect to technical communication errors.

Unit A: Matrices

Maximum 0.5 mark deduction per question if student forgets to use brackets on matrices.

Maximum 0.5 mark deduction per question if student does not express transition matrices in decimal or percentage form.

Unit B: Vectors

Maximum 0.5 mark deduction per question if student does not state a scale when using scale diagrams as a strategy.

Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches.

Unit D: Probability

Maximum 0.5 mark deduction per question if student does not include the final outcomes when asked for sample spaces.

Unit F: Design and Measurement

Maximum 0.5 mark deduction per question if student does not buy materials in whole units or rounds to whole units too soon. (Example: When calculating the number of cans of paint required in a question, students must consider all coats of paint before rounding.)

Unit G: Periodic Functions

Maximum 0.5 mark deduction per question if student forgets to include or incorrectly places “ $y =$ ”, “ \sin ”, or “ x ” when asked for equations.

Maximum 0.5 mark deduction per question if student does not draw a clearly labelled graph. A clearly labelled graph will include labels with units on both axes, an indication of scales on both axes, and an appropriate shape.

The marking of equations in the Periodic Functions unit has changed. Instead of awarding “2 marks for correct equation (0.5 mark for each of the parameters a, b, c, and d)”, award “1 mark for correct sinusoidal equation” and “1 mark for correct explanation”.

Example: Determine the sinusoidal equation which best represents your graph. Explain how you arrived at your answer.

$y = 5 \sin(0.52x - 3.14) + 30$	OR	$y = -5 \sin(0.52x) + 30$
Enter data into L1 and L2. Use SinReg to find equation.		This is an inverted sine curve with an amplitude of 5, a median value of 30, and a period of 12.

Marker Note(s):

→ Maximum 0.5 mark deduction per question if student forgets to include or incorrectly places “y =”, “sin”, or “x” when asked for equations.

Mark(s):

→ 1 mark for correct sinusoidal equation
→ 1 mark for correct explanation

Use of Classroom Resources

During the test, students need a pencil, a geometry set, and a graphing calculator or a computer. Students are allowed to use a bilingual dictionary containing only translations and no definitions.

Access to Internet tools used in the everyday Applied Mathematics class, such as applets or a mortgage payment calculator, is allowed during the test. The same measure applies to student-created templates such as spreadsheets and programs downloaded to the graphing calculator during the school year. Use of the Internet to access course notes, find definitions, or search for conceptual information about the course is **strictly prohibited** during the test and must be monitored by the supervising teacher.

Each student may bring **one** study sheet, prepared in advance, and refer to it during the Inquiry Task and Written Test. Both sides of an 8½” x 11” sheet may be used. This sheet may contain any information. Students may keep their study sheet after the first test session and bring it back for the second test session. There is no longer a formula sheet included in the test materials for student reference.

The rationale for this procedure is found on page 9 of *Senior 4 Applied Mathematics: A Foundation for Implementation* (2000).

One technique that pilot teachers found particularly helpful was to have each student prepare notes, formulae, and example questions on a sheet of paper and bring that sheet to all tests and examinations. The value of the sheet is [in] its creation. Students learn to discriminate between what might be required and what they already know, and demonstrate responsibility in the creation and maintenance of useful information and formulae throughout *Senior 4 Applied Mathematics*. Rather than simply memorizing information, they are consciously deciding what information to include and/or exclude.

An example of the instructions to students as they appear in each student's test booklet is presented on page 31.

The following materials must **not** be used during the test:

- textbooks and other similar documents
- subject-related materials on display
- dictionaries (other than bilingual dictionaries)

Note: Electronic communication between students through phones, email, or file sharing during the test is **strictly prohibited**. Students must turn off cellphones and all other electronic devices for the duration of the tests.

These restrictions are necessary to ensure fair assessment practices and parallel testing conditions in all participating schools throughout Manitoba.

EXEMPLAR PACKAGE

Introduction

This *Exemplar Package* has been prepared to introduce the Inquiry Task question from the **Vectors** unit. It is intended for use by teachers as they help students prepare for the Grade 12 Applied Mathematics Standards Tests.

This *Exemplar Package* contains a marking key and samples of student work for the Inquiry Task question. Rationales for the marks awarded to the exemplars are provided in order to help focus and clarify the marking criteria, and to make connections between the learning outcomes and standards.

Note that the content from the **Periodic Functions** unit will now be evaluated in the Written Test.

Vectors—Learning Outcomes B1, B2, B3—Open-Response Question

1. Two eaglets (baby eagles) are pulling on the same piece of fish in their nest. One eaglet is pulling with a force of 0.4 newtons in a direction of 20° west of south. The other eaglet is pulling with a force of 0.3 newtons in a direction of 34° south of east.

Total:
10 marks

- a) Draw a scale diagram of the two forces. Determine the magnitude and direction of the resultant force acting on the piece of fish. Show your work.

(4 marks)

- b) A crow sees the piece of fish in the eagle's nest and steals it. It wants to avoid the eaglets' mother who is 2 km northwest of her nest. The crow must bring the fish to its own family located 3 km northwest of the eagle's nest.

Design a route that the crow can take so that its journey is between 4 km and 10 km. The crow begins its journey by flying in a direction of $N 75^\circ E$, and must keep a distance of at least 400 m from the mother eagle. Indicate all the distances and directions. Show your work.

(4 marks)

- c) According to your route, determine the closest distance between the crow and the mother eagle. Explain how you arrived at your answer.

(2 marks)

Inquiry Task Question No. 1 and Answer

VECTORS

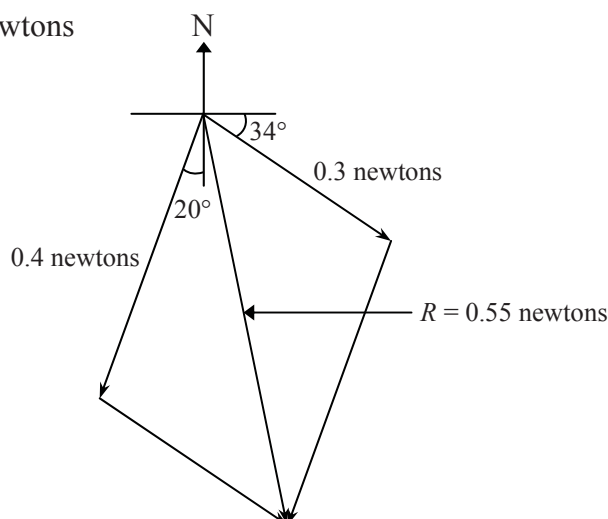
1. Two eaglets (baby eagles) are pulling on the same piece of fish in their nest. One eaglet is pulling with a force of 0.4 newtons in a direction of 20° west of south. The other eaglet is pulling with a force of 0.3 newtons in a direction of 34° south of east.

Total:
10 marks

- a) Draw a scale diagram of the two forces. Determine the magnitude and direction of the resultant force acting on the piece of fish. Show your work.

(4 marks)

Scale: 1 cm = 0.1 newtons



The resultant force acting on the piece of fish is 0.55 newtons
in a direction of 11° east of south.

Marker Note(s):

- Maximum 0.5 mark deduction per question if student does not state a scale when using scale diagrams as a strategy.
- Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches.
- Maximum 1 mark deduction per question if student uses the **same** incorrect directional method.
- Award a maximum of 2 marks in (a) if student adds the vectors tail-to-tail.

Mark(s):

- ① → 1 mark for correct first vector
- ② → 1 mark for correct second vector
- ③ → 1 mark for appropriate work
- ④ → 1 mark for correct answer

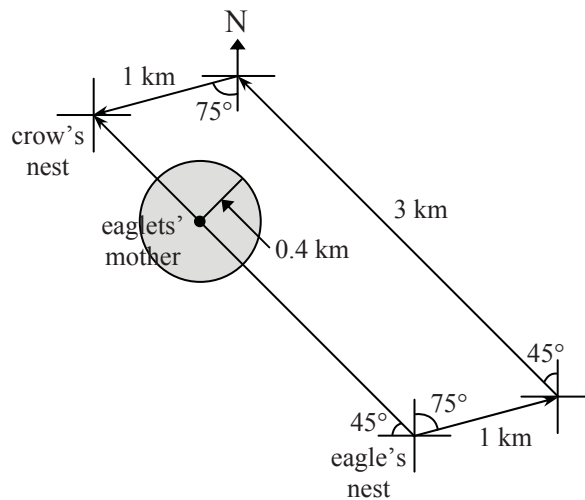
Question No. 1 continued

- b) A crow sees the piece of fish in the eagle's nest and steals it. It wants to avoid the eaglets' mother who is 2 km northwest of her nest. The crow must bring the fish to its own family located 3 km northwest of the eagle's nest.

Design a route that the crow can take so that its journey is between 4 km and 10 km. The crow begins its journey by flying in a direction of $N 75^\circ E$, and must keep a distance of at least 400 m from the mother eagle. Indicate all the distances and directions. Show your work.

(4 marks)

Scale: 1 cm = 0.5 km



The crow can fly 1 km in a direction of $N 75^\circ E$, 3 km northwest, and then 1 km in a direction of $S 75^\circ W$ to bring the fish to its own family.

Other answers are possible.

Marker Note(s):

- Maximum 0.5 mark deduction per question if student does not state a scale when using scale diagrams as a strategy.
- Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches.
- Maximum 1 mark deduction per question if student uses the **same** incorrect directional method.

Mark(s):

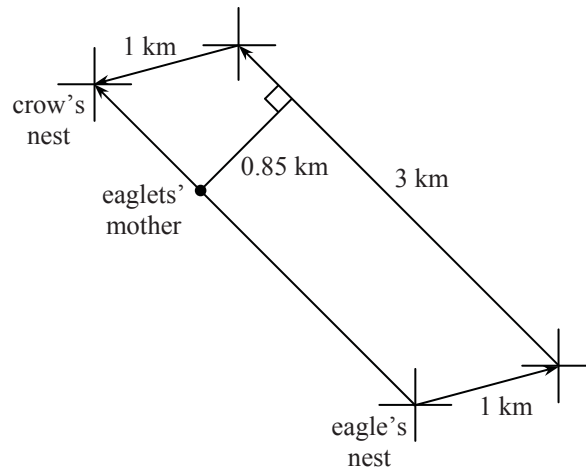
- ⑤ → 1 mark for vector which begins in a direction of $N 75^\circ E$
- ⑥ → 1 mark for route between 4 km and 10 km
- ⑦ → 1 mark for correct directions, including the location of the crow's nest
- ⑧ → 1 mark for route that is at least 400 m from the mother eagle

Question No. 1 continued

- c) According to your route, determine the closest distance between the crow and the mother eagle. Explain how you arrived at your answer.

(2 marks)

Scale: 1 cm = 0.5 km



According to my route, the closest distance between the crow and the mother eagle is 0.85 km. I drew a perpendicular line (the shortest distance) from the crow's flight path to the mother eagle.

Marker Note(s):

- Maximum 0.5 mark deduction per question if student does not state a scale when using scale diagrams as a strategy.
- Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches.
- Maximum 1 mark deduction per question if student uses the **same** incorrect directional method.

Mark(s):

- ⑨ → 1 mark for appropriate work or explanation
- ⑩ → 1 mark for correct answer based on route in (b)

Question No. 1 continued

Scoring Rubric

General Performance Indicators			
Level 1—limited understanding			
1 mark weak attempt: inappropriate strategy or no strategy 1 criterion correct	2 marks reasonable attempt: inappropriate strategy, major errors or omissions 2 criteria correct	3 marks reasonable attempt: inappropriate strategy but carried through correctly 3 criteria correct	
Level 2—good understanding			
4 marks sound strategy with major errors 4 criteria correct	5 marks sound strategy with minor errors 5 criteria correct	6 marks mostly complete with some omissions 6 criteria correct	7 marks almost complete and correct, major errors 7 criteria correct
Level 3—exceptional understanding			
8 marks complete, two minor errors, trivial errors 8 criteria correct	9 marks complete, one minor error 9 criteria correct	10 marks complete and correct 10 criteria correct	

Marker Note(s):

- Maximum 0.5 mark deduction per question if student does not state a scale when using scale diagrams as a strategy.
- Maximum 0.5 mark deduction per question if student forgets more than one arrowhead in scale vector diagrams or required vector sketches.
- Maximum 1 mark deduction per question if student uses the **same** incorrect directional method.
- Award a maximum of 2 marks in (a) if student adds the vectors tail-to-tail.

Marking Key		
①		1 mark for correct first vector
②	a)	1 mark for correct second vector
③		1 mark for appropriate work
④		1 mark for correct answer
⑤		b)
⑥	1 mark for route between 4 km and 10 km	
⑦	1 mark for correct directions, including the location of the crow's nest	
⑧	1 mark for route that is at least 400 m from the mother eagle	
⑨	c)	1 mark for appropriate work or explanation
⑩		1 mark for correct answer based on route in (b)

Exemplar 1

VECTORS

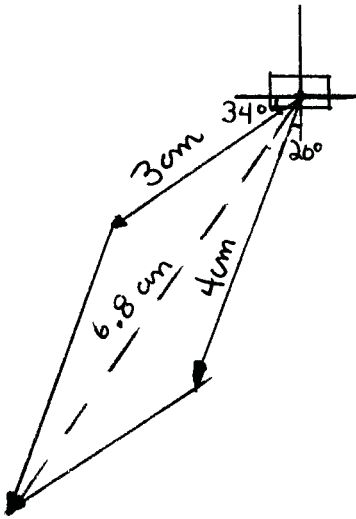
1. Two eaglets (baby eagles) are pulling on the same piece of fish in their nest. One eaglet is pulling with a force of 0.4 newtons in a direction of 20° west of south. The other eaglet is pulling with a force of 0.3 newtons in a direction of 34° south of east.

Total:
10 marks

- a) Draw a scale diagram of the two forces. Determine the magnitude and direction of the resultant force acting on the piece of fish. Show your work.

(4 marks)

$$1 \text{ cm} = 0.1 \text{ newton}$$



$$6.8 \times 0.1 = 0.68 \text{ newton}$$

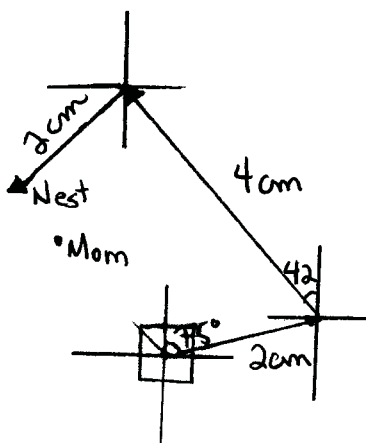
Direction $E 54^\circ S$

- b) A crow sees the piece of fish in the eagle's nest and steals it. It wants to avoid the eaglets' mother who is 2 km northwest of her nest. The crow must bring the fish to its own family located 3 km northwest of the eagle's nest.

Design a route that the crow can take so that its journey is between 4 km and 10 km. The crow begins its journey by flying in a direction of $N 75^\circ E$, and must keep a distance of at least 400 m from the mother eagle. Indicate all the distances and directions. Show your work.

(4 marks)

$$1 \text{ cm} = 1 \text{ km}$$



$$2 \text{ km } N 75^\circ E \rightarrow 4 \text{ km } N 42^\circ W \rightarrow 2 \text{ km } E 42^\circ S$$

Total route 8 km

- c) According to your route, determine the closest distance between the crow and the mother eagle. Explain how you arrived at your answer.

(2 marks)

The closest distance from the mother is 1 km, the distance that separates the crow's nest from the mother eagle.

8 marks:		
1		1 mark for correct first vector
3	a)	1 mark for appropriate work
4		1 mark for correct answer
5		1 mark for vector which begins in a direction of $N 75^\circ E$
6	b)	1 mark for route between 4 km and 10 km
8		1 mark for route that is at least 400 m from the mother eagle
9	c)	1 mark for appropriate work or explanation
10		1 mark for correct answer based on route in (b)

Exemplar 2

VECTORS

1. Two eaglets (baby eagles) are pulling on the same piece of fish in their nest. One eaglet is pulling with a force of 0.4 newtons in a direction of 20° west of south. The other eaglet is pulling with a force of 0.3 newtons in a direction of 34° south of east.

Total:
10 marks

- a) Draw a scale diagram of the two forces. Determine the magnitude and direction of the resultant force acting on the piece of fish. Show your work.

(4 marks)

$$1 \text{ cm} = 0.1 \text{ N}$$

$$m\angle DEF = 20^\circ$$

$$m \overline{EF} = 4.00 \text{ cm}$$

$$m\angle BEH = 34^\circ$$

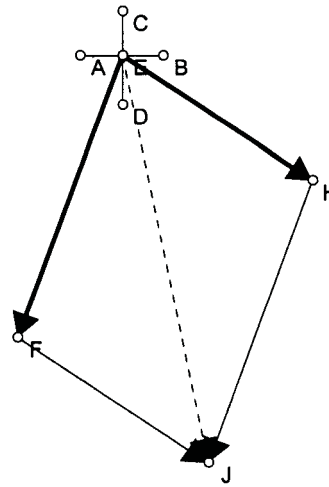
$$m \overline{EH} = 2.99 \text{ cm}$$

$$m \overline{HJ} = 4.00 \text{ cm}$$

$$m \overline{FJ} = 2.99 \text{ cm}$$

$$m \overline{EJ} = 5.54 \text{ cm}$$

$$m\angle DEJ = 12^\circ$$

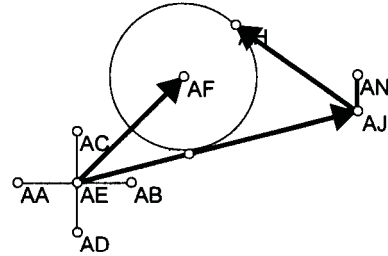


the resultant magnitude and direction is
5.54 newtons in a direction of 12° east of south

- b) A crow sees the piece of fish in the eagle's nest and steals it. It wants to avoid the eaglets' mother who is 2 km northwest of her nest. The crow must bring the fish to its own family located 3 km northwest of the eagle's nest.

Design a route that the crow can take so that its journey is between 4 km and 10 km. The crow begins its journey by flying in a direction of N 75° E, and must keep a distance of at least 400 m from the mother eagle. Indicate all the distances and directions. Show your work.

(4 marks)



1 cm = 1 km

$$m \overline{AEAF} = 1.99 \text{ cm}$$

$$m \angle CAEAF = 45^\circ$$

$$m \angle BAEAJ = 15^\circ$$

$$m \overline{AEAJ} = 3.80 \text{ cm}$$

$$m \overline{AJAH} = 1.95 \text{ cm}$$

$$m \angle ANAJAH = 54^\circ$$

the crow must fly 3.80 kms in a direction of N 75° E then fly 1.95 kms in a direction of N 54° W to reach its nest without being caught by the mother eagle

- c) According to your route, determine the closest distance between the crow and the mother eagle. Explain how you arrived at your answer.

(2 marks)

the closest distance the crow flies to the mother eagle is 1 km. I got this by making a circle around the mother eagle and where the circle touched first would be the closest place the crow would be to the mother eagle and that distance was 1 km.

8 marks:		
①		1 mark for correct first vector
②	a)	1 mark for correct second vector
③		1 mark for appropriate work
⑤		1 mark for vector which begins in a direction of N 75° E
⑥	b)	1 mark for route between 4 km and 10 km
⑧		1 mark for route that is at least 400 m from the mother eagle
⑨		1 mark for appropriate work or explanation
⑩	c)	1 mark for correct answer based on route in (b)

RELATED GUIDES

Sample of Instructions to Students: Applied Mathematics

SECTION B: CONSTRUCTED-RESPONSE QUESTIONS

Value: 46 marks

Suggested Time: 130 minutes

DIRECTIONS

- There are 13 constructed-response questions in this section of the test. Each question is worth from 2 to 6 marks.
- Provide **complete answers** in the spaces provided in the test booklet. You may print out diagrams from the computer or your calculator where applicable. Indicate your booklet number and question number on the printouts and staple them into the booklet where your answer begins. Remain seated and your teacher will distribute these printouts to you. Indicate in the response space of the question that the answer is on a printed sheet.
- If you need more space to answer a question in Section B, extra paper may be provided by your teacher. Write your booklet number and question number on any extra paper used and staple it into the booklet where your answer begins. Indicate in the response space of the question that the answer is on a separate sheet.
- Provide clear explanations or justifications where applicable. This can be done through labelled diagrams, in words, by showing mathematical operations to verify your answer, or by referring to a calculator or software program.
 - If you refer to a calculator program, indicate your input values.
 - If you refer to a software program or a website, indicate your input values and print or copy the screen showing the answers.
 - If you refer to a spreadsheet, print a copy of the answers.
- Let the mark values for each question guide your time and the amount of detail you use in your answer.
- Round your final answers to the nearest two decimal places.
- Unless otherwise indicated, it is not necessary to draw diagrams to scale. If you draw a diagram to scale, make sure to indicate the scale you used.
- An answer without any work shown will be considered incomplete.
- Always state your assumptions.



CONSUMER MATHEMATICS

- Grade 12 Consumer Mathematics Standards Test
- Schedule for Test Administration
- Test Specifications
- Use of Classroom Resources
- Related Guides
- Consumer Mathematics: Project Scoring Rubric
- Project Scoring Sheet
- Consumer Mathematics: Portfolio Scoring Rubric
- Portfolio Scoring Sheet
- Marking Guidelines for the Written Test

Grade 12 Consumer Mathematics Standards Test

The test is administered and scored by the classroom teacher. English and French versions of the test are available.

The Grade 12 Consumer Mathematics Standards Test is divided into three parts. The **first part** of the test, the Portfolio, will be distributed early in each semester to permit teachers flexibility in the timing of the assessment. The **second part** of the test, the Project, will be distributed mid-semester to allow teachers additional time to mark. The **third part** of the test, the Written Test, will be distributed towards the end of each semester. For non-semestered schools, the schedule for Semester 2 testing will apply unless alternate arrangements have been made.

Project component

The Project component of the Grade 12 Consumer Mathematics Standards Test is administered mid-semester over three 60-minute periods within a **one-week** time span, and is scored by the classroom teacher using the *Project Resource Package*, *Project Scoring Guide*, and *Project Scoring Sheet* provided by the Department. A general brainstorming session precedes the individual work periods. The *Project Resource Package* contains sufficient research materials for students to complete the Project. Although **students may research ideas between work periods, they may not bring project related materials in or out of the classroom. No material may be reproduced, removed from the classroom, or brought into the classroom for the project sessions.** It is expected that students complete the project in class, during the designated testing period. A copy of the rubric and the scoring sheet for the Project component are located on pages 41 and 42. **A copy of the rubric appears in the student's *Project Resource Package*.**

The Project counts for 30% of the total standards test.

In cases where a teacher uses a computer lab during the project, students must not have access to the Internet. Students are not permitted to email project files, post files on web pages, save to portable memory devices, or the like to prohibit the electronic transfer of project information. Please note that students are not required to word-process their projects: not all students have access to this resource, and should not be penalized with a reduction of marks. Similarly, while it enhances the overall look of the project, students should not be rewarded for simply word processing their work.

Portfolio component

The Portfolio component of the Grade 12 Consumer Mathematics Standards Test has a classroom-based administration and may be scored using either a written submissions approach or an interview approach, at the discretion of the classroom teacher. The scoring sheet and rubric for the Portfolio component are located on pages 43 and 44. The Portfolio questions are designed to function as both writing prompts (written submissions approach) and interview prompts (interview approach). Teachers are

encouraged to have students complete preparatory work on the reflection sheets and to begin the Portfolio process early in the semester to allow sufficient time for interviewing and/or marking.

The Portfolio counts for 30% of the total standards test.

Written Test

The Written Test component is locally administered and marked using the marking guide provided by the Department. Test items are grouped into six curriculum units of study (Personal Finance, Government Finance, Statistics, Variation and Formulas, Investments, and outcomes D5–D6 from the Design and Measurement Unit).

The Written Test counts for 40% of the total standards test.

Schedule for Test Administration

The following table summarizes the schedule for the Grade 12 Consumer Mathematics Standards Test:

Assessment Schedule				
Semester	Date	Preparation Time Prior to Assessment	Activity	Duration of Assessment
1	Any three 60-minute classroom periods (or equivalent) between November 28 and December 5, 2011	30 minutes preparation and instructions	Classroom-Based Project	Brainstorming and independent work = 3 × 60 minutes
	Prior to January 24, 2012	Preparation throughout the course	Classroom-Based Portfolio	Throughout the course
	January 24, 2012 (a.m.)*	20 minutes preparation and instructions	Written Test	90 minutes
2	Any three 60-minute classroom periods (or equivalent) between April 23 and April 30, 2012	30 minutes preparation and instructions	Classroom-Based Project	Brainstorming and independent work = 3 × 60 minutes
	Prior to June 13, 2012	Preparation throughout the course	Classroom-Based Portfolio	Throughout the course
	June 13, 2012 (a.m.)*	20 minutes preparation and instructions	Written Test	90 minutes

* **Please note that the students must write the Written Test components of the Grade 12 Consumer Mathematics Standards Test during a 90-minute period between 8:30 a.m. and 12:30 p.m.**

Students are expected to remain in the room for a minimum of 45 minutes from the start of the Written Test.

Test Specifications

The following table provides the approximate percentage of test marks according to each unit of study contained in the curriculum. In some instances, assessment items may relate to more than one unit.

Table 1			
Approximate Percentage by Unit			
Unit	Approximate Percentage (%)		
	Written Test (%)	Project (%)	Portfolio (%)
Personal Finance	7.5		
Government Finances	7.5		
Statistics	7.5		
Investments	7.5		
Variations and Formulas	7.5		
Design and Measurement (D5–D6)	2.5		
Problem Analysis			
Analysis of Games and Numbers		10	
Investigative Project		10	
Career/Life Project			8.5
Design and Measurement (D1–D4)			4.5
Personal Income Tax			8.5
Completing a Portfolio			8.5
APPROXIMATE TOTALS	40%		30%

Use of Classroom Resources

During the Written Test, students must have an HB pencil, a pen, a ruler, and a simple or scientific calculator. Students are allowed to use a bilingual dictionary containing only translations and no definitions.

A *Written Test Resource Package*, containing all necessary formulas, tables, and/or data for students, accompanies the Written Test.

During the Project and Portfolio components of the standards test, students may use classroom resources. During the Written Test, however, the following materials **may not** be used:

- cellphone calculators or calculators found on PDAs
- graphing calculators
- classroom notes, textbooks, and other such materials
- subject-related materials on display
- dictionaries (other than bilingual dictionaries)

Note: Electronic communication between students through phones, email, or file sharing during the test is **strictly prohibited**. Students must turn off cellphones and all other electronic devices for the duration of the tests.

These restrictions are necessary to ensure fair assessment practices and parallel testing conditions in all participating schools throughout Manitoba.

RELATED GUIDES

Consumer Mathematics: Project Scoring Rubric

	Level 1 (NOT YET AT STANDARD)	Level 2 (AT STANDARD)	Level 3 (ABOVE STANDARD)		
Insufficient Information/Evidence	<p>Example:</p> <ul style="list-style-type: none"> — little organization of ideas; limited (no) use of introductions, sections/headings, conclusion(s)/summary statement(s) — partially legible; information/details/calculations missing; vague presentation; difficult to follow 	<p>Example:</p> <ul style="list-style-type: none"> — most ideas organized; generally appropriate use of introductions, sections/headings, conclusion(s)/summary statement(s) — legible; most information/details/calculations evident; generally effective presentation; can follow with little difficulty 	<p>Example:</p> <ul style="list-style-type: none"> — exceptional organization of ideas; exemplary use of introductions, sections/headings, conclusion(s)/summary statement(s) — easy to read; insightful information/details/calculations evident; very effective presentation; easy to follow 		
	<p>Example:</p> <ul style="list-style-type: none"> — limited selection of required data — limited exploration of patterns/relationships; limited use of appropriate mathematical procedures (major computational errors) 	<p>Example:</p> <ul style="list-style-type: none"> — most required data selected (minor omissions) — most patterns/relationships explored; most mathematical procedures used were appropriate (some computational errors) 	<p>Example:</p> <ul style="list-style-type: none"> — all required data selected — insightful exploration of patterns/relationships; all mathematical procedures used were appropriate (only minor computational errors) 		
	<p>Example:</p> <ul style="list-style-type: none"> — limited evidence that the student understood the essential mathematical concepts — limited evidence of logical reasoning that led to appropriate conclusions; missing or incorrect justification(s)/explanation(s) 	<p>Example:</p> <ul style="list-style-type: none"> — evidence that the student understood most of the essential mathematical concepts — evidence of logical reasoning (some minor inconsistencies) that led to appropriate conclusions; some plausible justification(s)/explanation(s) 	<p>Example:</p> <ul style="list-style-type: none"> — evidence that the student understood all mathematical concepts — evidence of insightful and consistent reasoning that led to appropriate conclusions; clear and logical justification(s)/explanation(s) 		
	Level 1	Approaching Level 2	Level 2	Approaching Level 3	Level 3
0/5	1/5	2/5	3/5	4/5	5/5

Consumer Mathematics: Portfolio Scoring Rubric

Consumer Mathematics: Portfolio Scoring Rubric		Level 1 (NOT YET AT STANDARD)	Level 2 (AT STANDARD)	Level 3 (ABOVE STANDARD)		
Dimension 1 <ul style="list-style-type: none"> Communication/ Organization/ Sample Selection 	Insufficient Information/Evidence	<ul style="list-style-type: none"> Limited organization and communication of necessary information (samples are missing or incomplete) 	<ul style="list-style-type: none"> Good organization and communication of necessary information (samples are complete) 	<ul style="list-style-type: none"> Exceptional organization and communication of necessary information (varied selection of samples) 		
Dimension 2 <ul style="list-style-type: none"> Part A The Real-World Connection 		<ul style="list-style-type: none"> Limited connections to mathematical concepts and everyday life 	<ul style="list-style-type: none"> Good connections between mathematical concepts and everyday life 	<ul style="list-style-type: none"> Exceptional, multiple, or in-depth connections between mathematical concepts and everyday life 		
<ul style="list-style-type: none"> Part B The Mathematics Connection 		<ul style="list-style-type: none"> Limited reasoning; ideas are sometimes unrelated to mathematical concepts Limited explanation related to portfolio work sample 	<ul style="list-style-type: none"> Good reasoning; most ideas are related to relevant mathematical concepts Good explanation related to portfolio work sample 	<ul style="list-style-type: none"> Exceptional reasoning; insightful reflection using relevant mathematical concepts Exceptional explanation related to portfolio work sample 		
Performance Level		Level 1	Approaching Level 2	Level 2	Approaching Level 3	Level 3
Mark	0/5	1/5	2/5	3/5	4/5	5/5

Marking Guidelines for the Written Test

Several questions have been raised during the marking of the Grade 12 Consumer Mathematics Standards Test and during the Local Marking Training Sessions, including:

- What if a student doesn't include the unit of measurement (or has included an incorrect unit of measurement)?
- When is it appropriate to award marks for follow-through errors?
- What if a student goes too far with a question?

In response to these questions and to clarify these issues, several marking guidelines have been established in consultation with teachers of Consumer Mathematics. This information can be used as a resource for both teachers and students in preparing for the standards test.

Unit-of-measurement errors

The inclusion of units is an important part of a final answer. If the unit of measurement is implied in a question, it need not appear in the answer. However, if the unit of measurement is not implied, the student is expected to provide it.

The mark for the final answer will not be awarded in cases where a student failed to provide the correct unit of measurement. Additionally, if an incorrect or contradictory unit is provided, the student will not receive the mark for the final answer.

Sample of unit-of-measurement errors

The Dominski family is considering a move to a rural town in southeastern Manitoba. They are unsure of the town's tax rate. Calculate the property tax rate based on the following information:

Town Budget: \$10 250 000.00
Total Portioned Assessed Value: \$450 000 000.00

Answer: $\frac{\$10\,250\,000.00}{\$450\,000\,000.00} \times 1000 = \underbrace{22.78 \text{ (or } 22.8) \text{ mills}}_{0.5 \text{ mark}}$
0.5 mark

Sample 1: $\frac{\$10\,250\,000.00}{\$450\,000\,000.00} \times 1000 = 22.78$

Mark: 0.5 mark out of 1

Rationale: 0.5 mark for correct substitution

No mark for final answer, as unit was omitted

Follow-through errors

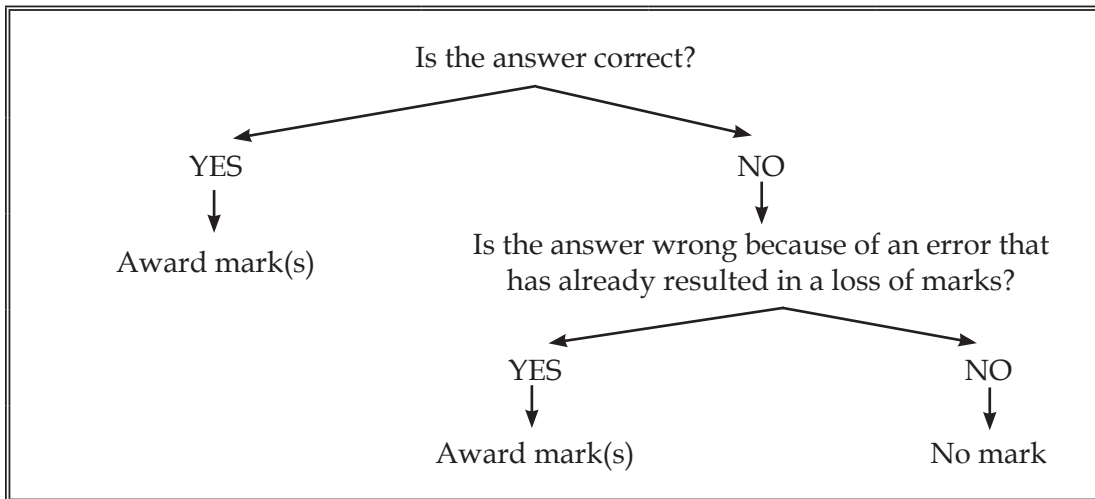
Marks for follow-through errors on a final answer will be awarded in the following cases:

- The error follows from something for which marks were already deducted.
- In multiple-part questions, if an error was made in Part A but subsequent parts were completed appropriately based on the incorrect information in Part A, full marks may be awarded in subsequent parts.

Marks for follow-through errors will not be awarded if:

- The question has a value of 1 mark with no half-mark increment.
- The error is conceptual in nature. For example, if students select the wrong formula from the *Written Test Resource Package*, they will not be awarded marks for follow-through errors.

Some have found the following flowchart useful in clarifying issues around follow-through errors.



Sample of follow-through errors

Connor wrote an entrance exam along with 699 other people. Ninety people scored below him and 79 other people scored the same as Connor. Determine his percentile rank.

$$\text{Answer: } = \frac{90 + 0.5(80)}{700} \times 100$$

0 mark for 1 correct substitution

OR

0.5 mark for 2 correct substitutions

OR

1.0 mark for 3 correct substitutions

AND

$$= 18$$

0.5 mark for final answer

$$\text{Sample 1: } \frac{90 + 0.5(79)}{700} \times 100 = 90.06$$

Mark: 0.5 mark

Rationale: 0.5 mark for 2 correct substitutions

No mark for final answer (answer does not follow from incorrect substitution)

$$\text{Sample 2: } \frac{70 + 0.5(79)}{700} \times 100 = 16$$

Mark: 0.5 mark

Rationale: 0 mark for 1 correct substitution

0.5 mark for final answer (answer follows from incorrect substitutions)

Additional-information errors

The answer presented must demonstrate an understanding of the topic. Credit for a final answer that does not reflect an understanding of the topic will not be awarded. For example, if students are asked to calculate the annual life insurance cost and they present the monthly life insurance cost, they would not receive credit for their final answer. However, if a student calculates the annual life insurance cost and labels it, then proceeds to calculate the monthly cost (with labels), this student has demonstrated an understanding of annual costs and is awarded the mark for the final answer.

A non-contradictory extension will not affect the mark(s) earned.

Sample of additional-information errors

Robert Hill is a 56-year-old non-smoker who wishes to purchase life insurance. He has chosen a 10-year term insurance policy with a face value of \$300 000. Calculate his annual premium.

Answer:
$$\frac{\$300\,000}{1\,000} \times \underbrace{7.22}_{0.5 \text{ mark}} = \$2\,166$$

0.5 mark

$$\$2\,166 + \underbrace{\$75}_{0.5 \text{ mark}} = \underbrace{\$2\,241}_{0.5 \text{ mark}}$$

Sample 1:
$$\frac{\$300\,000}{1\,000} \times 7.22 = \$2\,166$$

$$\$2\,166 + 75 = \$2\,241$$

$$\$2\,241 \times 0.09 = \$201.69 \text{ annual premium}$$

Mark: 1.5 marks out of 2

Rationale: Student did not receive the 0.5 mark for the final answer as the annual premium was mislabelled.

Sample 2:
$$\frac{\$300\,000}{1\,000} \times 7.22 = \$2\,166$$

$$\$2\,166 + 75 = \textcircled{= \$2\,241}$$

$$\$2\,241 \times 0.09 = \$201.69$$

Mark: 2 marks out of 2

Rationale: Student was awarded full marks for the answer, as an attempt was made to highlight the annual payment. Additional information does not affect the mark.



PRE-CALCULUS MATHEMATICS

- Grade 12 Pre-Calculus Mathematics Standards Test
- Schedule for Test Administration
- Test Specifications
- Item Types
- Formula Sheet
- Helpful Hints
- Graphing
- Instructions to Teachers
- Instructions to Students
- Marking Guidelines
- Use of Classroom Resources
- Calculator Use on Grade 12 Pre-Calculus Mathematics Standards Test
- Related Guides
- Formula Sheet: Pre-Calculus Mathematics
- Helpful Hints: Pre-Calculus Mathematics
- Marking Guidelines: Pre-Calculus Mathematics
- Sample of Instructions to Students: Pre-Calculus Mathematics

Grade 12 Pre-Calculus Mathematics Standards Test

The test is administered during one three-hour session between 8:30 a.m. and 12:30 p.m. English and French versions of the test are available. The test consists of the following two parts, each contained within a separate test booklet:

Part 1: Calculator

Part 1 takes one hour to complete and consists of long-answer questions (restricted-response and open-response items). A scientific or graphing calculator (see “Calculator Use on Grade 12 Pre-Calculus Mathematics Standards Test” on page 57) is required to answer some of the questions in this part of the test. The questions in Part 1 are designed so that there will be no advantage to using a graphing calculator over a scientific calculator. After one hour, students will receive Part 2 of the test and will no longer be permitted to use their calculator. Part 1 is worth approximately 35% of the final mark.

Part 2: Non-Calculator

Part 2 takes two hours to complete and consists of multiple-choice, short-answer (all restricted-response items), and long-answer questions (restricted-response and open-response items). Calculators are not permitted during this part of the test. Students are permitted to review or revise their responses to Part 1 items (without a calculator) during this portion of the test. Part 2 is worth approximately 65% of the final mark.

Schedule for Test Administration

Semester	Date	Duration
1	January 23, 2012*	3 hours
2	June 14, 2012*	3 hours

* Please note that students must write the Grade 12 Pre-Calculus Mathematics Standards Test between 8:30 a.m. and 12:30 p.m.

Test Specifications

The following table provides an overview of the structure of the test.

Grade 12 Pre-Calculus Mathematics Standards Test Test Specifications				
Unit	Approximate Distribution of Marks (%)	Approximate Distribution of Marks by Category and Item Type (%)		
		Selected Response	Constructed Response	
		<i>Multiple Choice</i>	<i>Short Answer</i>	<i>Long Answer</i>
Circular Functions (A) Trigonometric Identities (C)	30	5	4	21
Transformations (B)	15	2	3	10
Exponents and Logarithms (D) Geometric Sequences (H)	20	3	3	14
Permutations, Combinations, and Binomial Theorem (E) Probability (G)	25	4	4	17
Conic Sections (F)	10	1	1	8
Part				
Part 1: Calculator	35	—	—	35
Part 2: Non-Calculator	65	15	15	35

Item Types

The test will contain the following item types:

Multiple-choice items (15%)

There will be fifteen multiple-choice items, all in Part 2 of the test. Students will be required to select the correct or best answer from among four options and record their responses on an answer sheet. Each multiple-choice item is worth 1 mark. There is no penalty for incorrect answers.

Constructed-response items (85%)

Constructed-response items can be restricted-response items or open-response items. Regardless, in the test, items are grouped based on the length of the responses.

Short-answer questions (15%)

All of the short-answer questions are restricted-response items and are worth 1 mark each. Students are not required to show any work in order to obtain full marks for a correct answer. However, in the case of an incorrect final answer, part marks may be awarded only if work is shown. All of these questions are in Part 2 of the test.

Long-answer questions (70%)

Long-answer questions are either restricted-response items or open-response items. These questions appear in both Part 1 and Part 2 of the test. For full marks, students must show all pertinent diagrams, algebra, calculations, and explanations, in addition to a correct final answer.

Formula Sheet

A copy of the formula sheet as it will appear in the Grade 12 Pre-Calculus Mathematics Standards Test can be found on page 61.

Helpful Hints

A helpful hints page for students writing the Grade 12 Pre-Calculus Mathematics Standards Test can be found on page 62. This page is also included on the back of the formula sheet in Part 1 of the test.

Graphing

The emphasis in this course is on transformations of a limited number of parent functions and relations. Therefore, a table of values is not expected unless specifically requested. If a grid is provided, careful consideration should be given to where the graph crosses gridlines. If no grid is provided, the overall shape and characteristics of the graph are more important.

Teachers should be aware that in all functions, unless otherwise stated, the domain is the largest subset of the real numbers for which the function is meaningful.

A clearly labelled graph will include the following:

- labels on both axes
- indication of scales on both axes (one number on each axis is sufficient; values that are important to the function are ideal places to show scale.)

- arrowheads or endpoints that indicate whether the graph continues or stops (restrictions on domain or range)
- accurate shape (whether it is straight or curved and whether the curve opens up, down, left, or right)
- asymptotes (if applicable) drawn as non-solid lines, with the graph approaching the asymptote
- intercepts labelled with numeric values (if they are requested in the question)
- vertices and the centre of conic sections accurately located according to the scale shown

Instructions to Teachers

- **Decimal precision:** When an answer is required to be “**correct to 3 decimal places**” students should know that rounding to 3 or fewer places in the earlier stages of the problem will probably result in an inaccurate answer. In fact, rounding should be avoided until the final answer. Full marks will be given for answers that are rounded or truncated to 3 decimal places or that give 3 or more decimal places.

Example: The answer to $7 \div 9$ correct to 3 decimal places has the following acceptable answers:

$$\frac{7}{9} \quad 0.\overline{7} \quad 0.\overline{77} \quad 0.777 \quad 0.778 \quad 0.777\ 777$$

Not acceptable answers:

$$0.78 \quad 0.77$$

- **Explanation of cases:** Students are encouraged to explain their work to clarify their solutions. They will be required to briefly explain their calculations in certain permutation, combination, or probability problems involving cases. No marks will be awarded for these explanations. However, a half mark deduction will occur if no explanation is given. A brief explanation does not necessarily require words; simply indicating restrictions or elements chosen is sufficient.

The following examples show sufficient explanation.

Example: Using the digits 1, 2, 3, 4, 5, 6, how many 3-digit numbers less than 450 can be found if the repetition of digits is not allowed?

$$\text{Case 1:} \quad \frac{3}{\{1, 2, 3\}} \cdot \underline{5} \cdot \underline{4} = 60$$

$$\text{Case 2:} \quad \frac{1}{\{4\}} \cdot \frac{3}{\{1, 2, 3\}} \cdot \underline{4} = 12$$

$$60 + 12 = 72$$

Example: A committee of 5 students is to be randomly chosen from a group of 9 students. Louise and Adam are 2 of the students in the group. What is the probability that Louise and Adam will both be on the committee?

$$\frac{\begin{array}{l} \text{choose Adam and Louise} \\ \downarrow \\ 2C_2 \cdot 7C_3 \\ \uparrow \\ \text{choose 3 students} \end{array}}{\begin{array}{l} 9C_5 \\ \uparrow \\ \text{choose 5 students} \end{array}} \quad \text{or} \quad \begin{array}{l} P(\text{Adam}) \quad P(\text{Louise}) \\ \frac{5}{9} \quad \cdot \quad \frac{4}{8} \end{array}$$

- Marks may be awarded for “guess and check” solutions. Students should support “guess and check” methods with explanations or work in order to receive additional marks.
- Students are expected to show all possible solutions before rejecting any extraneous root(s).

Example: $\log_6 (x - 1) + \log_6 (x) = 1$
 $\log_6 (x^2 - x) = 1$
 $x^2 - x = 6$
 $x^2 - x - 6 = 0$
 $(x - 3)(x + 2) = 0$
 $x = 3 \quad x = -2$

“ $x = -2$ ” must be shown and then rejected if extraneous.

- Simplifying a question: If students significantly simplify a question, marks will be deducted.
- Identities: A common student error is to equate the left-hand side with the right-hand side of an identity throughout the work. In an effort to avoid this error, a T-structure will be provided in the test booklet.

Example:

Left-Hand Side	Right-Hand Side

Instructions to Students

A sample of the instructions given to students for the Part 1 long-answer questions is presented on page 65.

Marking Guidelines

A list of marking guidelines has been prepared from information gathered at sample marking and marker training sessions. These guidelines are provided on pages 63 and 64 as a resource for students and teachers in preparing for the standards test.



Please note that the guidelines have been updated this year.

Giving an answer of a probability greater than 1 is a concept error. However, since students who give such an answer will already have lost marks for one or more calculation errors, only $\frac{1}{2}$ marks will be deducted from the final answer. If the student notes that a probability cannot be greater than 1, no marks will be deducted from the final answer.

Use of Classroom Resources

During the test, students must have an HB pencil to shade in the answer sheet. They may also use a ruler, an eraser, and a bilingual dictionary containing only translations and no definitions. Students may use a scientific or graphing calculator on the test, provided it meets the requirements outlined in the section “Calculator Use on Grade 12 Pre-Calculus Mathematics Standards Test” found on page 57.

The following materials must **not** be used during the test:

- classroom notes, textbooks, and other such materials
- subject-related materials on display
- dictionaries (other than bilingual dictionaries)
- any information and communications technology (ICT) devices such as cellphones or MP3 players
- computers (including any graphing software)
- extra paper (scrap paper for student use is provided on perforated pages at the beginning of *Booklet 1*; additional blank pages for student use are included at the end of each test booklet)

Note: Electronic communication between students through phones, email, or file sharing during the test is **strictly prohibited**. Students must turn off cellphones and all other electronic devices for the duration of the tests.

These restrictions are necessary to ensure fair assessment practices and parallel testing conditions in all participating schools throughout Manitoba.

Calculator Use on Grade 12 Pre-Calculus Mathematics Standards Test

For the purposes of the Grade 12 Pre-Calculus Mathematics Standards Test, a calculator is defined as a hand held electronic device designed for graphing and/or computations. With the advent of more sophisticated calculators, it is important to identify calculator characteristics that will not be acceptable for student use on the test. These characteristics are outlined below.

Calculators that have symbolic manipulation abilities will not be acceptable for use on the test, as they could give students who use them an advantage over students who use only a scientific calculator.

Here is a list of graphing calculators that can be used for the test. If students wish to use a graphing calculator that is not on the list, teachers should request permission at the time of student registration. Requests should be submitted in writing to the Pre-Calculus Mathematics Assessment Consultant, Instruction, Curriculum and Assessment Branch, 1567 Dublin Avenue, Winnipeg, Manitoba R3E 3J5.

<u>Casio</u>	<u>Hewlett-Packard</u>	<u>Sharp</u>	<u>Texas Instruments</u>
FX-7400 series	HP-38G	EL-9600 series	TI-82
FX-9750 series	HP-39G	EL-9900 series	TI-83/TI-83 Plus
CFX-9850 series	HP-40G		TI-84 Plus
IFX 1.0 series			TI-Nspire*

* The TI-Nspire is approved with the TI-84 Plus keypad only; the TI-Nspire keypad is **not** approved.

Any scientific calculator is allowed for Part 1 of the Grade 12 Pre-Calculus Mathematics Standards Test.

Using a calculator containing information relevant to the Pre-Calculus Mathematics course that would be banned in paper form (e.g., programs or notes entered by a student) is prohibited. This information should be cleared from the calculator before the test. Calculators with the ability to either transmit or receive electronic signals are not allowed. Keyboards or other external support, such as manuals, printers, electronic writing pads, or expansion devices, are prohibited. Calculators must not be shared between students during the test.

RELATED GUIDES

Formula Sheet: Pre-Calculus Mathematics

$$s = \theta r$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\tan^2 \theta + 1 = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

$$\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$$

$$\tan(\alpha - \beta) = \frac{\tan \alpha - \tan \beta}{1 + \tan \alpha \tan \beta}$$

$$\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$$

$$\tan(\alpha + \beta) = \frac{\tan \alpha + \tan \beta}{1 - \tan \alpha \tan \beta}$$

$$\sin 2\alpha = 2 \sin \alpha \cos \alpha$$

$$\cos 2\alpha = \cos^2 \alpha - \sin^2 \alpha$$

$$\cos 2\alpha = 1 - 2 \sin^2 \alpha$$

$$\cos 2\alpha = 2 \cos^2 \alpha - 1$$

$$\tan 2\alpha = \frac{2 \tan \alpha}{1 - \tan^2 \alpha}$$

$$P(n, r) \text{ or } {}_n P_r = \frac{n!}{(n-r)!}$$

$$C(n, r) \text{ or } {}_n C_r = \frac{n!}{r!(n-r)!}$$

$$t_{k+1} = {}_n C_k a^{n-k} b^k$$

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

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

$$A = P \left(1 + \frac{r}{n} \right)^{nt}$$

$$A = P e^{rt}$$

$$e \approx 2.71828$$

$$\log_a(MN) = \log_a M + \log_a N$$

$$\log_a \left(\frac{M}{N} \right) = \log_a M - \log_a N$$

$$\log_a(M^n) = n \log_a M$$

$$\log_a M = \frac{\log_b M}{\log_b a}$$

$$(x-h)^2 + (y-k)^2 = r^2$$

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1, \quad a > b$$

$$\frac{(x-h)^2}{b^2} + \frac{(y-k)^2}{a^2} = 1, \quad a > b$$

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$

$$\frac{(y-k)^2}{a^2} - \frac{(x-h)^2}{b^2} = 1$$

$$(y-k) = a(x-h)^2$$

$$(x-h) = a(y-k)^2$$

$$t_n = t_1 r^{n-1}$$

$$S_n = \frac{t_1(1-r^n)}{1-r} = \frac{t_1(r^n-1)}{r-1}$$

$$S_n = \frac{t_1-t_n r}{1-r} = \frac{t_n r - t_1}{r-1}$$

$$S_\infty = \frac{t_1}{1-r}, \quad |r| < 1$$

Helpful Hints: Pre-Calculus Mathematics

Clearly labelled graphs include:

- labels on both axes
- scales on both axes (only one number on each axis is required)
- arrowheads or endpoints to indicate if the graph continues or stops
- accurate shape (whether it is straight or curved and whether the curve opens up, down, left, or right)
- asymptotes (if applicable) drawn as non-solid lines with the graph approaching the asymptote
- intercepts labelled with numeric values (only if they are requested in the question)
- vertices and centre of conic sections accurately located according to the scale shown

Guess and check

Marks may be awarded for this method if explanations are provided and work is backed up with evidence.

Exact value solutions	
Incomplete solution	Exact value solution
$5 - 3$	2
$4(3)$	12
$\frac{\sqrt{2}\sqrt{3}}{4}$	$\frac{\sqrt{6}}{4}$
$\frac{1}{2} - \frac{2\sqrt{11}}{5}$	$\frac{5 - 4\sqrt{11}}{10}$
$\frac{\sqrt{7}}{3} - \frac{\sqrt{5}}{3}$	$\frac{\sqrt{7} - \sqrt{5}}{3}$
$1 + \frac{\frac{1}{3}}{2}$	$\frac{2}{3}$
$2\left(\frac{2\sqrt{3}}{\sqrt{5}}\right)$	$\frac{4\sqrt{3}}{\sqrt{5}}$
$\frac{0.7}{1.4}$	$\frac{7}{14}$ or $\frac{1}{2}$ or 0.5

Rough work

If you clearly label work as "rough work," it will not be marked.

Expressing the answer correct to 3 decimal places

means that rounding should be avoided until the final answer.

Explanations

It is not always necessary to explain in words; simply indicate or label any restrictions or chosen elements.

Marking Guidelines: Pre-Calculus Mathematics

- Arithmetic error, deduct ½ mark
- Concept error, deduct 1 mark
- Notation error, deduct ½ mark
- For each different type of notation error, deduct ½ mark to a maximum of 1 mark per question
- Incorrect precision or rounding, deduct ½ mark
- Final probability answer greater than 1, deduct ½ mark
- Intercept stated as an ordered pair, deduct ½ mark
- Changing an equation to an expression or vice versa more than once, deduct ½ mark
- Variable introduced without being defined, deduct ½ mark

Example: $2 \sin x = 1$

$$\sin x = \frac{1}{2}$$

$$x = \frac{\pi}{6}, \frac{5\pi}{6} \text{ over } [0, 2\pi]$$

$$x = \frac{\pi}{6} + 2k\pi \text{ or } \frac{5\pi}{6} + 2k\pi, \text{ "k" not defined, deduct ½ mark}$$

(Note: Student can write " $k \in \mathbb{I}$ " or " k is an integer".)

- LHS and RHS equated throughout the proof of an identity, deduct 1 mark
- Variable omitted more than once in a trig identity or equation, deduct ½ mark
- Variable changed more than once without being redefined, in either an equation or an identity, deduct ½ mark



Example: $2 \sin \theta = 1$

$$\cos^2 \theta = 1$$

$$\sin x = \frac{1}{2}$$

or

$$x^2 = 1$$

$$x = \frac{\pi}{6}, \frac{5\pi}{6}$$

$$x = \pm 1$$

- Parentheses omitted such as:
 - a) $\log 3^{x+1} = x + 1 \log 3 = x \log 3 + \log 3$, deduct ½ mark
 - b) $\log 3^{x+1} = x + 1 \log 3 = x + \log 3$, deduct 1 mark
 - c) $\frac{2^2}{3} = \frac{4}{9}$, deduct ½ mark

- Unsimplified fractions such as $\frac{\frac{1}{2} + \frac{1}{3}}{2}$, deduct ½ mark

(Note: Unreduced fractions such as $\frac{6}{8}$ or unrationalized fractions such as $\frac{\sqrt{3}}{\sqrt{2} - 1}$ are acceptable.)

- Cases in permutations, combinations, or probability problems not briefly described, deduct ½ mark
- If an r value greater than 1 is used to calculate the sum of an infinite geometric series, deduct ½ mark
- Endpoints or arrowheads incorrectly shown, deduct ½ mark
- Asymptotes shown as solid lines or not shown, deduct ½ mark
- Graphs of functions drawn to cross or curl away from an asymptote, deduct ½ mark
- Domain or range written in incorrect order, deduct ½ mark
Example: $(-\infty, 0]$ written as $[0, -\infty)$
- Bracket error(s) made when stating the domain or range, deduct ½ mark

Long-Answer Questions

Instructions

- There are 10 long-answer questions for a total of 34 marks.
- Calculators (scientific or graphing) are allowed for this part of the test.
- Write each solution in the space provided.
- For full marks, your answers must show all pertinent diagrams, calculations, and explanations.
- Graphing calculator solutions should include an explanation of how your final answer is obtained.
- Your solutions should be neat, organized, and clear.
- If any curve contains asymptotes, the asymptotes should be included in the graph.
- Some answers are to be given as decimal values. Rounding too early in your solution may result in an inaccurate final answer for which full marks will not be given.
- Express your answers as exact values or correct to 3 decimal places unless instructed otherwise



Printed in Canada
Imprimé au Canada