ASSOCIATION OF CANADA LANDS SURVEYORS - BOARD OF EXAMINERS
WESTERN CANADIAN BOARD OF EXAMINERS FOR LAND SURVEYORS
ATLANTIC PROVINCES BOARD OF EXAMINERS FOR LAND SURVEYORS

SCHEDULE I / ITEM 1 — October 2005
MATHEMATICS

Note: This examination consists of 10 questions on 1 page. **Marks**

Time: 3 hours

Q. No		Value	Earned
1. a)	Given two distinct points A and B in the plane, what is the locus of points P such that PA + PB is constant, where PA and PB are the distances from P to A and B? Illustrate the answer with an appropriate diagram.	5	
b)	Given two distinct points A and B in the plane, what is the locus of points Q such that QA - QB is constant, where QA and QB are the distances from Q to A and B? Illustrate the answer with an appropriate diagram.	5	
2. a)	Given a triangle ABC in the plane, what is the area of ABC in terms in terms of the vectors $\overrightarrow{AB}$ and $\overrightarrow{AC}$ corresponding to the sides AB and AC?	5	
b)	Considering a tetrahedron ABCD in space, what is its volume in terms of the vectors $\overrightarrow{AB}$, $\overrightarrow{AC}$ and $\overrightarrow{AD}$ corresponding to the edges AB, AC and AD?	5	
3. a)	For complex variables z and w, what is the transformation $w = \alpha z$, assuming α to be a complex number?	5	
b)	For complex variables z and w, what is the transformation $w = \alpha z + \beta$, assuming α and β to be complex numbers?	5	
4. a)	Given a lower triangular matrix L of order 5, what is the corresponding characteristic polynomial for its eigenvalues?	5	
b)	Given an upper triangular matrix U of order 5, what is the corresponding characteristic polynomial for its eigenvalues?	5	
5. a)	An arbitrary matrix A has eigenvalues which are generally complex quantities. For real eigenvalues, what conditions does A need to satisfy?	5	
b)	Considering the same matrix A, what conditions would ensure positive real eigenvalues?	5	
6. a)	Expand $(1 - 2x)^{-1}$ as a series in powers of x. Give the first five terms only.	5	
b)	Expand $(1 - 3x)^{-1}$ as a series in powers of x-1. Give the first five terms only.	5	
7. a)	Given a small matrix A of 3 rows of 2 columns with elements 1, what is A^TA and is it invertible?.	5	
b)	Given a small matrix B of 2 rows of 3 columns with elements 1, what is BB^T and is it invertible?	5	
8. a)	For an homogeneous algebraic system Ax = 0 for a square matrix A, when does it have only the solution x = 0?	5	
b)	For the same homogeneous algebraic system Ax = 0 for a square matrix A, when does it have at least one solution $x \neq 0$?	5	
9. a)	What is the general solution of the differential equation dy/dx + 2x = 1 ?	5	
b)	What is the general solution of the differential equation dy/dx + 3y = 1 ?	5	
10. a)	Express the circular function sin x in terms of complex exponentials.	5	
b)	Express the hyperbolic function sinh y in terms of complex exponentials.	5	
	Total Marks:	100	