ASSOCIATION OF CANADA LANDS SURVEYORS - BOARD OF EXAMINERS
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SCHEDULE I / ITEM 1   March 2005
MATHEMATICS

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

Q. No	Time: 3 hours	Value	Earned
1. a)	Given three arbitrary points A, B, C in the plane, what is the angle at B between the line segments BA and BC? Use Cartesian x and y axes.	5	
b)	Three arbitrary noncollinear points C, E, F in space define a plane. What is the equation of this plane in Cartesian x, y and z coordinates?	5	
2. a)	Given two distinct vectors **a** and **b**, what does the vector or cross-product **a** x **b** represent? What is its magnitude?	5	
b)	Given two arbitrary vectors **c** and **d** in three-dimensional Cartesian space, how do you evaluate their vector or cross-product **c** x **d** ?	5	
3. a)	For a complex variable $z = x + iy$, with i denoting the square-root of -1, what is the exponential e^z equal to in terms of x and y, written as $u + iv$, for real u and v?	5	
b)	For a complex variable $z = x + iy$, with i denoting the square-root of -1, what is the (natural) logarithm log z in terms of x and y, written as $u + iv$, for real u and v?	5	
4. a)	Given a second-degree or quadratic expression $1 + 2x + 3x^2$, what are the roots? What is the corresponding discriminant?	5	
b)	Given a fourth-degree or quartic expression $4 + 5x^2 + 6x^4$, what are the corresponding roots?	5	
5. a)	Given an arbitrary upper triangular matrix of order 3, what is the matrix determinant in terms of its elements?	5	
b)	Given an arbitrary diagonal matrix of order 3, what is the matrix inverse in terms of its elements?	5	
6. a)	Given a square matrix of order 3, what is the corresponding characteristic polynomial for its eigenvalues?	5	
b)	For the previous square matrix of order 3, given its eigenvalues, how do you evaluate the corresponding eigenvectors?	5	
7. a)	In Cartesian coordinates, what is the equation of an ellipse centered at (x_o, y_o), with semi-major axis a and semi-minor axis b? Ellipse axes may be assumed parallel to the coordinate axes.	5	
b)	In Cartesian space coordinates, what is the equation of an ellipsoid centered at (x_o, y_o, z_o) with semi-axes a, b and c? Ellipsoid axes may be assumed parallel to the coordinate axes.	5	
8. a) b)	Expand sin 3x into a series about x=1. Evaluate the first three terms only. Expand log 5x into a series about x=1. Assuming the natural logarithm, evaluate the first three terms only.	5 5	
9. a) b)	What is an orthogonal matrix? Give an example of order 2. What is a unitary matrix? Give an example of order 2.	5 5	
10. a) b)	Solve the ordinary differential equation $y' - y = 0$ where $y' = dy/dx$. Solve the ordinary differential equation $y'' - y = 0$ where $y'' = d^2y/dx^2$.	5 5	
	Total Marks:	100	