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

March 2006

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

Time: 3 hours

Q. No		Marks Value	Earned
1	(a) Define continuity and differentiability of a function f(x) on the real line. Illustrate your answer with appropriate diagrams. (b) Give an example of a continuous function that is not differentiable at one point. Is the converse possible? Briefly explain with diagrams.	5 5	
2	(a) Set up the integral needed to compute the area inside a unit circle. (b) Set up the integral needed to compute the volume inside a unit sphere.	5 5	
3	(a) Given a curve corresponding to $f(x,y) = 0$ in a Cartesian (x,y) system, what is the normal direction at some point (x_o, y_o) on the curve? (b) Considering the same curve corresponding to $f(x,y) = 0$ in a Cartesian (x,y) system, what is the curvature at (x_o, y_o) on the curve?	5 5	
4	(a) Complex scalars have Cartesian and polar representations. What are they? How are they related? Illustrate with simple examples. (b) Complex vectors have Cartesian and polar representations. What are they? How are they related? Illustrate with simple examples.	5 5	
5	(a) Given a small matrix $A = [a_{ij}]$ with elements $a_{ij} = 1 / (i + j + 2)$, $i,j = 1, 2, 3$, what is A^2, the square of A? (b) What is the inverse of the same matrix $A = [a_{ij}]$ with elements $a_{ij} = 1 / (i + j + 2)$, $i,j = 1, 2, 3$?	5 5	
6	(a) Given three equations $2x + y - z = 2.25$, $x + 3y + z = 2$, $-x + y + 4z = 0.25$, what are x, y and z using Cramer's rule? (b) What are x, y and z using Gaussian elimination using the three equations?	5 5	
7	(a) Expand the exponential function e^x as a power series in x. Give the first five terms. (b) Expand the exponential function $e^{\sin x}$ as a power series in x. Give the first five terms only.	5 5	
8	(a) What is a quadratic form? How is it useful? Give a simple example. (b) What is a Jacobian matrix in coordinate transformations? Give a simple example.	5 5	
9	(a) What is a singular value decomposition (SVD) of an arbitrary matrix? (b) How is the SVD of a matrix useful in solving a system of linear equations?	5 5	
10	(a) What is the differential equation corresponding to a simple harmonic motion? (b) What is the general solution for a simple harmonic motion.	5 5	
	Total Marks:	**100**	