CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS
ATLANTIC PROVINCES BOARD OF EXAMINERS FOR LAND SURVEYORS

SCHEDULE I / ITEM 1
MATHEMATICS

March 2008

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

Time: 3 hours

Q. No		Marks Value	Earned
1	a) Define the continuity of a function f(x) at some point $x = x_o$ as a limit. Use appropriate diagrams.	5	
	b) Define the inverse of a function f(x) at some point $x = x_o$, using as an example $f(x) = x^2$. Briefly explain the situation.	5	
2	a) Given the curve of f(x) = sin x, what is the geometrical interpretation of the corresponding derivative $f'(x) = df(x)/dx = \cos x$ at any arbitrary point x?	5	
	b) Given the curve of f(x) = sin x, what is the geometrical interpretation of the corresponding second derivative $f''(x) = d^2f(x)/dx^2 = -\sin x$ at any arbitrary x?	5	
3	a) Given three noncollinear points $P_n = (x_n, y_n)$, n=1, 2, 3, in the (x,y) plane, how can the centre of the circle with these three points on its circumference be computed?	5	
	b) For the same situation, how can the radius of the circle be computed?	5	
4	a) Give the first three terms of the series expansion of $(1 + 2x)^{-3}$ about x = 0.	5	
	b) What is the general expression for the remainder after the three terms of the preceding series expansion?	5	
5	a) Given a small matrix $A = [a_{ij}]$ with $a_{ij} = i + j - 2$ for i, j = 1, 2, 3, what is its determinant?	5	
	b) For the same small matrix A, what is the determinant of A^2 (the square of A)? Explain.	5	
6	a) Given three equations: $x - y + 2z = 4$, $x + 2y + 3z = 5$, $2x + 3y + 4z = 6$, what are x, y and z using Gaussian elimination?	5	
	b) Given the three equations: $x - y + 2z = 0$, $x + 2y + 3z = 0$, $2x + 3y + 4z = 0$, what can be said about the unknowns x, y and z?	5	
7	a) What is the scalar or inner product of the two vectors $(1.1\ \ 2.2\ \ 3.3)^T$ and $(4.4\ \ 5.5\ \ 6.6)^T$, where T denotes transpose?	5	
	b) What is the vector or cross product of the same two vectors $(1.1\ \ 2.2\ \ 3.3)^T$ and $(4.4\ \ 5.5\ \ 6.6)^T$, where T denotes transpose?	5	
8	a) What is the geometrical interpretation of the scalar or inner product of two vectors in three dimensional space? Illustrate with diagrams.	5	
	b) What is the geometrical interpretation of the vector or cross product of two vectors in three dimensional space? Illustrate with diagrams.	5	
9	a) What is a rotation matrix for an angle θ in two dimensions?	5	
	b) What is the corresponding situation in three dimensions? Any special cases?	5	
10	a) What is an orthogonal matrix? What is its determinant? Give simple examples.	5	
	b) What are symmetric and skew-symmetric matrices? Give simple examples.	5	
	Total Marks:	100	