CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

<div align="center">

SCHEDULE I / ITEM 1   **March 2010**

MATHEMATICS

</div>

Note: The use of calculators or similar devices is not permitted in this exam.

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

Q. No	Time: 3 hours	Value	Earned
1.	a) What is a (mathematical) function? How does a function differ from a simple relation between two variables? Give simple examples. b) What is the inverse of a function called? Give simple examples.	5 5	
2.	a) Define the limit of an infinite sequence such as 1, 1/2, 1/3, 1/4, ... b) Define the sum of an infinite series such as $1 + 1/4 + 1/9 + 1/16 + ...$ Express the sum as the limit of an infinite sequence.	5 5	
3.	a) Expand $(2 + 3x)^{-1}$ as a power series in x. Give the first five terms only. b) Does the previous power series in x converge for all values of x? Explain.	5 5	
4.	a) Express $\sin \theta$ and $\cos \theta$ in terms of $e^{i\theta}$, or exponential iθ, for imaginary $i \equiv (-1)^{1/2}$ b) What is $e^{i\theta}$ for θ equal to 0, $\pi/2$ and π?	5 5	
5.	a) Solve the quadratic equation $ax^2 + bx + c = 0$ for some given parameters a, b and c b) Solve the quartic equation $dx^4 + ex^2 + f = 0$ for some given parameters d, e and f.	5 5	
6.	a) Given three linear algebraic equations $a'x + b'y + c'z = d'$ $a''x + b''y + c''z = d''$ $a'''x + b'''y + c'''z = d'''$ for some arbitrary coefficients a', b', c', d', a'', b'', c'', d'', a''', b''', c''' and d'''. When is the x, y, z solution unique assuming that d', d'' and d''' are not all zero? b) How can there be no x, y, z solution or infinitely many x, y, z solutions depending on the coefficients? Briefly explain the general situation.	5 5	
7.	a) What are the general y(x) and z(x) solutions for $dy/dx + x = 0$ and $d^2z/dx^2 + x = 0$? b) What are the general u(x) and v(x) solutions for $du/dx + u = 0$ and $d^2v/dx^2 + v = 0$?	5 5	
8.	a) What is the geometrical interpretation of the scalar or dot product of two vectors? Illustrate with simple vectors. b) What is the geometrical interpretation of the vector or cross product of two vectors? Illustrate with simple vectors.	5 5	
9.	a) What are symmetric and skew symmetric matrices? Give simple examples. b) What are orthogonal and unitary matrices? Give simple examples.	5 5	
10.	a) What is a right-angle spherical triangle? What is the simplest formula for its area? b) What is the area of a spherical triangle in terms of the angular sides?	5 5	
	Total Marks:	100	