

**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
MATHEMATICS**

**February 2001
(1990 Regulations)
(Closed Book)**

Time: 3 hours

Marks

Note: This examination consists of 10 questions on 2 pages.

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|------|---|---|
| 1.a) | What is the limit of $f(x) = x e^{-x}$ as x goes to infinity? | 5 |
| b) | What is the limit of $g(x) = x^{-1} \sin x$ as x goes to zero? | 5 |
| 2.a) | Differentiate $f(x) = e^{\sin x}$ with respect to x . | 5 |
| b) | Differentiate $g(x) = x^{\sin x}$ with respect to x . | 5 |
| 3.a) | Give the first three terms in the Taylor series expansion in x for $(1 + 3x)^{-1}$. | 5 |
| b) | What is an expression for the remainder after the previous three terms in the series expansion for $(1 + 3x)^{-1}$? | 5 |
| 4.a) | Set up the integral to compute the area inside an ellipse with semi-major axis a and semi-minor axis b . | 5 |
| b) | Set up the integral to compute the arclength around an ellipse with semi-major axis a and semi-minor axis b . | 5 |
| 5.a) | Given three points in two-dimensional Cartesian space, how can one check for collinearity? | 5 |
| b) | Given four points in three-dimensional Cartesian space, how can one check for coplanarity? | 5 |
| 6.a) | Given a small square matrix A of order 3 with elements $a_{ij} = i + j$ for $i = 1, 2, 3$ and $j = 1, 2, 3$, what is the principal property of A ? | 5 |
| b) | What is the determinant of the matrix A of order 3 with elements $a_{ij} = i + j$ for $i = 1, 2, 3$ and $j = 1, 2, 3$? | 5 |
| 7.a) | For a system of linear algebraic equations with zero right-hand side, what can be done for a solution? Illustrate the situation with three simple equations. | 5 |
| b) | For a system of linear algebraic equations with nonzero right-hand side which are not independent, what can be done for a solution? Illustrate the situation with three simple equations. | 5 |
| 8.a) | What is the method of separation of variables for solving differential equations? Illustrate with a simple differential equation. | 5 |
| b) | What is the general solution of $d^2x/dt^2 - ax = 0$ for arbitrary scalar a ? | 5 |

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SCHEDULE I / ITEM 1 MATHEMATICS (continued) February 2001

- 9.a) Given two vectors $\underline{a} = (1, 5, 7)^T$ and $\underline{b} = (3, 2, 1)^T$, where the superscript T means transpose, what is $\underline{a} \cdot \underline{b}$? 5
- b) Given two vectors $\underline{c} = (2, 3, 7)^T$ and $\underline{d} = (3, 1, 2)^T$, where the superscript T means transpose, what is $\underline{c} \times \underline{d}$? 5
- 10.a) Given two linear equations: $x + 2y = 8$ and $2x + 3y = 13$, solve them for x and y using Cramer's rule. 5
- b) Given the same two linear equations: $x + 2y = 8$ and $2x + 3y = 13$, solve them for x and y using Gaussian elimination. 5

Total Marks: 100
