CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C-1 MATHEMATICS

March 2024

Although programmable calculators may be used, candidates must show all formulae used, the substitution of values into them, and any intermediate values to 2 more significant figures than warranted for the answer. Otherwise, full marks may not be awarded even though the answer is numerically correct.

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

Time: 3 hours

Q. No		Value	Earned
1.	(a) Find $$\sum_{n=1}^{2024} \frac{1}{n^2+3n+}$$ Hint: use partial fractions and telescoping s((b) Find the limit of the following geometri($$\infty \quad 2n \quad 1$$	10	
2.	If you were to make a nonstop flight from the city of Dayton, Ohio (39(to Tokyo $(35°39'N, 139°45'E)$ by the shortest route, in which directio you start your flight?	10	
3.	(a) Find the eigenvalues of $$A = \begin{bmatrix} 3 & -1 \\ 2 & 0 \end{bmatrix}$$ and find one eigenvector for each eigenvalue. (b) Find $a, b, c, d, \lambda_1, \lambda_2$ in	10	
4.	(a) An orthogonal matrix is one whose column vectors form a basis. The vectors of an orthonormal basis all have length 1 an orthogonal to each other. Find a, b for the orthogonal matrix $$\begin{bmatrix} 0.5 & 0.4 & x \\ 0.7 & a & y \\ \sqrt{0.26} & b & z \end{bmatrix}$$	10	
5.	The electric power (in W) produced by a certain source is giv $$P = \frac{144r}{(r+0.6)^2}$$ where r is the resistance in ohms in the circuit. For what val	10	

6.	(a) The Arcadium arcade in Lynchburg, Tennessee uses 3 diff tokens for their game machines. For $20 you can purchase ai lowing mixtures of tokens: 14 gold, 20 silver, and 24 bronze; 15 silver, and 19 bronze; OR, 30 gold, 5 silver, and 13 bronze. monetary value of the silver token? (b) Use Cramer's Rule to find y in terms of a and b when you	10	
7.	(a) Provide the second derivative (the derivative of the deriv following function in its simplest form. $$f(x) = 5x - \frac{3}{x-2}$$ (b) Provide the second derivative (the derivative of the deriv following function in its simplest form.	10	
8.	Find the equation of the tangent line to the curve $$y = \frac{1}{5\sin x + 2\cos x}$$	10	
9.	(a) Find the following indefinite integral $$\int x^2 \ln x \, dx$$ (b) Find the function $y = f(x)$ whose function graph passes point $(1, 2)$ and whose derivative is	10	
10.	Find the three cube roots of the complex number 64 and provide them in rectangular form *a+bi*.	10	
	Total Marks:	100	