

CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS

C-1 MATHEMATICS

October 2018

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

Marks

Q. No

Time: 3 hours

Value Earned

1.	a) Using the equation for a straight line in the plane, show that the line has zero curvature.	5	
	b) Show that an ellipse with constant elliptical curvature is a circle.	5	
2.	a) Distinguish between convergence of a sequence a_1, a_2, a_3, \dots and convergence of the corresponding series $a_1 + a_2 + a_3 + \dots$ for real numbers a_1, a_2, a_3, \dots .	5	
	b) Briefly discuss the convergence or divergence of the two harmonic series $1 + 1/2 + 1/3 + 1/4 + 1/5 + \dots$ and $1 - 1/2 + 1/3 - 1/4 + 1/5 - \dots$	5	
3.	a) What are the first three terms of the Taylor expansion of $\log(1+5x)$ about $x=0$?	5	
	b) Give an expression for the remainder term after the preceding three terms of the Taylor expansion of $\log(1+5x)$ about $x=0$.	5	
4.	a) Any square matrix can be expressed as the sum of a symmetric matrix and a skew-symmetric matrix. Briefly discuss and give simple examples.	5	
	b) Any square matrix can be expressed as the sum of a lower triangular matrix and an upper triangular matrix. Briefly discuss and give simple examples.	5	
5.	a) For an arbitrary nonsingular square matrix A, what is called its characteristic polynomial? Give a simple numerical example.	5	
	b) What are called the eigenvalues of the preceding matrix A? Give a simple numerical example.	5	
6.	a) For a unit circle, what is the integral for evaluating its circumference?	5	
	b) For an ellipse with semi-major axis a and semi-minor axis b, what is the integral for evaluating its area?	5	
7.	a) Using Gaussian elimination, solve the following three equations for x, y and z: $2x + 3y - 4z = 7, 3x - 5y + 7z = 11, 4x + 5y + 6z = 13$	5	
	b) Using matrix algebra, reformulate and solve the preceding linear equations.	5	
8.	a) For a complex variable z, what are the real and imaginary parts of e^z ?	5	
	b) For a complex variable z, what are the magnitude and argument of e^z ?	5	
9.	a) Give a simple ordinary differential equation for $f(x) = \sin x + \cos x$.	5	
	b) What is the difference between an initial value problem and a boundary value problem for an ordinary differential equation? Give simple examples.	5	
10.	Spherical excess is important in area computations for spherical triangles. With interior angles within zero and 2π , what are the corresponding minimum and maximum spherical excess values for spherical triangles? Give examples.	10	
Total Marks:		100	