

**CANADIAN BOARD OF EXAMINERS FOR PROFESSIONAL SURVEYORS**

**C-1 MATHEMATICS**

**October 2016**

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

**Marks**

**Q.No**

Time: 3 hours

Value Earned

1.	a) What is the limit of $x^{-1}\sin x$ as $x \rightarrow 0$ ? Show all the steps in deriving the limit.	5	
	b) What is the limit of $x^{-1}\cos x$ as $x \rightarrow \pi$ ? Show all the steps in deriving the limit.	5	
2.	a) Verify that the radial derivative of the area of a circle of radius $r$ is equal to its circumference.	5	
	b) Verify that the radial derivative of the volume of a sphere of radius $r$ is equal to its surface area.	5	
3.	a) What is the difference between an indefinite and a definite integral of some function $f(x)$ ?	5	
	b) It is well known that not all functions $f(x)$ can be integrated between some finite limits $a$ and $b$ . Give simple examples of a function $f(x)$ that cannot be integrated between $0$ and $1$ , and briefly explain why.	5	
4.	a) For general second-degree curves in Cartesian coordinates, explain how to distinguish between ellipses, parabolas and hyperbolas. Give simple examples.	5	
	b) What is called the eccentricity of a conic section? Give examples.	5	
5.	a) Given two arbitrary vectors $\mathbf{a} = (a_x, a_y, a_z)$ and $\mathbf{b} = (b_x, b_y, b_z)$ in Euclidean three-dimensional space, how can they be checked for being parallel?	5	
	b) What the corresponding check for being orthogonal?	5	
6.	a) Given the complex polynomial equation $z^n - 1 = 0$ for $n = 2, 3$ and $4$ . What are the corresponding roots?	5	
	b) Given the complex polynomial equation $z^n + 1 = 0$ for $n = 2, 3$ and $4$ . What are the corresponding roots?	5	
7.	a) What is the determinant of the small matrix $\begin{pmatrix} 3 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 5 \end{pmatrix}$ ?	5	
	b) What is the corresponding characteristic polynomial? Evaluate its coefficients.	5	
8.	a) What is the gradient of the function $f(x, y, z) = \sin x + 2 \cos y + 3 \tan z$ ?	5	
	b) What is the Laplacian of the same function?	5	
9.	a) Given three equations $3x + 2y + z = 7$ , $2x - 5y + 2z = 9$ , $3x + 2y - 3z = 12$ , what are $x$ , $y$ and $z$ using Gaussian elimination?	5	
	b) What are the corresponding $x$ , $y$ and $z$ using Cramer's rule?	5	
10.	On the unit sphere, given three non-collinear points in terms of their latitude $\phi_i$ and longitude $\lambda_i$ , $i=1,2,3$ , what is the corresponding interior spherical triangle area?	10	
<b>Total Marks:</b>		100	