



## **MASENO UNIVERSITY**

### **UNIVERSITY EXAMINATIONS 2015/2016**

**FIRST YEAR SECOND SEMESTER EXAMINATIONS FOR THE  
DEGREE OF BACHELOR OF SCIENCE WITH INFORMATION  
TECHNOLOGY**

### **MAIN CAMPUS**

### **MMA 110: FOUNDATIONS OF APPLIED MATHEMATICS**

Date: 27<sup>th</sup> April, 2016

Time: 2.30 - 4.30 pm

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#### **INSTRUCTIONS:**

- Answer question ONE and any other TWO questions.
- Start each question on a fresh page.
- Indicate question numbers clearly at the top of each page.
- Observe further instructions from the booklet.

**MASENO UNIVERSITY**

**ISO 9001:2008 CERTIFIED**



Question 1 [30 Marks]

(a) Find equation to the tangent to a curve

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$$x^2 + y^2 = 25$$

at the point (3,4)

[6 Marks]

(b) Find the inverse of the matrix A given as

$$A = \begin{bmatrix} -1 & 1 & 2 \\ 3 & -1 & 1 \\ -1 & 3 & 4 \end{bmatrix}$$

[6 Marks]

(c) By use of Cramer's rule solve for  $x_2$  in the following system of linear equation

$$\begin{pmatrix} 1 & 0 & 4 \\ 2 & 1 & -1 \\ 1 & 0 & 1 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \\ -1 \end{pmatrix}$$

[4 Marks]

(d) Find the 27<sup>th</sup> derivative of  $\cos x$

[3 Marks]

(e) Find the number of Mathematics students at a college taking atleast one of the following languages: French, German and Russian given the following set of data

65 study French

45 Study German

42 study Russian

20 study French and German

25 study French and Russian

15 study German and Russian

8 study all the three languages

[6 Marks]

(f) From the definition, find the derivative of  $\cos x$

[5 Marks]

Question 2 [20 Marks]

(a) Find the cube root of  $z = i$  [8 Marks]

(b) Validate the theorem

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$$

[6 Marks]

(c) Evaluate

$$\lim_{t \rightarrow 0} \frac{\sqrt{t^2 + 9} - 3}{t^2}$$

[4 Marks]

Question 3 [20 Marks]

(a) A ladder 10 metres long rests against the vertical wall. If the bottom of the ladder slides away from the wall at the rate of 1m/s. How fast is the top of the ladder sliding down when the bottom of the ladder is 6m from the wall? [8 Marks]

(b) Evaluate

$$\int \frac{4x^2 - 3x - 4}{x^3 + x^2 - 2x} dx$$

[8 Marks]

(c) Find the volume of a parallelepiped determined by the vectors

$$\vec{A} = \hat{i} + 2\hat{j} - \hat{k}, \quad \vec{B} = -2\hat{i} + 3\hat{k}, \quad \vec{C} = 7\hat{j} - 4\hat{k}$$

[10 Marks]

Question 4

<sup>20</sup>  
[18 Marks]

(a) Using Cramer's rule solve the following system of equations

$$\begin{aligned} x + y + z &= 6 \\ x - y + y &= 2 \\ 2x + y - z &= 1 \end{aligned}$$

[6 Marks]

(b) Find the equation tangent to the hyperbola

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$$

at the point  $(x_0, y_0)$

[7 Marks]

(c) Show that

$$(A - B) \cup (B - A) = (A \cup B) - (A \cap B)$$

[6 Marks]

Question 5

[20 Marks]

(a) Find the complex cube root of

$$-1 + \sqrt{3}i$$

leave your ans in polar form with argument in degrees [6 Marks]

(b) A Mercedes Benz is traveling West at 50km/h and A Volvo is traveling to the North at 60 Km/h. Both are headed for the intersection of the two roads. At what rate are the cars approaching each other when Mercedes Benz is 0.3 km and Volvo is 0.4 km from the intersection [7 Marks]

(c) Write the partial fractions decomposition for

$$\frac{x^3 - 8}{x^2(x - 1)^3}$$

[7 Marks]

===== END =====