



MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

SECOND YEAR FIRST SEMESTER EXAMINATIONS FOR THE
DEGREE OF BACHELOR OF SCIENCE IN APPLIED
STATISTICS, ACTUARIAL SCIENCE, MATHEMATICAL
SCIENCE AND MATHEMATICS AND ECONOMICS WITH
INFORMATION TECHNOLOGY

MAIN CAMPUS

MIT 403: WRITING MACROS IN LATEX

Date: 7th December, 2016

Time: 3.30 - 6.30 pm

INSTRUCTIONS:

- Answer question ONE and any other TWO questions.

MASENO UNIVERSITY

ISO 9001:2008 CERTIFIED



QUESTION 1. (COMPULSORY) (30 MARKS)

(a) Debugging is an important part in any programming.

i.) define debugging as used in this course.

[2 marks]

ii.) explain any 3 errors one might incur while writing a \LaTeX document.

[6 marks]

QUESTION 1. (COMPULSORY) (60 MARKS)

- (a) Debugging is an important part in any programming.
- i.) define debugging as used in this course [2 marks]
 - ii.) explain any 3 errors one might incur while writing a \LaTeX document. [3 marks]
- (b) Most of the commands in \LaTeX require certain packages otherwise one will get errors. State the packages required to run the following: [4 marks]

Command	package
$\backslash\text{floatbarrier}$	
$\backslash\text{multicolumn}$	
$\backslash\text{includegraphics}$	
$\backslash\text{clip}$	

- (c) There is a common problem that occurs with user-defined macros with no arguments. Give an illustration of this problem and how one can solve it. [4 marks]
- (d) Define a command that takes two arguments:
- (a) a font sizing command (e.g. $\backslash\text{size11}$)
 - (b) a line of text
- and define the command so that the text in the second argument is centered and is sized according to the first argument. Give a demonstration of how it works. [8 marks]
- (e) You can define your own environments in \LaTeX . Write your own environment that will number a single number to a given set of equations. For example: [6 marks]

$$\begin{aligned} a &= b + c \\ &= d + e \end{aligned} \tag{1}$$

QUESTION 2. (20 MARKS)

- (a) For each of the following operations, write a command with the given number of arguments that does the same operation. Give an example to demonstrate how your command works. [12 marks]

Operations	number of argument(s)	commented
write the first 2 terms and the last term of a sequence in the first argument. e.g. of a sequence in x_1, x_2, \dots, x_n call it myseq	2	
Write $\text{Hom}_k(V, W)$ without having to write $\$\\backslash\text{math}(\\text{Hom}_k(V, W))\$$.	3	
Completely write any environments without options as a command with two arguments	2	
Write a 3×2 matrix	4	

- (ii) Identify types of errors and how they occur in the following \LaTeX document extract. Rewrite a correct extract. (5 marks)

1	<code>\documentclass[12pt,a4paper]{article}</code>
2	<code>\usepackage{amsmath}</code>
3	
4	<code>\begin{document}</code>
5	Errors & omissions in \LaTeX
6	Consider $3x^2 + 2x + 6$
7	The equation
8	$3x^2 + y$ describes a straight line.
9	
10	<code>\end{document}</code>
11	

- (c) Specify the packages required if any for the environment you defined in question 4(c). (2 marks)

QUESTION 5. (20 MARKS)

- (a) Tikz is an important package that can be used to draw a lot of shapes in \LaTeX . Write a code (from scratch) that will produce the following figure given that:

- the radius of the circle is 1.5 units
- the smaller dots (showing paths) have 0.1 units radius

(10 marks)

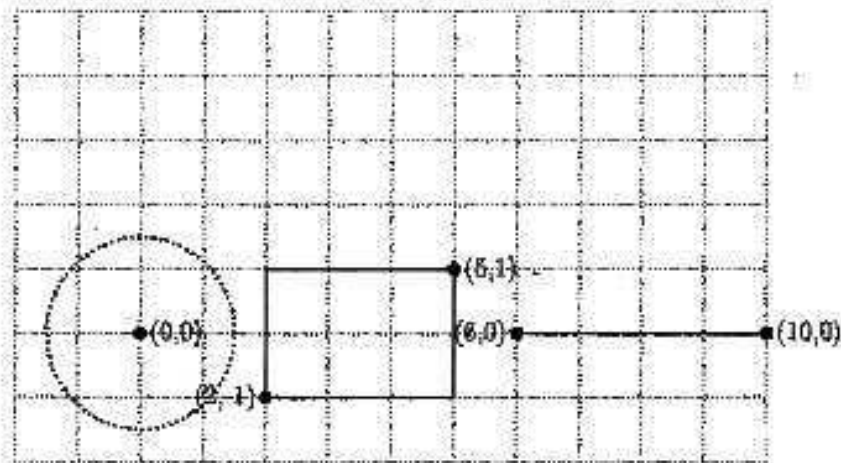


Figure 1: Some plane figures on a dotted grid

- (b) Write a code (from scratch) that will draw the graph of $y = x^2 - x + 3$ for $-2 \leq x \leq 3$ as shown in the figure below (include the caption). Use `\foreach` command to show the points the curve intersects line $x = -2, -1, 0, 1, 2, 3$ with 0.1 units circles. [10 marks]

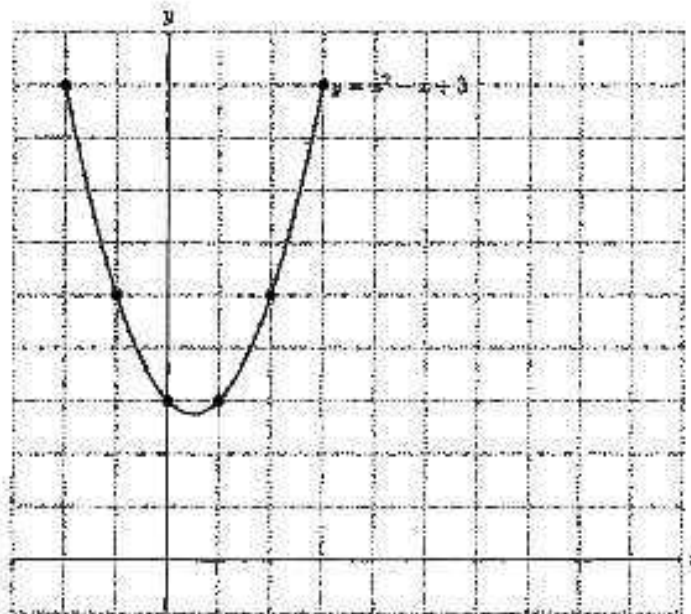


Figure 2: Graph of $y = x^2 - x + 3$

QUESTION 4. (20 MARKS)

- (a) Reproduce the L^AT_EX code of the following extract. [12 marks]

We say that the rings R and S are isomorphic and write $R \cong S$. For example,

The ring $R = \{m + n\sqrt{2} : m, n \in \mathbb{Z}\}$ is isomorphic to the ring

$$S = \left\{ \begin{pmatrix} m & n \\ 2n & m \end{pmatrix} : m, n \in \mathbb{Z} \right\} \quad (2)$$

with the operations of matrix addition and multiplication, the isomorphism being

$$\varphi : m + n\sqrt{2} \mapsto \begin{pmatrix} m & n \\ 2n & m \end{pmatrix}.$$

If S is a ring defined by (2), then there is a monomorphism $\theta : \mathbb{Z} \rightarrow S$ given by

$$\theta(m) = \begin{pmatrix} m & 0 \\ 0 & m \end{pmatrix} \quad (m \in \mathbb{Z}),$$

Let $\varphi : R \rightarrow S$ be a homomorphism, where R and S are rings, with zero elements $0_R, 0_S$, respectively, and let

$$K = \{a \in R : \varphi(a) = 0_S\}. \quad (3)$$

We refer to K as the kernel of φ denoted by $\ker \varphi$.

- (b) Write \LaTeX code to reproduce the table in question 1(b). Insert your answers in the corresponding cells. [8 marks]

QUESTION 5. (20 MARKS)

Write a \LaTeX code (from scratch) that will produce the sample document below. Use BibTeX. [20 marks]