Question numbers clearly at the top

Calculators are not allowed in this exam.

Question One

(a) Can one only produce PDF documents from LaTeX? [5 marks]

(b) Why do I have to go to the example folder to compile my .tex-file to a PDF [6 marks]

(c) How do you write special characters, like German umlauts, in LaTeX?, [5 marks]

(d) How can you refer to a `\bibitem` label? [5 marks]

(e) Why use pdflatex and not latex directly to convert the .tex-files to PDF documents?, [5 marks]

(f) How do you best write your LaTeXdocuments? [6 marks]

(g) Is the term in square brackets after the item in a description list, the term you want to define? [3 marks]

Question Two

Write LaTeXCode that produces the document entitled Latex Examination Question 2(attached). Make sure your document settings reflect the values contained in the narratives.

Question Three

Write LaTeXCode that produces the document entitled LaTex Examination Question 3 (attached)

Question Four

a) What is LaTeX? What are its advantages?

b) How do you install LaTeX?

c) Briefly describe how LaTeXworks

d) Outline important ideas you learnt in the course

...stion Five

...ate LaTeX codes that produce the following tables

Team sheet		
Goalkeeper	GK	Paul Robinson
Defenders	CB	Dawson
	LB	Chimbonda
	CB	King
	RB	Gardner
Midfielders	MC	Tainio
	MC	Zakora
	MC	Lennon
Strikers	ST	Malbranque
	ST	Berbatov
	ST	Defoe

Table 1: Team Sheet: Spurs v. Blackburn

Day	Min Temp	Max Temp	Summary
Friday	11C	17C	Bright or sunny spells at first, generally becoming more cloudy, with showers developing, and with more prolonged rain spreading from the southwest. Moderate to fresh southwest winds with stronger gusts.
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Sunday	10C	16C	More generally cloudy with longer spells of rain, southerly winds of 15mph.

Table 2: Weather

[12 marks]

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]

(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
\FloatBarrier	
\multicolumn	
\includegraphics	
\citep	

(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. \small)

(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]

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

(b) Identify types of errors and how they occur in the following LaTeX document extract. Rewrite a correct extract.

[6 marks]

```
1  \documentclass12pt,a4paper]{article}
2  \usepackage{amsmaths}
3
4  \begin{document}
5  Errors & omissions in \LaTeX.
6  Consider $$y=x^2\sina $$
7  The equation
8  $2x=y describes a straight line.
9
10 \end{document}
11
```

(c) Specify the packages required if any for the environment you defined in question 1(e). [2 marks]

QUESTION 3. (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 points) have 0.1 units radius

[10 marks]

QUESTION 1. COMPULSORY (30 MARKS)

(a) What do you understand by Debugging as used in the course? [2 marks]

(b) Errors can be put into different categories. List any two 'common mistakes' that could lead to the following errors and give an example for each.

(i) Undefined control sequence [3 marks]

(ii) Missing package [3 marks]

(c) Write the source code that will produce the table below.

Program	Units Code	
Math Science	MMA	Real Analysis
Actuarial Sci.	MAC	Risk Theory
Applies Stat.	MAS	Probability

Table 1: Simple table

[6 marks]

(d) There are two main ways ways of bibliography management. *BibTeX* and the embedded system. It is always a challenge dealing with capital letters in BibTeX. Briefly explain. [2 marks]

(e) Explain **TWO** reasons why you would prefer creating a document in LaTeX rather than WYSIWYG? [4 marks]

(f) Give any **FOUR** 'special' characters in LaTeX and how they can be written to appear in your document. [4 marks]

(g) You have an image that you want to use in your latex document. What's the first step you will take to include the image and give a short LaTeX code including the image ('img.png' for example). Caption: 'My first image'. What package(s) do you require? [6 marks]

QUESTION 2. (20 MARKS)

(a) (i) Give any two examples of *floats* as used in LaTeX. [1 mark]

(ii) In your own words what do you understand by `Float barrier` and why and where will someone use `\FloatBarrier` and what package do you require to use it? [5 marks]

(b) Write a LaTeX code to give the following. What package(s) is (are) required?

$$y = \overbrace{a + f(\underbrace{\quad bx \quad}_{\geq 0 \text{ by assumption}})}^{\text{Wrong}} = \overbrace{a + f(\underbrace{bx}_{\geq 0 \text{ by assumption}})}^{\text{Right}}$$

[8 marks]

(c) *Identify and correct the errors in the following extract.* [6 marks]

```
\documentclass[a4paper,12pt]{article}


\begin{document}
\chapter{First chapter}

This is the first chapter of this document.
It has several sections.
\section{The first section}
This section is the first and last.
Let's do some math.
\begin{align}
(a+b)^2&=a^2+2ab+b^2\\
(a-b)^2&=a^2-2ab+b^2
\end{align}
\end{document}
```

QUESTION 3. (20 MARKS)

(a) Give any two reasons why it is important to create customised commands in LaTeX? [2 marks]

(b) Define a command that typesets its argument as both bold and italic. [3 marks]

(c) Define commands with the given number of arguments that will work as explained in the table below. [15 marks]

Command name	No. of arguments	Function
comb	2	$\binom{arg1}{arg2}$
matt	5	$\begin{pmatrix} arg1 & arg2 \\ arg3 & \frac{arg4}{arg5} \end{pmatrix}$
seq	4	$arg1_{arg2} + \cdots + arg1_{arg3} + arg4^2$
ovrund	4	$\overbrace{arg1 + \cdots + arg2}^{arg3} + \underbrace{arg1}_{arg4}$

QUESTION 4. (20 MARKS)

(a) (i) Give one reason why BibTeX is more preferred to the embedded bibliography. [2 marks]

(ii) Give any TWO ways in which BibTeX is different from embedded bibliography. [4 marks]

(b) Briefly explain when, where and why the following are used: [6 marks]

```
\renewcommand{\bibname}{REFERENCES}
\renewcommand{\refname}{REFERENCES}
```

(c) Write LaTeX codes to show how you would write the following in both BibTeX and embedded system [hint: use article as the document class and apa as the bibliography style] [8 marks]

QUESTION 1. (COMPULSORY: 30 MARKS)

(a) List any two ways in which `report` class differs with `article` class. [2 marks]

(b) State any two differences between errors and warnings in LaTeX. [2 marks]

(c) Which one of the following is the odd one out. Why? [2 marks]

A) `\caption` B) `\label` C) `\ref` D) `\table`

(d) Briefly explain the two scenarios that give rise to **missing $ inserted** error in LaTeX. Give an example of each. [6 marks]

(e) Give any two reasons why one would choose to use LaTeX instead of a word processing software to prepare a document. [4 marks]

(f) BibTeX bibliography management style is Flexible and consistent. Explain. [4 marks]

(g) You have figures to include in your document. You also want to produce the list of figures. List the commands and environment you **MUST** use to make this happen. [4 marks]

(h) Name two math environments that require the package `amsmath` and give one example of how to use each. [6 marks]

QUESTION 2. (20 MARKS)

(a) Kyalo is writing his Real Analysis notes in LaTeX. He needs to create Theorem environments to write definitions, theorems, lemmas and corollaries. In the preamble of his document he uses the theorem style plain by adding a line `\theoremstyle{plain}`.

i. Which package is required? [1 mark]

ii. Which error is he likely to obtain? [2 marks]

iii. Suppose he wants to use Theorem, Lemma and Corollary as thm, lem and cor respectively, write the three lines that defines the theorem environments so that their numbering is done within section and all follow same numbering. [6 marks]

(b) What environment do we use when using embedded bibliography management style? [1 mark]

(c) State any four types of matrix environments. Give a 2×2 matrix output example for each. [6 marks]

(d) Give two examples to differentiate between 'in-line' and 'display' math (code and output for both). [4 marks]

QUESTION 3. (20 MARKS)

(a) Give any two key attributes of `@artricle` that are not attributes of `@book` in BibTeX. [2 marks]

(b) Write a code that will produce the following mathematical equation: [use `dcases*`] [8 marks]

(b) Write a code that will produce the following mathematical equation: [use `dcases*`] [8 marks]

$$f(x) = \begin{cases} \int_0^x t^2 + 1, & \text{for } x \geq 1 \\ \sum_{n=0}^{2} (n+1)^2 x^n, & \text{when } 0 < x < 1 \\ 0, & \text{elsewhere} \end{cases}$$

(c) Define debugging. [2 marks]

(d) Identify and explain the errors in the following extract. [4 marks]

```
1  \documentclass[a4paper,12pt]{report}
2  \usepackage{amsmaths}
3
4  \begin{document}
5  \chapter{First chapter}
6
7  This is the first chapter of this document.
8  It has several sections.
9  \section{The first section}
10 This section is the first and last.
11 Let's do some math.
12 \begin{eqnarray}
13 (a+b)^2&=a^2+2ab+b^2\\
14 (a-b)^2&=a^2-2ab+b^2
15 \end{eqnarray}
16 We have a figure
17 \includegraphics[scale = 0.4]{images/fig1}
18 \end{document}
```

(e) Most of the commands in LaTeX require certain packages otherwise one will get errors. State the packages required, if any, to run the following: [4 marks]

Command	package
`\FloatBarrier`	
`\multicolumn`	
`\includegraphics`	
`\multirow`	

QUESTION 4. (20 MARKS)

(a) `\caption` can only be used in floats. Name the two types of floats and give the two commands that are used in order to utilize `\caption` in cross-referencing. [4 marks]

(b) Write new commands with the following properties:

(i) A series in a given variable (the first argument) starting from some index (second argument) up to some index (third argument) added to some added variable (fourth argument) squared `sumseq`.
[hint: `\sumseq{x}{k}{n}{y}` will produce $x_k + \cdots + x_n + y^2$] [4 marks]

(ii) A 2×2 matrix in which the entries are the arguments.
[hint: `\matt{-4}{8}{0}{-1}` will produce $\begin{bmatrix} -4 & 8 \\ 0 & -1 \end{bmatrix}$] [4 marks]

(c) Write the bib file for the following bibliography. [8 marks]

References

[1] Acebron J. A., Bonilla L. L., et al. (2005). The karumoto model; a simple paradigm for synchronization phenomena. *Review of modern physics*, 77:137–185.

[2] Arnold I. V. (1989). *Mathematical methods in classical mechanics*. Springer-Varlog, New York, second edition.

QUESTION 5. (20 MARKS)
Write a LaTeX code to produce the following extract. Use embedded style for bibliography. Assume that Figure 1 in the extract is stored by the name 'cylinder.png' in the mother folder. [20 marks]

QUESTION 1. (COMPULSORY: 30 MARKS)

(a) Name any two document classes in LaTeX and state when they are used. [4 marks]

(b) Explain any two circumstances leading to each of the following types of errors in LaTeX. [4 marks]

i. Undefined control sequence

ii. Missing $ inserted

(c) Which one of the following is the odd one out. Why? [2 marks]

A) `miktex` B) `pdftex` C) `texlive` D) `mactex`

(d) State three reasons why you-as a mathematician-would choose LaTeX to write your academic report. [6 marks]

(e) Write the output of the following lines extracted from a LaTeX editor: [4 marks]

```
This document
is in LaTeX. Consider $x+y=4$
This is the second
paragraph. Now consider $$2x+y=6$$
```

(f) Explain any two reasons why one would choose BibTeX bibliography management style in their LaTeX document. [4 marks]

(g) i. What is the first step you take to include a figure in your LaTeXdocument before writing the code to include it. [2 marks]

ii. Suppose the picture file is named `fig1.png`. Write the code to include the figure in your document. Use any caption of your choice and label the figure. [4 marks]

QUESTION 2. (20 MARKS)

(a) Name any two differences between embedded and Bibtex bibliography management style. [4 mark]

(b) Write the code to produce the following matrices. [Ignore the preamble and document environment].

i. $\begin{vmatrix} 2 & 7 \\ -4 & 8 \end{vmatrix}$ [2 marks]

ii. $\begin{bmatrix} 5 & -7 \\ 3 & -3 \end{bmatrix}$ [2 marks]

(c) Give an example (code and output) to demonstrate the difference between 'in-line' and 'display' math. [4 marks]

(d) Give any two scenarios that may lead to a `missing package` error can occur. Give an example of each. [4 marks]

(e) Write the following math in LaTeX (Ignore preamble). [4 marks]

$$f(x) = a_0 + \sum_{n=1}^{\infty} \left(a_n \cos \frac{n\pi x}{L} + b_n \sin \frac{n\pi x}{L} \right)$$

QUESTION 3. (20 MARKS)

(a) Identify and explain the errors in the following extract. [6 marks]

```
1  \documentclass[12pt,a4paper]{article}
2  %\usepackage{amsmath}
3  \begin{document}
4  \chapter{Introduction}
5  The following figure is just an example.
6  It gives a glimpse of what we will learn
7  in this topic.
8  \begin{figure}[h!]\centering
9  \includegraphics[scale=0.3]{fig1}
10 \caption{The first figure}
11 \label{fig:firstone}
12 \end{figure}
13
14 $$\begin{pmatrix}
15 2&9\\8&7
16 \end{pmatrix}$$
17 \end{document}
```

(b) Give any 6 key attributes of `@artricle` in BibTeX. [3 marks]

(c) Write the LaTeX code for the following bibliography in embedded style. [8 marks]

References

[1] E. I. Zel'manov, On additional laws in the Burnside problem on periodic groups, *Internat. J. Algebra Comput.*, **3** no. 4 (1993) 583–600.

[2] G. Glauberman, A p-group with no normal large abelian subgroup, *Character theory of finite groups*, 61–65, Contemp. Math., 524, Amer. Math. Soc., Providence, RI, 2010.

(d) Explain where the FloatBarrier command is used in LaTeX. [3 marks]

QUESTION 4. (20 MARKS)

(a) Wairimu is writing her Real Analysis notes in LaTeX. She needs to create Theorem environments to write definitions, theorems, lemmas and corollaries. In the preamble of her document she uses the theorem style plain by adding a line `\theoremstyle{plain}`.

i. Which package is required? [1 mark]

ii. Which error is he likely to obtain? [2 marks]

iii. Suppose he wants to use Theorem, Lemma and Corollary as thm, lem and cor respectively, write the three lines that defines the theorem environments so that their numbering is done within section and all follow same numbering. [3 marks]

(b) Write a code that will produce the following mathematical equation: [use `dcases*`] [8 marks]

$$f(x) = \begin{cases} \int_{10}^{\infty} x^2 + 1, & \text{for } x \geq 10 \\ \sum_{n=0}^{10} (n)^2 x^n, & \text{when } 0 < x < 10 \\ 0, & \text{elsewhere} \end{cases}$$

(c) Give any two reasons why it is important to create customised commands in LaTeX? [2 marks]

(d) Define commands with the given number of arguments that will work as explained in the table below. [5 marks]

Command name	No. of arguments	Function
comb	2	$\binom{\texttt{arg1}}{\texttt{arg2}}$
seq	4	$\texttt{arg1}_{\texttt{arg2}} + \cdots + \texttt{arg1}_{\texttt{arg3}} + \texttt{arg4}^2$

QUESTION 5. (20 MARKS)

Write a LaTeX code to produce the following extract. Use Bibtex style for bibliography. [20 marks]

Question One

(a) Can one only produce PDF documents from LaTeX? [5 marks]

(b) Why do I have to go to the example folder to compile my .tex-file to a PDF [6 marks]

(c) How do you write special characters, like German umlauts, in LaTeX?, [5 marks]

(d) How can you refer to a `\bibitem` label? [5 marks]

(e) Why use pdflatex and not latex directly to convert the .tex-files to PDF documents?, [5 marks]

(f) How do you best write your LaTeXdocuments? [6 marks]

(g) Is the term in square brackets after the item in a description list, the term you want to define? [3 marks]

Question Two

Write LaTeXCode that produces the document entitled Latex Examination Question 2(attached). Make sure your document settings reflect the values contained in the narratives.

Question Three

Write LaTeXCode that produces the document entitled LaTex Examination Question 3 (attached)

Question Four

a) What is LaTeX? What are its advantages?

b) How do you install LaTeX?

c) Briefly describe how LaTeXworks

d) Outline important ideas you learnt in the course

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	RB	Gardner
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	MC	Zakora
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Table 1: Team Sheet: Spurs v. Blackburn

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Table 2: Weather

[12 marks]

QUESTION 1. (COMPULSORY) (30 MARKS)

(a) Debugging is an important part in any programming. [2 marks]

i.) define debugging as used in this course

ii.) explain any 3 errors one might incur while writing a LaTeX document. [6 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]

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\citep	

(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. \small)

(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]

[30 Marks]

(a) What is LaTeX? What are its advantages? (5 Marks)

(b) Can one only produce PDF documents from LaTeX? (5 marks)

(c) Briefly describe how LaTeXworks. (5 marks)

(g) Is the term in square brackets after the item in a description list, the term you want to define? (5 marks)

(d) Describe the five standard classes that are used to produce a document in LaTeX. (10 Marks)

Question Two [20 Marks]

(a) What is a "macros" in LaTeX? Why is it neccessary to define one's own procedures in a programming language?

(b) Write the LaTeXcodes that perform the following functions;

(i) Define a command that typesets its argument as both bold and italic.

(ii) Define a command that takes two arguments; a font sizing command (e.g. small) and 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.

Question Three [20 Marks]

Write LaTeXCode that produces the document entitled Poincaré's h-Cobordism and the price of fish, shown below;

The scientific world has been astonished by an announcement from Dr Tony Strainer, a mathematics lecturer at the University of Nuneaton, establishing a definite link between Poincaré's h-Cobordism and the price of fish. A partner in this remarkable work is Mr Bert Wilkins, fishmonger and amateur algebraic topologist. Explained Dr Strainer: "we have established a proof of Drivle's Theorem when the fish function C is finitely-undermined, via a new form of the Rincewind inequality".

Their work is due to appear in the *Proceedings of the Iceland Cod Fisheries Society of London, Series D.*

Professor Hertz of Göttingen has remarked: "this result is very ex
ing... We may now be able to show that $f(C)$ is indeed grease-proof, thus opening the way to a mathematical systematisation of wet fish."

Question Four [20 Marks]

Write LaTeXCode that produces a one page document titled "Actuarial Science Project". Include ALL features of LaTeXthat you have learned so far.

Question Five [20 Marks]

Write LaTeXcodes that produce the following tables

(a)

Team sheet		
Goalkeeper	GK	Paul Robinson
Defenders	CB	Dawson
	LB	Chimbonda
	CB	King
	RB	Gardner
Midfielders	MC	Tainio
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Table 1: Team Sheet: Spurs v. Blackburn

MASENO UNIVERSITY

UNIVERSITY EXAMINATIONS 2016/2017

FOURTH YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE AND BACHELOR OF EDUCATION WITH INFORMATION TECHNOLOGY