THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION AND VOCATIONAL TRAINING

BASIC APPLIED MATHEMATICS SYLLABUS FOR ADVANCED SECONDARY EDUCATION

FORM V - VI

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Designed and prepared by:

Tanzania Institute of Education

P.O. Box 35094

Dar es Salaam

Tanzania

Tel: +255 222 2773005

Fax: +255 22 2774420

E-mail: director.general@tie.go.tz

Website: www.tie.go.tz

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1.0. Introduction

1.1 Background Information

The Basic Applied Mathematics syllabus of 2009 replaces the syllabus of 1996 for the same subject. The review of the syllabus was guided by two main factors.

The first was the change from content-based curriculum to a competence-based one. This paradigm shift has already been used in the review of the Basic Mathematics syllabus at Ordinary Secondary Education which is a pre-requisite for Basic Applied Mathematics. Therefore competence based approach should be consistently maintained at Advanced Secondary Education.

The second factor was the development in science and technology and the change in needs of other subjects and fields of study. A survey was conducted to assess these needs and suggestions of experts and stakeholders were incorporated in the revised syllabus. Crosscutting issues (CCI) and the use of Information and Communication Technology (ICT) in teaching and learning were added and emphasised.

1.2 Subject Description

Basic Applied Mathematics (BAM) is a subsidiary subject in Advanced Secondary Education. The subject is offered to Form Five and Form Six students who are not studying Advanced Mathematics and who need mathematics as a tool for mastering the content in their subject combinations. BAM will be compulsory for students studying one or more of the following subjects (provided they are not studying Advanced Mathematics):

- Natural Sciences (Physics, Chemistry, Biology, Computer Science, Agriculture),
- Business Studies (Economics, Commerce, Accountancy) and
- Home Economics (Home Management, Nutrition, Textile Technology)

The subject also provides skills to solve real-life problems and focuses on how Mathematics is applied in daily life situations. Therefore it is useful for all students in Advanced Secondary Education.

1.3 Rationale for Review of the Subject Syllabus

The rationale for the review of the Basic Applied Mathematics syllabus was three fold. First, it took into account the mathematical skills needed in Principal subjects. Second, it aimed at placing more emphasis on the application of mathematics in real-life situations and thus creates a greater appreciation for the subject; and third, the use of ICT has been incorporated whenever possible.

The syllabus of 2009 has clear demarcation of topics to be covered in Form Five and Form Six. The contents of the topics of Coordinate Geometry as well as Ratios and Proportions have been placed within the topics of Functions and Algebra respectively. Subtopics within the topics of Differentiation and Integration have been developed and re-arranged from simple to complex. The Calculus of Trigonometric, Exponential and Logarithmic Functions has been shifted to Form Six within the topics of Trigonometry as well as Exponential and Logarithmic Functions respectively. The topics of Units and Measurements as well as Vectors have been removed since both have been covered in Basic Mathematics syllabus for Ordinary Secondary Education.

2.0 Aims and Objectives of Education in Tanzania

The general aims and objectives of education in Tanzania are to:

a) guide and promote the development and improvement of the personalities of the citizens of Tanzania, their human resources and effective utilisation of those resources in bringing about individuals and national development;

b) promote the acquisition and appreciation of the culture, customs and traditions of the people of Tanzania;

c) promote the acquisition and appropriate use of literacy, social, scientific, vocational, technological, professional and other forms of knowledge, skills and understanding for the development and improvement of the condition of man and society;

d) develop and promote self-confidence and an inquiring mind, and understanding and respect for human dignity and human rights

and readiness to work hard for self-advancement and national development;

e) enable and expand the scope of acquisition, improvement and upgrading of mental, practical, productivity and other life skills needed to meet the changing needs of industry and economy;

f) enable every citizen to understand the fundamentals of the National Constitution as well as the enshrined human and civic rights, obligations and responsibilities;

g) promote love and respect for work, self and wage employment and improved performance in the production and service sectors;

h) inculcate principles of the National Ethics and Integrity, National and International Cooperation, peace and justice, through the study, understanding and adherence to the provisions of the National constitution and other international basic charter and;

i) enable a national use, management and conservation of the environment.

3.0 Aims and Objectives of Secondary Education

In Tanzania, secondary education refers to post-primary formal education offered to learners who successfully complete seven years of primary education and have met the requisite entry requirements.

The aims and objectives of secondary education are to:

a) consolidate and broaden the scope of baseline ideas, knowledge, skills and principles acquired and developed at the primary educational level

b) enhance the development and appreciation of national unity, identity and ethic, personal integrity, respect and readiness to work, human rights, cultural and moral values, customs, traditions and civic responsibilities and obligations.

c) promote the development of competency in linguistic ability and effective use of communication skills in Kiswahili and English.

d) provide opportunities for the acquisition of knowledge, skills,

attitudes and understanding in prescribed or selected fields of study.

e) prepare students for tertiary and higher education, vocational, technical and professional training.

f) inculcate a sense and ability for self-study, self-confidence and self-advancement in new frontiers of science and technology, academic and occupational knowledge and skills and;

g) prepare the students to join the world of work.

4.0 General Subject Competences

By the end of the two-year course the student should have the ability to:

a) think critically and logically in interpreting and solving problems;

b) use mathematical language in explaining and identifying mathematical related ideas;

c) apply mathematical knowledge and techniques in other fields;

d) recognize the application of mathematical concepts in different fields;

e) appreciate the application of mathematical knowledge and skills in everyday life and;

f) use appropriate technology to solve mathematical problems.

5.0 General Subject Objectives

By the end of the two-year course the student should be able to:

a) create alternative methods and techniques in solving mathematical problems;

b) identify, read and write mathematical symbols and expressions;

c) promote the development and application of mathematical skills in solving problems in daily life;

d) apply mathematical concepts in interpreting situations at local and global levels;

e) develop an interest in the use of mathematical approach to solving problems and

f) develop a foundation of mathematical knowledge, techniques and

- life skills for studying mathematics and related subjects.

6.0 Structure and Organization of the subject Syllabus

In the revised syllabus of 2009, competences for each class level have been taken into account. This has influenced the development of class level objectives and the organisation of the syllabus. The following are new in the organization of the Basic Applied Mathematics syllabus:

i) Class level competences and objectives which have lead to a clear demarcation of Form Five and Form Six topics;
ii) Extra column for assessment has been added; and
iii) An additional column for suggested number of periods per subtopic has been inserted.

6.1 Class Competences

These are competences that a student should acquire by the end of the class level. Some competences are to be developed in both years.

6.2 Class Objectives

In order to achieve a class level competence one or more class level objectives need to be achieved. These are indicated at the beginning of each year.

6.3 Content matrix

6.3.1 Topic/Subtopics

Topics were developed from class level competences and consequently objectives in light of the rationale for the review of the subject. Some of the topics of the Basic Applied Mathematics syllabus of 1996 were retained with revisions. Topics are in both spiral and block arrangement. Topics are divided into subtopics for a better treatment in the teaching-learning process.

6.3.2 Specific objectives

The specific objectives refer to each subtopic. The specific objectives when achieved would ensure that class level objectives and competences are realised. A subtopic may have one or more specific objectives.

6.3.3 Teaching and learning strategies

The suggested Teaching and Learning strategies are not exhaustive. The teacher is strongly advised to use them plus any other strategies which are applicable and relevant. In some cases the teaching and learning strategies also provide a guide for the coverage of the subtopic. The approach is learner-centred and activity-oriented. Group work has been used to promote more participation and cooperation. Since some of the topics build upon knowledge from Basic Mathematics in Ordinary Secondary Education, questions-and-answers and other methods for review are used. To develop independent learning students are to conduct investigations and make class presentations on their findings. This strategy will also help to develop communication skills of students. Among other things, students are to conduct investigation into how different mathematical concepts are applied in real-life problems. The aim of these investigations is to promote a greater appreciation for the subject.

6.3.4 Teaching and learning resources

Each strategy has some suggested teaching and learning resources and the teacher is strongly advised to use them. Under different circumstances, the teacher is also advised to use other relevant and more contextualized resources. The use of the chalkboard/whiteboard is assumed. The scientific calculator is mentioned only in some areas in which calculations are to be done but students are to be encouraged to use it in other subjects. Whenever possible students should use ICT and practice using appropriate application packages that can be applied to solve mathematical problems.

6.3.5 Assessment

For every specific objective, one or more assessment techniques are suggested. Both formative and summative assessments should be used. A project type of assessment is suggested at the end of Form Five and Form Six courses to ensure the application of learnt knowledge on Statistics and Linear Programming respectively. Whenever possible, projects that apply mathematical knowledge learnt in various topics should be undertaken.

6.3.5 Estimated Number of periods

Each subtopic has a suggested number of periods, which serve as a guide and vary according to subtopics. The teacher should make provision for learners whose background is not strong in Basic Mathematics. The remedial solution will depend upon the environments prevailing in the local institution.

7.0 Instructional Time

The Basic Applied Mathematics syllabus is designed to be taught in two years. The allocated time is 4 periods of 40 minutes per week. Effective days of classroom teaching and learning are 194 days and the teacher should make maximum use of this time. In case instructional time is lost it must be compensated according to local conditions.

8.0 Assessment in the subject

The table below shows the type of assessment and the accompanied assessment measures to be used. The assessment measures listed in the table contributes to continuous and final assessments of the student achievement. The frequency for each assessment measure has been indicated with the weight in percentage. You are therefore strongly advised to apply a wide selection of assessment measures in order to develop students' ability for the mastery of the subject matter during the teaching and learning process.

TYPES OF ASSESSEMENT	ASSESSMENT MEASURE	FREQUENCY				WEIGHT %	TOTAL WEIGHT %
		Term 1	Term 2	Term 3	Term 4		
I. CONTINUOUS ASSESSEMNT	1. Test	2	2	2	-	10	
	2. Individual Assignments (open ended investigation)	1	1	1	-	5	
	3. Oral reports	1	1	1	-	5	
	4. Written projects	-	1	1	-	10	
	5. ICT based tasks	1	1	1	-	5	
	6. Terminal exams	1	1	1	-	15	50
II. FINAL EXAMINATION	6. National Examination	-	-	-	1	50	50
TOTAL MARKS							100

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Acting Commissioner for Education
Ministry of Education and Vocational Training
P.O. Box 9121
Dar es Salaam
Website: www.moe.go.tz
Tel: 2110150-2, 2110179
Fax: 022113271

FORM V

CLASS COMPETENCES

By the end of Form Five the student should have the ability to:

1. use appropriate technology to solve mathematical problems;
2. apply mathematical knowledge to draw and interpret graphs in other subjects;
3. apply mathematical skills in solving algebraic equations arising in different fields;
4. use differentiation to solve real-life problems;
5. use integration to solve problems in other fields and;
6. organise, analyse and present data using mathematical knowledge.

CLASS OBJECTIVES

By the end of Form Five the students should able to:

1. use scientific calculators and computer packages to evaluate mathematical problems;
2. sketch linear and quadratic graphs;
3. identify the features of different types of graphs;
4. solve simultaneous equations of two unknowns (linear-linear, linear-quadratic) ;
5. find the sum of finite and infinite series;
6. formulate and solve algebraic equations from real-life problems;
7. explain the physical meaning of the derivative;
8. use techniques of differentiation to determine the derivatives of polynomial functions;
9. solve real-life problems by using differentiation;
10. distinguish between derivative and anti-derivative;
11. distinguish between definite and indefinite integral;
12. solve real-life problems using integration;

13. collect, organise and present data in tables and (statistical) graphs and;

14. calculate and interpret measures of central tendency and dispersion for given data.

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
1.0 CALCULATING DEVICES 1.1 The Scientific Calculators	By the end of this subtopic the student should be able to use scientific calculators to evaluate mathematical expressions.	i. Students through think pair and share to identify basic features of a scientific calculator. ii. Teacher to guide students to demonstrate the use of scientific calculators . iii. Students to perform computation individually on mathematical expressions using scientific calculators.	Scientific calculator	Is the student able to use a scientific calculator to evaluate mathematical expressions?	4
1.2 The Computer packages	By the end of this subtopic the student should be able to: a) use a calculator from the computer.	i. Teacher to guide students to open a calculator from the computer. ii. Teacher to demonstrate how to use the calculator from the computer. iii. Students in groups to use the calculator from the computer.	Computer	Is the student able to use a calculator from the computer?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) evaluate mathematical expressions using spreadsheet packages.	i. The teacher to introduce and guide students to open a spreadsheet package from the computer. ii. The teacher to demonstrate to groups of students how to use a spreadsheet package in evaluating mathematical expressions. iii. Students in pairs to evaluate mathematical problems using a spreadsheet package.	Computer with a spreadsheet package	Is the student able to evaluate mathematical expressions using spreadsheet packages?	
2.0 FUNCTIONS 2.1 Basic Concepts	By the end of this subtopic the student should be able to: a) compare and contrast a relation and a function.	i. The teacher and students to brainstorm on the properties of functions and relations. ii. Students to identify relationship and differences between relations and functions.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Pictorial illustrations of functions and relations.	Is the student able to distinguish a relation from a function?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) distinguish types of functions.	i. The teacher to guide students to mention types of functions. ii. Students to distinguish types of functions.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of graphs of functions.	Is the student able to identify different types of functions?	
	c) basic properties of functions.	i. Students individually to explain the meaning of domain and range of a function. ii. The teacher to introduce the property of functions namely that the sum, difference, product and quotient of functions is a function.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Pictorial illustrations of functions.	Is the student able to explain the meaning of a function? Is the student able to demonstrate that the sum, difference, product and quotient of functions are a function?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
2.2 Graph of a Function	By the end of this subtopic the student should be able to: a) interpret the graph of a linear function.	i. Students in small groups to review drawing graphs of linear functions using table of values and intercepts. ii. Students using the graphs drawn, to state domain and range of linear functions. iii. Students in groups to compare graphs with different slopes (positive and negative) and discuss their findings. iv. Teacher to explain the meaning of the constant function as a special case of the linear function .	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph paper v. Sample of graphs of linear functions	Is the student able to draw graphs of linear functions using table of values? Is the student able to compare graphs of linear functions? Is the student able to identify and interpret graphs of linear functions?	14
	b) analyse graphs of step functions	i. Students to give examples of step functions in daily life situations. ii. Students in small groups to discuss how to sketch graphs of step functions. iii. Students to state domain and range of step functions.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph paper	Is the student able to sketch the graph of a step function? Is the student able to state the domain and range of step functions?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iv) Students in groups to discuss how to interpret the graphs of step functions and present their findings to the entire class.	v. Sample of graphs of step functions	Is the student able to interpret the graph of a step function?	
	c) sketch graphs of quadratic and cubic functions.	i. The teacher to demonstrate how to prepare table of values for quadratic and cubic functions. ii. Students, through small groups to sketch graphs of quadratic and cubic functions and discuss their shapes. iii. The teacher and students to summarise findings on the shapes of graphs of quadratic and cubic functions.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph paper v. Scientific calculators	Is the student able to sketch the graphs of quadratic and cubic functions?	
	d) determine intercepts and turning points of graphs of quadratic functions.	i. The teacher to demonstrate how to determine turning points of a quadratic function. ii. Students in groups to determine turning points of quadratic functions and discuss their nature (maximum and minimum).	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph paper v. Scientific calculators	Is the student able to determine the domain, range and the turning points of quadratic functions?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii. The teacher and students to discuss how to determine the domain and range of quadratic functions. iv. The teacher to guide students to determine intercepts of quadratic functions. v. The teacher to demonstrate on how to use intercepts and turning points to sketch graphs of quadratic functions. vi. Students individually to practice sketching graphs of quadratic functions using intercepts and turning points.	vii. Scientific calculators		
	e) sketch graphs of rational functions of the form $f(x)=\frac{1}{ax+b}$	i. Students to prepare table of values for rational function $f(x)\frac{1}{x}$	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph paper	Is the student able to sketch the graph of a rational function of the form $f(x)=\frac{1}{ax+b}$ by using table of values?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii. Students in small groups. by using graph papers. to sketch graphs of the functions $f(x)\frac{1}{x}$ iii. Students in small groups. to prepare table of values and sketch graphs of rational functions of the form $f(x)=\frac{1}{ax+b}$	iv. Scientific calculators		
	f) identify important features of rational functions.	i. Students in small groups to compare graphs of rational functions of the form $f(x)=\frac{1}{ax+b}$ and make presentations to the class. ii. The teacher to explain the behaviour of graphs of rational functions on the: domain. range. intercepts and asymptotes.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph papers v. Scientific calculators vi. sample of graphs of simple rational functions	Is the student able to identify graphs of rational functions? Is the student able to use the knowledge of intercepts and asymptotes to sketch the graph of a rational function?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii. The teacher to demonstrate how to use intercepts and points in the neighbourhood of asymptotes to sketch graphs of rational functions. iv. Students individually to use the knowledge of intercepts and asymptotes to sketch graphs of rational functions.	v. Graph board		
	g) plot graphs by using computers.	i. The teacher to guide students to demonstrate how to use the computer to plot graphs. ii. Students in groups to plot graphs analytically and with the use of computers and compare.	i. Computer with appropriate packages ii. Scientific calculatos iii. Graph paper	Is the student able to plot graphs by using computers?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
2.3 Importance of Functions	By the end of this subtopic the student should be able to: a) represent simple associations using functions.	i. Students to discuss in small groups, phenomena which can be represented as functions (such as demand and supply; velocity and time; production; chemical solutions and so on). ii. Students individually to present real life phenomena using function notation.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Books v. Newspapers vi. Magazines	Is the student able to represent simple associations using functions?	6
	b) use properties of functions to explain phenomena in real life.	i. Students to brainstorm on examples of functions from real life situation. ii. Students in groups to identify types of functions from given examples. iii. Students in groups to discuss characteristics of the functions and relate to the real situation and then present their findings to the entire class.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Books v. Newspapers vi. Magazines	Is the student able to use properties of functions to explain phenomena of real life?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.0 ALGEBRA 3.1 Simultaneous Equations	By the end of this subtopic the student should be able to: a) form simultaneous equations involving two unknowns from word problems.	i. Students to discuss in groups the word problems that can lead to simultaneous equations. ii. The teacher to demonstrate how to form simultaneous equations from word problems on the chalkboard.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to form simultaneous equations using word problems?	4
	b) find solutions of simultaneous equations involving linear and quadratic equations.	i. The teacher to lead discussion on how to solve linear simultaneous equations. ii. The teacher to guide students to solve simultaneous equations involving linear and quadratic equations. iii. Students individually to solve simultaneous equations involving linear and quadratic equations.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to solve simultaneous equations involving linear and quadratic equations?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.2 Finite and Infinite Series	By the end of this subtopic the student should be able to: a) define finite and infinite series.	i. Through oral questions and answers, students to enumerate examples of finite and infinite series. ii. Students to distinguish finite and infinite series. iii. The teacher to guide students to write standard definitions of finite and infinite series.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to distinguish finite and infinite series?	6
	b) write sums in sigma notation.	i. Teacher to guide students through question and answer to explain the meaning of sigma notation. ii. The teacher to demonstrate how to write sums using sigma notation. iii. Students in small groups to write sums in sigma notation.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Books, v. newspapers, vi. magazines (with samples of sigma notation)	Is the student able to write sums using sigma notation?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) calculate sum of finite series for AP and GP series	i. Teacher to guide students to demonstrate how to calculate sums of Arithmetic Progression (AP) and Geometric Progression (GP). ii. Students to solve real life problems involving AP. iii. Students to solve real life problem involving GP, such as compound interest.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Books vi. Newspaper vii. Magazines	Is the student able to calculate sum of finite series for AP and GP series?	
	d) calculate infinite GP series	i. The teacher to guide students to develop formula for infinite GP series from the formula for finite series. ii. Students individually to solve problems using infinite series such as conversion of recurring decimals to fractions.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to solve problems involving infinite GP series?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
3.3 Ratio and Variations	By the end of this subtopic the student should be able to: a) apply ratios in solving daily life problems.	i. Through questions and answers teacher to guide students to review the meaning and properties of ratios. ii. The teacher to guide students to discuss various uses of ratios in real life problems (e.g. currency conversion, scale drawing, making mixtures). iii. Students to solve real life problems involving ratios.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Books vi. Newspaper vii. Magazines	Is the student able to use ratios in solving real- life problems?	8
	b) distinguish problems involving direct , inverse and joint variations.	i. Students to brainstorm on the examples involving variations. ii. The teacher to guide students to identify direct, inverse and joint variation from among the given examples. iii. The teacher to guide students to write variations in standard form.	i. Marker pen ii. Coloured chalks iii. Books iv. Newspaper v. Magazines	Is the student able to identify problems involving direct, inverse and joint variations? Is the student able to write variations in standard form?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) solve problems involving variations.	Students individually to solve problems involving variations (e.g. demand and supply).	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to solve problems involving variations?	
4.0 DIFFERENTIATION 4.1 Differentiation by First Principle	By the end of this subtopic the student should be able to: a) differentiate by using first principle.	i. Students to plot a graph of a simple quadratic equation on the board. ii. The teacher to guide students to use the concept of a slope to deduce the definition of a derivative.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Mathematical sets v. Graph board	Is the student able to use the first principle to find the derivative?	6
	b) write first derivative in standard forms.	i. The teacher to write on the board, different notations of derivatives. ii. Students to practise on writing different notations of derivative using various functions.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to write derivatives in standard form?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) find general rule of derivative of $y = x^n$	i. Students in groups to find the derivatives of $y = x^0$, $y = x^1$, $y = x^2$, and $y = x^3$ using first principle. ii. The teacher to guide students to deduce general formula for derivative of $y = x^n$ iii. Students to apply the formula to find derivatives of $y = x^n$, when n is any integer	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to deduce the general rule of the derivative of $y = x^n$?	
4.2 Techniques of Differentiation	By the end of this subtopic the student should be able to a) find derivatives of polynomials.	i. Students in small groups to deduce the derivative of the scalar multiple of a function by using First Principle . $g(x) = kf(x)$ ii. Teacher to guide students in small groups to derive the derivative of sum of functions using First Principle $h(x) = g(x) + f(x)$ iii. Students individually to apply knowledge of derivatives of scalar multiples to differentiate polynomials.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to find derivatives of polynomials?	8

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) find derivatives by using chain rule.	i. Teacher to guide student in groups to give examples of composite functions of the form $y = (u(x))^n$. ii. Students to expand simple composite functions of the form of the form $y = (u(x))^n$ (where n is 2 or 3) and find their derivatives. iii. The teacher to demonstrate the use of chain rule. iv. Students to use chain rule to differentiate functions.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to use the chain rule to differentiate functions?	
	c) find derivatives by using product rule.	i. The teacher to demonstrate how to find the derivative of product of functions using the product rule. ii. Students to use product rule to differentiate product of functions.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to use the product rule to differentiate the product of functions?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) find derivatives by using quotient rule.	i. The teacher to demonstrate how to find the derivative of quotient of functions using the quotient rule. ii. Students individually to use quotient rule to differentiate quotient functions.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to use the quotient rule to differentiate the quotient of functions?	
4.3 First and Second Derivatives	By the end of this subtopic the student should be able to find first and second derivatives of polynomial functions.	i. The teacher to introduce the concept of second derivative. ii. The teacher to demonstrate how to write the second derivative . iii. Students in small groups to practise how to determine first and second derivatives of polynomial functions.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to determine the first and second order derivatives of polynomial functions?	4
4.4 Implicit Differentiation	By the end of this subtopic the student should be able to perform implicit differentiation.	i. The teacher to guide students to discuss forms of functions which lead to explicit and implicit differentiation $\left(y=u\left(x\right)andw\left(x,y\right)=c\right)$	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to perform implicit differentiation?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii. The teacher to guide students to find simple functions that can be expressed in the form $(y = u(x) and w(x, y) = c)$ and to find their deritatives. iii. The teacher to demonstrate how to perform implicit differentiation of functions. iv. Students to compare the results of explicit and implicit differentiation for simple functions which can be differentiated using both techniques. v. Students to use implicit differentiation in finding derivatives.			
4.5 Application of Differentiation	Student should be able to: a) find slope of a curve at a given point.	i. The teacher to lead students to the meaning of the derivative. ii. Students to use differentiation to determine the slope of a given curve at a given point.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. sample of graphs of quadratic and cubic functions	Is the student able to apply differentiation in finding a slope of a curve at a given point?	14

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) calculate rates of change.	i. The teacher to guide students to brainstorm on problems involving rate of change. ii. The teacher to show students the relationship between rate of change and derivative. iii. Students to solve problems involving rate of change in real life situations.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Books vi. Newspapers vii. Magazines	Is the student able to calculate rate of change using differentiation?	
	c) determine the critical points of a curve.	i. Using graph papers, students to draw graphs of quadratic and cubic functions. ii. Students to use shape of graphs of quadratic and cubic functions to discuss the concepts of maxima. minima and point of inflexion.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of graphs of quadratic and cubic functions	Is the student able to determine critical points of a curve using differentiation?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		v. Students to use derivatives to find slope of curves at critical points and discuss their findings. vi. The teacher to guide students in summarising the behaviour of derivatives at critical points. vii. Student individually to determine critical points of curves by using differentiation.	v. Graph papers		
	d) determine the nature of critical points.	i. Students in small groups to use derivatives to find slopes of curves in the neighbourhood of critical points and discuss their findings. ii. Students in small groups to find second derivatives at critical points and discuss their findings. iii. The teacher to guide students to discuss on how to use derivatives to classify critical points.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of graphs of quadratic and cubic functions	Is the student able to determine the nature of critical points of quadratic and cubic functions? Is the student able to apply differentiation to sketch the graphs of quadratic and cubic functions?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		v. Students in small groups to use critical points and intercepts to sketch graphs of quadratic and cubic functions.			
	e) apply differentiation to solve real life problems.	i. The teacher to guide students to brainstorm on problems from real-life situation such as motion, marginal cost and revenue; maximisation and minimisation problems, and so on that can be solved by differentiation. ii. Students to apply differentiation to solve real-life problems.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Books v. Newspaper vi. Magazines	Is the student able to apply differentiation to solve real life problems?	
5.0 INTEGRATION 5.1 The Anti- derivative	By the end of this subtopic the student should be able to: a) distinguish between a derivative and anti-derivative.	i. Students through oral questions to give examples of functions and their derivatives ii. The teacher to introduce and demonstrate the concept of anti-derivative	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to distinguish derivatives and anti-derivatives?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii. Students to identify anti- derivative using given functions and their derivatives			
	b) deduce the general formula for the anti- derivative of $f(x) = x^n$	i. Students in groups to find the anti-derivative of x^0, x^1, x^2 and x^3 by using the general formula for derivatives of $y = x^n$ ii. The teacher to guide students to deduce the general formula for the anti-derivative of $f(x) = x^n$	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to deduce the formula for the anti-derivative of $f(x) = x^n$?	
5.2 Indefinite Integral	By the end of this subtopic the student should be able to: a) write integral of $f(x) = x^n$ in standard form.	i. The teacher to introduce to students the indefinite integral using anti-derivatives. ii. The teacher to demonstrate how to write the anti- derivative in integral notation. iii. The teacher to guide students to write the general formula for anti-derivative of $f(x) = x^n$ using integral notation.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to write anti-derivative using the integral notation? Is the student find the indefinite integrals of the form $f(x) = x^n$	8

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iv. Students individually to find indefinite integrals of the form $f(x) = x^n$.			
	b) determine the indefinite integral of polynomials.	i. The teacher to demonstrate how to find the integral of scalar multiples of functions $f(x) = x^n$. ii. The teacher to demonstrate how to find integrals of sums of functions. iii. Students individually to find indefinite integrals of polynomials.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to find indefinite integral of polynomials?	
	c) use the technique of substitution to integrate of polynomial functions.	i. The teachers to demonstrate to students the use of the technique of substitution in evaluating integrals. ii. Students in groups to give examples of integrals that require substitution. iii. Students individually to use technique of substitution to evaluate indefinite integrals of polynomials.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to use the technique of substitution to evaluate indefinite integrals of polynomial functions?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
5.3 The Definite Integral	By the end of this subtopic the student should be able to evaluate definite integrals of polynomials.	i. The teacher to introduce to students the definite integral as a number given by $\int_a^b f(x)dx = f(b) - f(a)$ ii. The teacher to guide students in groups to discuss the difference between definite and indefinite integral. iii. Students individually to evaluate definite integrals of polynomials.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to distinguish between definite and indefinite integrals? Is the student able to evaluate definite integrals of polynomials?	8
5.4 Application of Integration	By the end of this subtopic the student should be able to: a) determine area under a given curve of a polynomial up to the third degree.	i. Students to review how to sketch graphs of functions on the board. ii. The teacher to demonstrate how to locate intervals along which curves are above and below x-axis. iii. The teacher to guide students on how to interpret the definite integral as area under a positive function on a given interval. iv. Students to use integration to find area under a curve.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph board v. Sample of curves vi. Graph paper	Is the student able to able to interpret the definite integral as an area under the curve? Is the student able to use integration to find the area under the curve?	12

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) determine area between two curves.	i. Students in small groups to sketch curves of two functions on the same plane and identify the area enclosed by two curves. ii. The teacher to guide students on how to find area between two curves using integrals. iii. Students to use integration to determine the area between two curves.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph board v. Graph paper	Is the student able to use integration to find the areas between two curves?	
	c) find volume of solids of revolution .	i. The teacher to demonstrate how to sketch graphs of curves. ii. Students in groups to discuss shapes formed by rotating curves about one of the axes. iii. The teacher to guide students to determine the volume of solids of revolution about both of the two axes using integrals.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph board v. Graph paper vi. Scientific calculators	Is the student able to find volumes of solids of revolution?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iv. Students to apply integration to find volumes of solids of revolution about any of the two axes.			
	d) apply integration to solve real life problems.	i. The teacher to guide students to brainstorm on problems from real-life situations (such as motion (displacement and velocity); total cost and revenue; areas and volumes) that can be solved using integration.. ii. Students to apply integration to solve real-life problems.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Books v. Newspapers vi. Magazines	Is the student able to apply integration to solve real-life problems?	
6.0 STATISTICS 6.1 Collection, Organisation and Presentation of data	By the end of this subtopic student should be able to: a) collect data from various sources.	i. Students in small groups to discuss the importance of statistics in real life. ii. Students to collect data from iii. different sources e.g. student attendance, cases of HIV/AIDS, rates of accidents etc.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Books v. Newspaper	Is the student able to collect data from various sources?	8

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
			vi. Magazines		
	b) organise data and form frequency distribution tables.	i. Students to brainstorm on different ways of organising data in frequency distribution tables. ii. The teacher to guide students on how to organise data in frequency distribution tables. iii. Students to work in small groups, to construct frequency distribution tables of ungrouped and grouped data.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of data	Is the student able to organise grouped and ungrouped data in frequency distribution tables?	
	c) present data graphically and pictorially.	i. Students to review how to present data graphically and pictorially. ii. The teacher to guide students how to use computers to present data graphically and pictorially.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of data v. Computers with appropriate packages	Is the student able to present data graphically and pictorially? Is the student able to use the computer to present data graphically and pictorially?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
6.2 Measures of Central Tendency of Grouped and Ungrouped Data	By the end of this subtopic student should be able to : a) find the mode of a distribution.	i. Through oral questioning guided by the teacher, students to explain the meaning of mode. ii. The teacher to guide students to find modes of ungrouped and grouped distributions. iii. Students in small groups to find mode of distributions in real life problems and interpret it for each problem.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of data v. Scientific calculators	Is the student able to find mode of ungrouped and grouped distributions?	10
	b) find the median of a distribution.	i. Students to review the meaning of a median. ii. The teacher to demonstrate how to find medians of ungrouped and grouped data. iii. Students in small groups to find the median of distributions in real life problems and interpret it for each problem.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of data v. Scientific calculators	Is the student able to find the median of grouped and ungrouped data?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) evaluate the arithmetic mean of a distribution.	i. Students in small groups to revise the meaning and types of mean. ii. The teacher to guide students to calculate the mean of ungrouped data. iii. The teacher to guide students to find the mean of grouped distribution using assumed mean and coding methods. iv. Students in small groups to find the mean of distributions in real life problems and interpret it for each problem.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of data v. Scientific calculators	Is the student able to calculate the mean of ungrouped and grouped data?	
	d) determine quartiles and percentiles.	i. In small groups, students to distinguish between mean, median, quartile and percentile. ii. The teacher to demonstrate how to find quartiles and percentiles of distributions.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of data v. Scientific calculators	Is the student able to determine quartiles and percentiles?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		vi. Student in small groups to determine and interpret quartiles and percentiles of distributions in real life problems.			
6.3 Measures of Dispersion of Grouped and Ungrouped Data	By the end of subtopic student should be able to: a) calculate range.	i. Through questions-answer session students to discuss the meaning of range of distributions. ii. The teacher to ask few students to solve problems involving range on the board.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of data v. Scientific calculators	Is the student able to calculate the range of distributions?	6
	b) calculate the variance of data.	i. The teachers to guide students to brainstorm on the meaning of a variance. ii. The teacher to guide students to calculate the variance of ungrouped and grouped data.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of data v. Scientific calculators	Is the student able to calculate variance of grouped and ungrouped data?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii. Students in small groups to determine the variance of distributions in real life problems and interpret its meaning for each problem.			
	c) calculate the standard deviation of given data.	i. The teacher to guide students to show the relationship between the variance and standard deviation. ii. Students in groups to find the standard deviation of ungrouped and grouped distributions in real life problems and interpret its meaning for each problem.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of data v. Scientific calculators	Is the student able to calculate the standard deviation of grouped and ungrouped data?	
6.4 Application of Statistics	By the end of this subtopic student should be able to: apply statistical knowledge in summarising, presenting and analysing data.	i. The teacher to invite a guest speaker to talk about the importance of statistics in real- life situation ii. The teacher to demonstrate to students how to use computer packages to perform statistical computations	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to explain the importance of statistics in real- life situations?	10

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii. Students in small groups to apply statistical knowledge to collect summarise and analyse data on a real life problem of their choice. iv. The teacher to guide students to discuss how to prepare and present a written project for finishing their Form Five course v. Students in small groups to present a written mini-project on a real-life problem of their choice	v. Graph papers vi. Sample of mini-projects vii. Computer with appropriate packages	Is the student able to apply statistical knowledge to do a project on collecting, summarising, presenting and analysing data?	

FORM VI

CLASS COMPETENCES

By the end of the Form Six the student should have the ability to:

1. apply the knowledge of probability in real-life settings;
2. use mathematical knowledge to draw and interpret graphs in other subjects;
3. apply knowledge of trigonometry to solve real-life problems;
4. apply the knowledge of exponents and logarithms in solving real-life problems;
5. use differentiation to solve real-life problems;
6. use integration to solve problems in other fields;
7. use matrices to solve problems from other fields and;
8. apply knowledge of linear programming to solve real-life problems.

CLASS OBJECTIVES

By the end of Form Six the student should be able to:

1. use the knowledge of permutations and combinations to determine sample space;
2. use the knowledge of probability to solve practical problems;
3. plot and sketch trigonometric, exponential and logarithmic graphs;
4. identify the different features of trigonometric, exponential and logarithmic graphs;
5. solve problems using trigonometric ratios and identities;
6. differentiate trigonometric functions;
7. integrate trigonometric functions;
8. define exponential functions;
9. differentiate exponential functions;
10. integrate exponential functions;
11. define logarithmic function and relate it to exponential function;
12. differentiate logarithmic functions;
13. use common logarithms to determine the integral of $\frac{1}{x}$
14. use exponents and logarithms to solve mathematical problems;

15. solve systems of linear simultaneous equations using matrices;
16. solve real-life problems using matrices and;
17. solve real-life problems using linear programming.

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.0 PROBABILITY 7.1 Permutations and Combinations	By the end of this subtopic the student should be able to: a) find the ways of arranging n unlike objects	i. Teacher to guide students' collection of objects of different sizes (e.g. fruits, stones, coins) ii. Students in groups to arrange the objects in different ways and record the number of ways obtained.	i. Sample of objects ii. Manila paper iii. Marker pen iv. Coloured chalks	Is the student able to arrange *n* unlike objects in *r* different ways?	8
	b) apply the factorial notation	i. The teacher to introduce the factorial notation ii. Students in groups to exchange ideas on how to write factorials as a product iii. Students working individually to compute factorials	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to write factorials in product form? Is the student able to compute factorials?	
	c) define permutation	i. The teacher to guide students to deduce the definition of permutation ii. Students to discuss the application of permutation in daily life.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to define permutation?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) evaluate ${}^{n}P_{r}$ for given *n* and *r*	i. The teacher to guide students to evaluate ${}^{n}P_{r}$ ii. Students in small group to evaluate ${}^{n}P_{r}$ for given *n* and *r*.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to evaluate ${}^{n}P_{r}$?	
	e) find the number of ways of choosing *r* objects from *n* unlike objects	i. Students in groups, to play a game of choosing *r* objects from *n* unlike objects. ii. Teacher to guide students in groups to record the number of ways obtained.	i. Sample of objects ii. Manila paper iii. Marker pen iv. Coloured chalks	Is the student able to choose *r* unlike objects from *n* unlike objects?	
	f) define combinations	i. The teacher to introduce the concept of combination. ii. Students to discuss the application of combination in daily life.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the studentable to define combinations?	
	g) evaluate C_r^n for r given n and r	i. The teacher to guide students to compute C_r^n ii. Students in small groups to evaluate C_r^n for given n and r	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to compute C_r^n ?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.2 Probability of an Event	By the end of this subtopic the student should be able to: a) describe basic properties of probability	i. Students to discuss in groups the events that are certain to occur and the ones that are not certain to occur and give reasons for their choices ii. The teacher to guide students to define probability using their own words.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to define probability and describe its basic properties?	4
	b) define sample space, outcome and an event	i. Students to review on the possible outcomes of experiments of tossing fair coins, fair dice and spinning spinners ii. From the reviews the teacher to guide students to come up with the definitions of sample space, outcome and event	i. Manila paper Marker pen ii. Coloured chalks iii. Coins iv. Dices v. Spinners	Is the student able to define sample space, outcome and event?	
	c) find the probability of an event	i. Students to review the relationship between sample space, outcome and event ii. The teacher to lead the discussion on finding the probability of an event by a formula. iii. Students in small groups to find the probability of an event by using formula.	i. Manila paper ii. Marker pen iii. Coloured	Is the student able to find the probability of an event?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.3 Combined Events	By the end of this subtopic the student should be able to: a) draw tree diagram of combined events	i. Students to discuss in groups the events that can constitute combined events. ii. The teacher to guide students in small groups to represent combined events by using tree diagrams.	i. Manila paper ii. Marker pen iii. Coloured	Is the student able to draw tree diagrams to represent combined events?	4
	b) find the probability of combined events	i. The teacher to lead students to determine the probability of combined events using formula. ii. Students in small groups to determine the probability of combined events using formula and interpret its meaning.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to determine the probability of combined events using formula?	
7.4 Mutually Exclusive Events	By the end of this subtopic student should be able to: a) give the meaning of mutually exclusive events	i. Students to brainstorm on the real-life phenomena that can not occur at the same time ii. The teacher to guide students to the definition of mutually excusive events.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to define mutually exclusive events?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) calculate the probability of two mutually exclusive events	i. Students to review the formula for calculating mutually exclusive events ii. The teacher to guide students in small groups to calculate mutually exclusive events using formula.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to calculate the probability of two mutually exclusive events using formula?	
7.5 Independent Events	By the end of this subtopic student should be able to: a) distinguish independent events from dependent events	i. In small groups, students to discuss events whereby the occurrence of one event affects the occurrence of the other. ii. The teacher to guide students to the definition of independent events and dependent events	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to distinguish independent events from dependent events?	4
	b) find probability of independent and dependent events	i. The teacher to guide students to find probability of independent and dependent events using formula. ii. Students in small groups to determine and interpret probability of independent and dependent events.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to find the probability of independent and dependent events using formula?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
7.6 Application of Probability	By the end of this subtopic student should be able to: able to apply the knowledge of probability in solving real life problems	i. Students in small groups to investigate the application of probability in real-life situations (such risk assessment in areas like the spread of HIV-AIDS pandemic, games of chance, gambling, sampling and so on) and make class presentations ii. Teacher to guide students role play of some games of chance such as lottery and lotto iii. Students individually to apply probability to solve real life problems	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Newspapers vi. Magazines vii. Articles	Is the student able to apply the knowledge of probability to explain real life phenomena? Is the student able to apply the knowledge of probability to solve real life problems?	6
8.0 TRIGONOMETRY 8.1 Trigonometric Ratios	By the end of this subtopic student should be able to: a) define sine, cosine, tangent of angles and their reciprocals	i. Students in small groups to draw well labelled right-angled triangles and rotate the positions of right-angle ii. With the aid of rotated triangles, teacher to guide students to define sine, cosine, tangent of angles and their reciprocals	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Geo-board v. Rubber bands, vi. Cut-out of triangles	Is the student able to define sine, cosine, tangent of an angle and its reciprocals?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) solve problems involving trigonometric ratios	i. The teacher to lead class discussion on the methods of solving problems involving trigonometric ratios ii. Students individually to do exercises involving trigonometric ratios iii. The teacher to demonstrate to students how to evaluate trigonometric ratios by using appropriate computer packages (for example built-in trigonometric functions of spreadsheet packages)	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Computer with appropriate packages	Is a student able to solve problems involving trigonometric ratios?	
8.2 Sine and Cosine Rules	By the end of this subtopic student should be able to: a) derive sine and cosine rules	i. Students to brainstorm on how to state the sine and cosine rules ii. Teacher to guide students in groups to derive sine and cosine rules	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Mathematical set	Is the student able to state the sine and cosine rules? Is the student able to derive the sine and cosine rules?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) use sine and cosine rules to solve problems.	i. Teacher to guide students to brainstorm on real life problems in which sine and cosine rules are applicable. ii. Students individually to solve problems involving sine and cosine rules are applicable.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to use the sine and cosine rules to solve problems?	
8.3 Trigonometric Identities	By the end of this subtopic student should be able to: a) deduce the double angle formulae for sine, cosine and tangent	i. Students in small groups to review the compound angle formulae for sine, cosine and tangent ii. Teacher to guide students in small groups to deduce double angle formulae for sine, cosine and tangent	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Mathematical set	Is the student able to state the compound angle formulae for sine, cosine and tangent? Is the student able to deduce the double angle formulae for sine, cosine and tangent?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) apply the compound angle formulae in solving trigonometric problems	i. The teacher guide students to discuss how the compound and double angle formulae are used to solve problems. ii. Students to do home assignments in using the formulae to solve mathematical problems.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Computers with appropriate packages	Is the student able to use the compound angle formulae to solve trigonometric problems?	
8.4 Graphs of Trigonometric Functions	By the end of this subtopic student should be able to: sketch graphs of sine, cosine and tangent	i. The teacher to guide students to sketch graphs of sine, cosine and tangent ii. Students in small groups to interpret graphs of sine, cosine and tangent iii. Teacher to guide discussion on real life problems that can be expressed using trigonometric functions iv. Students in small groups to sketch graphs of trigonometric functions and discuss their features (such as periodicity and amplitude).	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Graph paper vi. Graph board	Is the student able to interpret graphs of sine, cosine and tangent? Is the student able to interpret graphs of trigonometric functions in real life problems?	6

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
8.5 Calculus of Trigonometric Functions	By the end of this subtopic student should be able to: a) differentiate sine, cosine and tangent and their reciprocals	i. The teacher to demonstrate how to differentiate sine, cosine and tangent and their reciprocals ii. Students in groups, to do assignment on differentiating sine, cosine and tangent and their reciprocals. iii. Teacher to guide students in groups to use the chain rule to find derivatives of trigonometric functions of the form sin (g(x)), cos(g(x)), tan (g(x)) where g(x) is a polynomial function.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to differentiate sine, cosine and tangent and their reciprocals?	8
	b) integrate selected trigonometric functions in the form $\sin(ax+b), \cos(ax+b)$ *and* $\sec^2(ax+b)$	i. Students to discuss in small groups how to find the integrals of $\sin(x)$, $\cos(x)$ and $\sec^2(x)$ ii. The teacher to demonstrate how to use trigonometric identities and the technique of substitution to find the integral of the selected trigonometric functions iii. Students in small groups to integrate selected trigonometric functions	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to integrate selected trigonometric functions of the form $\sin(ax+b), \cos(ax+b)$ *and* $\sec^2(ax+b)$?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
9.0 EXPONENTIAL AND LOGARITHMIC FUNCTIONS 9.1 Basic Properties of Exponential Functions	By the end of this subtopic student should be able to: a) define exponential functions	i. Students in small groups to give examples of exponential expressions ii. Students in small groups to review the laws of exponents iii. The teacher to introduce to students the exponential function $f(x)=a^x\,(a\succ 0)$ iv. Teacher through questions and answer to guide students to give examples of exponential functions	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to define and express exponential functions?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) draw graphs of exponential functions	i. The teacher to guide students to prepare the table of values for different exponential functions (both the case of $0 < a < 1$ and $a > 1$) ii. In small groups, students to sketch the graphs of exponential functions and discuss their shapes iii. The teacher and students to summarize findings on the shape of graphs of exponential functions	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Graph paper vi. Graph board	Is the student able to draw the graphs of exponential functions?	
	c) determine domain and range of exponential functions	i. Students in groups to compare and discuss the characteristics of exponential functions ii. The teacher and students to summarise the characteristics of exponential functions in terms of domain, range, y-intercept, asymptote and rapid growth/decline	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of graphs of exponential functions	Is the student able to determine the domain and range of exponential functions?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
9.2 Calculus of the exponential function. $f(x) = e^x$	By the end of this subtopic student should be able to: a) distinguish between exponential function $g(x) = a^x$ and the exponential function $f(x) = e^x$ using derivatives of exponential functions.	i. The teacher to demonstrate how to find approximations for derivatives of different exponential functions using the first principle (a = 2. 3.10) ii. Students in groups to discuss their findings iii. The teacher to summarise findings on the approximations for derivatives of different exponential functions $[d\frac{(a^x)}{dx} = ka^x$ k a constant dependent on a. iv. The teacher to introduce to students the exponential function $f(x) = e^x$ v. Students to do investigations on the constant e (history, value, application) and prepare class presentation	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators	Is the student able to explain the difference between exponential functions $g(x) = a^x$ in general and the exponential function $f(x) = e^x$? Is the student able to state information about the constante?	8

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) find derivatives of the exponential function $f(x) = e^x$	i. Students to state the derivative of the exponential function $f(x) = e^x$ ii. Students in small groups, to discuss how to use the laws of exponents in finding derivatives of the exponential function iii. Teacher and students to discuss how to apply the chain rule in finding derivatives of exponential functions of the form $f(x) = e^{g(x)}$ iv. Students to solve problems involving the differentiation of the exponential function	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to find the derivatives of the exponential function? Is the student able to solve problems involving the differentiation of the exponential function?	
	c) Integrate the exponential function $f(x) = e^x$	i. Students to discuss how to apply the knowledge of anti-derivatives to determine the integral of e^x ii. The teacher and students to discuss how to apply the laws of exponents to simplify the integrals of the exponential function.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculator	Is the student able to solve problems involving the integration of the exponential function?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii. The teacher and students to discuss how to apply the technique of substitution to solve problems on the integration of the exponential function iv. Students to solve problems involving the integration of the exponential function.			
9.3 Basic Properties of Logarithmic Functions	By the end of this subtopic student should be able to: a) define the logarithmic function.	i. Students in small groups to give examples of logarithmic equations and show their relation to exponential equations ii. Students in groups to discuss the laws of logarithms iii. Through oral questions, students to give examples of logarithmic functions	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to define the logarithmic function? Is the student able to express logarithmic functions as an inverse of exponential functions and vice versa?	8

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iv. Students to express logarithmic functions as inverse of exponential functions and vice versa v. The teacher to introduce to students the logarithmic function $f(x) = \log a \quad x(a!0)$			
	b) sketch graphs of logarithmic functions	i. Students to use knowledge of inverse of a function and graphs of exponential functions to sketch graphs of logarithmic functions ii. The teacher to guide students to prepare table of values of logarithmic functions iii. Students to use table of values to sketch graphs of logarithmic functions	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Graph paper vi. Graph board	Is the student able to sketch graphs of logarithmic functions?	
	c) state domain and range of logarithmic functions	i. Students in groups to use the knowledge of inverse of a function and exponential function to state the domain and range of logarithmic functions	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to state the domain and range of logarithmic functions?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii. Students in groups to compare and discuss the behaviour of graphs of logarithmic functions iii. The teacher and students to summarise findings on behaviours of graphs of logarithmic functions in terms of domain, range, x-intercept and asymptote	iv. Sample of graphs of logarithmic functions		
	d) distinguish between common and natural logarithmic functions.	i. Students to prepare table of values for common and natural logarithmic functions and plot them on graph paper ii. The teacher to guide students to convert logarithms from one base to another iii. Students individually to convert common logarithms to natural logarithms and vice versa iv. Students in small groups to discuss relationship between common and natural logarithmic functions	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to distinguish between common and natural logarithmic functions? Is the student able to convert logarithms from one base to another?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
9.4 Differentiation of Logarithmic and Exponential Functions	By the end of this subtopic student should be able to: a) find the derivatives of common and natural logarithmic functions	i. The teacher to guide students to derive the expression for the derivative of $f(x)$ $\ln x$ ii. Students in groups to apply knowledge of the derivative of the natural logarithmic function and conversion of base to derive the derivative of common logarithmic function iii. Students in groups to to discuss how to apply the chain rule to find derivatives of natural logarithmic functions $f(x)$ $\ln(ax \quad b)$ iv. Students individually to solve problems on differentiation of common and natural logarithmic functions	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to find the derivatives of common and natural logarithmic functions?	4
	b) find derivatives of exponential functions of the form $f(x) = a^x \ (a > 0)$	i. The teacher to demonstrate to students in groups how to derive the expression for the derivative of exponential functions $f(x) = a^x \ (a > 0)$	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to find derivatives of exponential functions?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii. Students individually to find derivatives of exponential functions			
9.5 Integration of $f(x)=\frac{1}{ax+b}$	By the end of this subtopic student should be able to: integrate functions of the form $f(x)=\frac{1}{ax+b}$	i. The teacher to lead discussion on how to apply the knowledge of anti-derivative to determine the integral of $f(x)=\frac{1}{x}$ ii. The teacher to guide students to discuss how to apply substitution method to find the integral of $f(x)=\frac{1}{ax+b}$ iii. Students individually to solve problems involving the integration of rational functions of the form $f(x)=\frac{1}{ax+b}$	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to integrate functions of the form $f(x)=\frac{1}{ax+b}$?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
9.6 Application of Exponential and Logarithmic Functions	By the end of this subtopic student should be able to: a) use exponents and logarithms to solve problems of compound interests and depreciation	i. Students in small groups to discuss the distinction between simple and compound interest ii. Through oral questions and answers conducted by the teacher, students to state the formula for compound interest iii. The teacher to lead whole class to discuss the meaning of depreciation and derive formula for depreciation iv. Students individually to use knowledge of exponents and logarithms to solve problems on compound interest and depreciation.	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Books, newspapers, magazines (with articles on compound interest and depreciation)	Is the student able to use exponents and logarithms to solve problems on compound interest and depreciation?	8
	b) solve problems on real life processes using exponential and logarithmic functions	i. Students in groups to investigate real life processes that can be described by exponential functions (such as: population growth and decay; radioactive decay, cooling and so on) and conduct class presentation based on their findings	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Scientific calculators v. Books	Is the student able to solve problems involving real life processes using exponential and logarithmic functions?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii. Through individual assignments, students to apply knowledge of exponential and logarithmic functions as well as their calculus to solve real-life problems	iii. Newspapers iv. Magazines		
10.0 MATRICES 10.1 Introduction to Matrices	By the end of this subtopic student should be able to: a) define matrices	i. The teacher to guide students to brainstorm on real life problems that can lead to the definition of matrices. ii. The teacher to guide students to discuss on how to state size of a given matrix iii. The teacher to guide students to name an element in a matrix using row and column. iv. Students individually to practice stating size of given matrices and naming elements of matrices using row and column.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to define and name matrices? Is the student able to state the size of a given matrix? Is the student able to name the elements of a matrix using row and column?	2

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) Identify equal matrices	i. Through oral questions conducted by the teacher, students to give examples of matrices different sizes ii. The teacher to guide students in groups to discuss conditions for equality of matrices.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to identify equal matrices?	
10.2 Operations with Matrices	By the end of this subtopic student should be able to: a) perform addition and subtraction of matrices	i. The teacher to guide students to discuss conditions for addition and subtraction of matrices ii. Students individually to add and subtract matrices. iii. Students in small groups to solve real life problems involving addition and subtraction of matrices.	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to add and subtract matrices?	4
	b) multiply a matrix by a scalar	i. Students in small groups to discuss in groups on how to multiply a matrix by a scalar. ii. Students individually to do exercises on multiplying a scalar by a matrix by a scalar	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to multiply a matrix by a scalar?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii. Students in small groups to solve real life problems involving multiplication of a matrix by a scalar.			
	c) multiply a matrix by another matrix	i. The teacher to guide students in group to multiply 2 x 2 matrices ii. The teacher to guide students to discuss the conditions for multiplication of matrices of different sizes iii. Students individually to multiply matrices of different sizes iv. Students in small groups to solve real life problems involving multiplication of matrices. v. Students in small groups to investigate the commutatively of the product of matrices	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to explain the conditions for multiplying matrices? Is the student able to multiply matrices? Is the student able to demonstrate the non-commutative property of matrix multiplication?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		vi. The teacher and students to summarise the findings on the commutatively of the product of matrices			
	d) transpose a matrix	i. The teacher to introduce the transpose of a matrix and its notation ii. Students in small groups to find the transpose of given matrices	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to transpose a matrix?	
10.3 Determinant of a Matrix	By the end of this subtopic student should be able to: determine the determinant of a matrix	i. The teacher to introduce the concepts of minors and co-factors ii. Students individually to practise finding minors and co-factors of each element of a matrix (up to 3 x 3 matrices) iii. The teacher to guide students to find the determinant of a matrix using co-factors iv. Students individually to find determinant of matrices (up to 3 x 3 matrices)	i. Manila paper ii. Marker pen iii. Coloured chalks	Can the student find the determinant of a matrix (up to 3 x 3)?	8

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
10.4 Identity and Inverse of a Matrix	By the end of this subtopic student should be able to: a) define the inverse of a matrix	i. The teacher to guide students to determine matrix of co-factors ii. Students to form matrix of co-factors for up to 3 x 3 iii. The teacher to state the formula for determining the inverse of a matrix (using adjoint matrix)	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to define the inverse of a matrix?	8
	b) find inverse of a matrix	i. The teacher to guide students to find the inverse of non-singular matrices (up to 3 x 3) ii. Students individually to find the inverse of non-singular matrices (up to 3 x 3).	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to find the inverse of a matrix?	
	c) define an identity matrix	i. The teacher to introduce to students the concept of the identity matrix ii. Students in groups to give examples of identity matrices of different sizes	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to define an identity matrix?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	d) state properties related to the identity matrix	i. The teacher to guide students to find the product of identity matrix and another matrix ii. Students to find the product AA^{I} and $A^{I}A$ where A^{I} is the inverse matrix of matrix A iii. The teacher and students to summarise the properties of identity matrices • $AI = IA = A$ • $AA^{I} = A^{I}A = I$	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to state the properties of the identity matrix?	
10.5 Matrix Solution of Systems of Linear Equations	By the end of this subtopic student should be able to: a) represent real -life problems involving systems of linear equations in a matrix form	i. Students to brainstorm on real-life problems that involve systems of linear equations ii. The teacher to guide students to write linear equations in matrix form iii. Students to practise writing linear equations in matrix form	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to represent real life problems in matrix form?	8

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) Use the Inverse Matrix method to solve systems of linear equations up to three unknowns	i. The teacher to guide students to determine the solution of linear equations by using Inverse Matrix method ii. Students individually to solve systems of linear equations by Inverse Matrix method	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to use Inverse Matrix method to solve systems of linear equations up to three unknowns?	
	c) apply Cramer's rule to solve systems of linear equations up to three unknowns	i. The teacher to state Cramer's rule to solve systems of linear equations up three unknowns ii. Students individually to apply Cramer's rule to solve systems of linear equations up to three unknowns	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to apply Cramer's rule to solve systems of linear equations up to three unknowns?	
11.0 LINEAR PROGRAMMING 11.1 Identification of Real Life Problems	By the end of this subtopic student should be able to: identify real life problems in which linear programming is applicable	i. The teacher to guide students to brainstorm on real life problems in which linear programming is applicable ii. Students to form project groups of 2-3 members and investigate real life problems in which linear programming is applicable	i. Books ii. Newspapers iii. Magazines iv. Manila paper v. Marker pen vi. Coloured chalks	Is the student able to identify real life problems that involve linear programming?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii. Students in project groups to collect data necessary to form a real life problem which requires linear programming for its solution (5 or more constraints including non-negativity ones)			
11.2 Formation of Linear Programming Problems	By the end of this subtopic student should be able to: a) form an objective function from given information	i. The teacher to guide students to discuss in small groups the meaning and use of objective function in linear programming problems (both maximisation and minimisation cases) ii. Students in their project groups to determine objective functions of word problems iii. Students in their project groups to form an objective function for solving their linear programming projects	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to form an objective function from a given problem?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	b) develop constraints from given information	i. The teacher to guide students to discuss in small groups the meaning, development and types of constraints in linear programming problems ii. Students in their project groups to develop constraints of word problems (5 or more constraints) iii. Students in their project groups to develop constraints for their linear programming projects	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student develop constraints from given information?	
11.3 Graphs of linear inequalities.	By the end of this subtopic student should be able to: a) represent linear inequalities graphically	i. The teacher to guide students in small groups to represent linear inequalities graphically ii. Students in their project groups to solve problems involving representation of 5 or more linear inequalities graphically on the same plane	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Graph paper v. Graph board	Is the student able to represent linear inequalities graphically?	4

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		iii. Students in their project groups to represent graphically inequalities formed from constraints of their linear programming project			
	b) identify feasible region	i. The teacher to guide students to brainstorm on identification and significance of the feasible region of linear programming problems ii. Students in small groups to identify and discuss feasible regions formed by graphical inequalities iii. Students in their project groups to identify the feasible region of their linear programming project	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of graphical representation of inequalities	Is the student able to identify feasible region?	
11.4 Solution of Linear Programming Problems	By the end of this subtopic student should be able to: a) locate corner points of feasible region	i. The teacher to guide students in small groups to discuss how to locate corner points of a feasible region	i. Manila paper ii. Marker pen iii. Coloured chalks iv. Sample of feasible regions	Is the student able to locate corner points of feasible region?	10

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
		ii. Students in small groups to discuss the significance of corner points of the feasible region in a linear programming problem iii. Students in their project groups to locate corner points of feasible regions iv. Students in their project groups to locate corner points of their linear programming project			
	b) determine maximum, minimum and intermediate values of linear programming problems	i. The teacher to guide students to determine maximum/minimum and intermediate values of word problems for which corner points have been located ii. Students in their project groups to determine the maximum or minimum value of their linear programming project	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to determine maximum, minimum and intermediate values?	

TOPICS/SUB-TOPICS	SPECIFIC OBJECTIVES	TEACHING AND LEARNING STRATEGIES	TEACHING AND LEARNING RESOURCES	ASSESSMENT	NUMBER OF PERIODS
	c) Present the solution of a linear programming problem	i. The teacher to guide students in their project groups to discuss how to present solutions of linear programming problems ii. Students individually prepare a written project for the real life problem (including recommendations) that was solved in the topic as part of the assessment for finishing their Form Six course	i. Manila paper ii. Marker pen iii. Coloured chalks	Is the student able to solve real life linear programming problems? Is the student able to present linear programming project report?	

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