-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

Hanover House
24 Douglas Street
GLASGOW G2 7NQ

NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **7180331** **-Session-1991-92**
-Superclass- **RB**

-Title- **CORE MATHEMATICS 4**

-DESCRIPTION-

Purpose

This module extends mathematical skills in trigonometry and algebra.

The module is broadly comparable to Standard Grade Mathematics at 1 or 2.

The use of mathematical investigations allows the development of skills in practical situations. "A Guide to Mathematical Investigations: SQA 1991" provides guidance on investigations.

The Appendix gives further guidance on mathematics modules in general and contains a grid showing the relationship between modules.

Preferred Entry Level

7180321 Core Mathematics 3
or Standard Grade Mathematics at 3/4 or '0' Grade Mathematics
or an equivalent level of experience.

Outcomes

The student should:

1. use trigonometry;
2. perform algebraic operations;
3. solve algebraic equations;
4. use variation;
5. carry out a mathematical investigation.

Assessment Procedures

Acceptable performance in the module will be satisfactory achievement of all the Performance Criteria specified for each Outcome.

The following abbreviations are used below:

PC Performance Criteria
IA Instrument of Assessment

Note: The Outcomes and PCs are mandatory and cannot be altered. The IA may be altered by arrangement with SQA. (Where a range of performance is indicated, this should be regarded as an extension of the PCs and is therefore mandatory).

OUTCOME 1 USE TRIGONOMETRY

PCs

(a) Plotting of the graphs of y = a sinx and y = b cosx and the identification of given graphs is correct.
(b) Use of the cosine and sine rules is correct.
(c) Conversion of degrees to radians and vice versa is correct.
(d) Calculation of arc length and areas of sectors and segments of circles is correct.
(e) Solution of simple trigonometric equations is correct.

IA Graphical and Calculation Exercise

Topics should be assessed on the number of occasions indicated:

(a)	plotting	2
	identification	2
(b)	problems in context involving the cosine or sine rules (cosine : calculation of one side) (cosine : calculation of one angle) (sine : calculation of one side) (sine : calculation of one angle)	4
(c)	conversion	2
(d)	problems in context involving calculation of:	
	arc length	1
	area of sector	1
	area of segment	1
(e)	solution of trigonometric equations such as:	

$3\cos x = 2$	$0 < x < 2\pi$
$5\sin x + 3 = O$	$-180° < x < 180°$
$\tan x = -2$	$O° < x < 360°$ 3

Satisfactory achievement of the Outcome will be demonstrated by the student producing 4 correct responses for (a), 3 correct responses for (b) and (d), and 2 correct responses (c) and (e).

OUTCOME 2 **PERFORM ALGEBRAIC OPERATIONS**

PCs

(a) Manipulation of simple fractions is correct.
(b) Transposition of formulae is correct.
(c) Simplification of products, quotients, powers and roots is correct.

IA Calculation Exercise

Topics should be assessed on the number of occasions indicated:

(a)	operations on algebraic fractions	4
(b)	transposition of formulae	4
(c)	simplification	4

Satisfactory achievement of the Outcome will be demonstrated by the student producing 3 correct responses for each of (a) and (b) and 4 correct responses for (c).

OUTCOME 3 **SOLVE ALGEBRAIC EQUATIONS**

PCs

(a) Construction of a pair of simultaneous linear equations in 2 variables is correct.
(b) Algebraic solution of a pair of simultaneous linear equations in 2 variables is correct.
(c) Graphical solution of a pair of simultaneous linear equations in 2 variables is correct.
(d) Algebraic solution of quadratic equations is correct.

IA Graphical and Calculation Exercise

Topics should be assessed on the number of occasions indicated:

(a)	construction of a pair of simultaneous linear equations;	1
(b)	algebraic solution of simultaneous equations;	3

(c) graphical solution of simultaneous equations; 1
(d) solution of quadratic equations 3

Satisfactory achievement of the Outcome will be demonstrated by the student producing correct responses for (a) and (c) and 2 correct responses for each of (b) and (d).

OUTCOME 4 USE VARIATION

PCs
(a) Determination of the variation equation from a statement is correct.
(b) Use of a variation equation is correct.

IA Assignment

Four problems in context, at least one involving direct variation, at least one involving inverse variation and at least one involving joint variation.

Satisfactory achievement of the Outcome will be demonstrated by the student satisfying both Performance Criteria for 3 of the problems.

OUTCOME 5 CARRY OUT A MATHEMATICAL INVESTIGATION

PCs
(a) Identification of key factors of the investigation is correct.
(b) Identification of strategies is appropriate to the situation.
(c) Implementation of appropriate strategies is correct.
(d) Drawing of conclusions is appropriate to the investigation.
(e) Communication of findings is clear.

IA Project

The student should present evidence which shows the structure of the investigation and processes carried out during the investigation.

Satisfactory performance will be achievement of all the Performance Criteria.

The following sections of the descriptor are offered as guidance.
They are not mandatory.

CONTENT/CONTEXT

Corresponding to Outcomes 1-5:

1. Use of trigonometric ratios for all angles.

   Graphs: y = 2 sinx, y = -5 cosx over at least one cycle.

   Cosine and sine rules in context. Selection of the appropriate rule. Area of a triangle is $\frac{1}{2}$absinC.

   Conversion of angles such:
   as 30°, 100°, 270°π radians, $-\frac{p}{4}$ radians, 2.3 radians.

   Practical examples involving sectors and segments such as water in a pipe, flat on a crankshaft, contact of a drive belt on a pulley.

   Trigonometric equations such as:

2 sinx = 1	0° < x < 360°
3 cosx = 2	- π< x < π
2 tany + 1 = - 5	0° < y < 360°

2. Addition, subtraction, multiplication and division of algebraic fractions and simplification of the results, eg.

   Addition: $\frac{3}{a}+\frac{a}{2}$

   Subtraction: $\frac{4}{xy}-\frac{3}{y^2}$

   Multiplication: $\frac{5a}{6}x\frac{3}{a^2}$

   Division: $\frac{2xy}{3}\quad\frac{5x}{2y}$

   Transposition of formulae such as:

   $X=\frac{1}{2\pi fC}$ for C;

   $F=\frac{mv^2}{r}$ for V; $C=\frac{5}{9}(F-32)$ for F;

$V = u + at$ for t; $T = 2\text{p}\,\frac{\sqrt{1}}{g}$ for 1;

Indices: $2a^2 xa^3$; $5b-^2\ x3b$; $(9m^2)^{\frac{1}{2}}$;

m½ x 3m

$2x^2 \quad 4x$; $\frac{5ab^2}{2a^3b}$; $\frac{1}{\sqrt{(3m^6)}}$;

$6a \quad 3a^{-4}$;

(2.71 x 10^5) x (6.3 x 10^-7).

3. Linear equations involving integer and/or decimal coefficients eg. Kirchoff's laws; solution of quadratic equations such as $x^2 + 2x - 8 = 0$ and $2x^2-5x + 1 = 0$. Formulae should be used and factorisation may be used. Examples such as projectiles, stopping distance of a car at different speeds.

4. Examples to include direct, inverse and joint variation. Consideration of graphs.

5. The document "A Guide to Mathematical Investigations: SQA 1991" provides detailed information concerning, and exemplars of, investigations. The investigation should involve the content of other outcomes.

SUGGESTED LEARNING AND TEACHING APPROACHES

The module descriptor lists discrete outcomes, but the learning and teaching approaches adopted may change the order or integrate the outcomes as appropriate. Several approaches are possible depending on the availability of resources, experience of tutors and the type of student group. This may involve individualised learning, group work and class work. Multi media approaches should be encouraged where possible: text, practical activities, simulations, computer programs, videos etc. Problem solving should be encouraged throughout the module as part of the learning and teaching process, within the investigations, and as part of the assessment process. Likewise the investigation of mathematical ideas should be encouraged throughout the module. Diagnostic and formative assessment may be used where appropriate. The summative assessment may form an integral part of the whole learning/teaching process or may consist of separate 'tests'.

The student should be encouraged to keep a log book/workfile. This should form a complete record of the student's work throughout the module. The workfile could contain the student's notes, class handouts, completed worksheets, exercises, assignments, projects, investigations, log of computer activities and a summary of the important details for later revision purposes.

The sensible use of appropriate technologies, (numeric/scientific/graphics/programmable calculators or computers etc.) should be encouraged. Due account should be taken of estimation, rounding and errors introduced into calculations.

Investigations should allow for divergent mathematical thinking. They may allow for comparisons and contain open ended or closed problems. Situations may occur where no solution is obtainable. The acquisition of mathematical skills may occur within the investigation. A typical investigation used for the purposes of summative assessment may take 3 to 4 hours.

A support pack for this unit is available from SQA. Please call our Sales and Despatch section on 0141-242-2168 to check availability and costs. Quote product code B088.

APPENDIX

FRAMEWORK OF THE MATHEMATICS MODULES 91/92

The module grid summarises the complete structure of the mathematics modules and some of their relationships.

Progression through the grid is to the right.

When considering the suitability of a module, it is important to consider it in relation to others in the grid and not just in isolation.

The first module, Using Numbers in Everyday Situations, relates to the most elementary number concepts and skills.

The modules Using Basic Number Skills, Using Arithmetic Skills, Dealing With Basic Measurements, Dealing With Money, Using Measurement Skills Within Everyday Activities and Small Scale Planning, Estimating and Costing were developed for the BBC Basic Skills Numeracy project.

The modules Core Maths 2, 3 and 4 relate approximately to work done in Standard Grade Mathematics. They are appropriate as National Certificate modules because they allow for consolidation of mathematical skills and they provide students with a second opportunity to create a base from which they can develop their mathematical knowledge and skills.

The modules Business Numeracy, Construction Numeracy 1 and 2, Engineering Numeracy and Laboratory Numeracy have a vocational bias and cater for the mathematical needs of students on craft, operator, clerical or YTS courses.

Craft Technology 1 and 2 are designed to consolidate the mathematical skills at craft level.

The remaining modules meet the needs of students requiring further mathematics in support of their other studies.

Modules Analysis/Algebra 1, Analysis/Algebra 2, Calculus 1(A) and Calculus 1(B) relate approximately to work done in Higher Grade mathematics, but alternative groupings are possible for students continuing or intending to continue, with college or university studies in, for example, business studies or engineering.

Specialist modules such as Business Statistics, Boolean Algebra, Numerical Methods, Operational Research and Spherical Trigonometry are available.