-SQA- SCOTTISH QUALIFICATIONS AUTHORITY

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NATIONAL CERTIFICATE MODULE DESCRIPTOR

-Module Number- **7180401** **-Session-1991-92**
-Superclass- **RB**

-Title- **MATHEMATICS: ANALYSIS/ALGEBRA 1**

-DESCRIPTION-

Purpose

This module extends the properties of algebraic and trigonometric relationships and introduces the topic of vectors.

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

7180331 Core Mathematics 4
or Standard Grade mathematics at $^{1}/_{2}$.
or '0' Grade Mathematics
or an equivalent level of experience.

Outcomes

The student should:

1. use the properties of linear relationships;
2. use the properties of quadratic functions;
3. use the properties of trigonometric functions;
4. use vectors in two dimensions;
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 THE PROPERTIES OF LINEAR RELATIONSHIPS

PCs

(a) Drawing of a reasonably fitting line from supplied data is correct.
(b) Determination of the equation of a straight line from a graph of experimental data is correct.
(c) Extraction of information from plotted graphs is correct.

IA Assignment

Two problems each assessing all 3 Performance Criteria. One problem will be such that, with appropriately chosen scales, the value of the intercept on the vertical axis can be read from a graph. The other will be such that it cannot be read from a graph.

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

OUTCOME 2 USE THE PROPERTIES OF QUADRATIC FUNCTIONS

PCs

(a) Identification of a sketch from a quadratic function is correct.
(b) Identification of the turning point and zeros as appropriate, from a quadratic function is correct.
(c) Determination of an equation of a quadratic function from a graph is correct.

IA (1) PCs (a) and (c) Multiple Choice
IA (2) PC (b) Graphical and Calculation Exercise

Topics should be assessed on the number of occasions indicated:

(a)	one equation and four pictures	3
(b)	turning point and zeros from quadratic function (one function with no real roots, one with one real root and, one with two real roots)	3
(c)	one picture and four equations	3

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

OUTCOME 3 **USE THE PROPERTIES OF TRIGONOMETRIC FUNCTIONS**

PCs

(a) Sketching of trigonometric functions involving
  (i) multiple angles and
  (ii) phase angles, is correct.

(b) Identification of trigonometric functions involving
  (i) multiple angles and
  (ii) phase angles from their graphs, is correct.

(c) Solution of trigonometric equations involving both multiple and phase angles is correct.

(d) Determination of the periodicity of a function is correct.

(e) Use of $\sin^2 A + \cos^2 A = 1$ and

$$\tan A = \frac{\sin A}{\cos A}$$ is correct

IA Graphical and Calculation Exercise

Topics should be assessed on the number of occasions indicated:

(a)	sketches of trigonometric functions such as 3 cos 2x, 2 sin (x - 30°)	2
(b)	identification of trigonometric functions such as $\tan(x - \frac{\pi}{6})$, $\frac{1}{2}\cos 3x$	2
(c)	solution of trigonometric equations such as: $5\cos(0.5 + \frac{\pi}{6}) = 1 \quad 0 \le x < 2\pi$ $\sin(3x + 50°) = 0.5 \quad 0 \le x < 180°$	3

(d) periodicity of a function:
graph 2
equation 2

(e) use of $\sin^2 A + \cos^2 A = 1$ and

$$\tan A = \frac{\sin A}{\cos A}$$ 3

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

OUTCOME 4 USE VECTORS IN TWO DIMENSIONS

PCs
(a) Solution of a vector system by scale drawing is correct.
(b) Solution of a vector system by calculation using components is correct.

IA Graphical and Calculation Exercise

Topics should be assessed on the number of occasions indicated:

(a) solution by scale drawing 1
(b) solution by calculation 3

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

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. Examples may involve the following: selection of appropriate scales; plotting supplied data and drawing by eye the best fitting straight line; use of a software package to determine best fitting straight line; determining the equation of the straight line from its graph using y = mx + c or y - b = m (x - a). Extraction of information by interpolation; discuss the dangers of extrapolation.

2. Quadratic functions may include those with real distinct roots, real equal roots, and no real roots. Turning points and zeros from the graph and/or equation.

3. Trigonometric functions involving the use of degrees and radians such as:

   f (x) = 2 sin 3 x
   f (x) = cos (x + 30°)
   f (x) = 240 sin $(100\pi t - \frac{\pi}{4})$

   Trigonometric equations such as:

   $\cos(x + \frac{\pi}{6}) = -0.6$

   $4\tan 2x = 10$

   $\sin(2\pi t - 0.3) = 0.5$

   with solutions within a specified range.

   Period of a function from its graph and from its equation where it may be periodic or non-periodic.

   Simplify $\frac{1 - \cos^2 x}{2\cos x}$

4. Vector systems such as force or velocity diagrams, phasor systems.

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 should 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 4 to 6 hours.

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.