



**ZIMBABWE SCHOOL  
EXAMINATIONS COUNCIL  
(ZIMSEC)**

**ZIMBABWE GENERAL CERTIFICATE OF EDUCATION  
(ZGCE)**

**ORDINARY LEVEL SYLLABUS**

**ADDITIONAL MATHEMATICS  
(4033,4034)**

**EXAMINATION SYLLABUS FOR NOVEMBER 2013-2017**

**Additional copies of the syllabus and specimen question paper booklets can be ordered from Zimsec.**

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***\* Available in the November Examination only.***

## PREFACE

In November 2005 to 2007, the following syllabuses will be examined by the Zimbabwe School Examinations Council (ZIMSEC).

1122	English Language
2013	Literature in English
2042	Religious Studies A
2043	Religious Studies B
2166	History
2248	Geography
2283	Economics
3011	French
3155	Ndebele
3159	Shona
4008/4028	Mathematics
5006	Integrated Science
5008	Biology
5009	Physical Science
5035	Agriculture*
6015	Art*
6035	Woodwork*
6045	Metalwork*
6051	Fashion and Fabrics*
6064	Food and Nutrition*
6078	Home Management*
7014	Computer Studies*
7035	Building Studies*
7049	Technical Graphics*
7103	Commerce
7112	Principles of Accounts
2157	History World Affairs since 1919
2167	History Southern and Central Africa
2252	Sociology
2292	Law
3001	Latin*
3025	German*
3035	Spanish*
3151	Afrikaans*

4033	Additional Mathematics*
4034	Additional Mathematics*
4041	Statistics*
5055	Physics*
5071	Chemistry*
5097	Human and Social Biology
5027	Science (Physics/Biology)
5128	Science (Chemistry/Biology)
6020	Music*
7108	Commercial Studies*
7116	Business Studies*

\* Indicates syllabuses not available in June

**Subjects 4033/4034. ADDITIONAL MATHEMATICS**

- 4033: This version is for candidates not using calculators.  
4034: This version is for candidates using calculators

*\* Available in the November Examination only.*

**ADDITIONAL MATHEMATICS**  
**GCE O LEVEL ADDITIONAL MATHEMATICS (4033/4034)**  
**Additional Mathematics, 4033 is the non-calculator version and**  
**4034 is the calculator version.**

**Syllabus Aims**

The course should enable students

1. to extend their elementary mathematical skills and use these in the context of more advanced techniques;
2. to develop an ability to apply mathematics in other subjects, particularly science and technology;
3. to develop mathematical awareness; and the confidence to apply their mathematical skills in appropriate situations;
4. to extend their interest in the mathematics and appreciate its power as a basis for specific applications.

**Assessment Objectives**

The examination will test ability of candidates to

1. recall and use manipulative techniques;
2. interpret and use mathematical data, symbols and terminology;
3. comprehend numerical, algebraic and spatial concepts and relationships;
4. recognise the appropriate mathematical procedure for a given situation;
5. formulate problems into mathematical terms and select and apply appropriate techniques of solution.

**Examination Structure**

There will be two papers, each of 2½ hours

- PAPER 1 (Pure Mathematics)(100 marks) will be on the common core syllabus detailed below.
- Section A (52 marks) will consist of a number of compulsory short questions of variable mark allocations.

- Section B (48 marks) will consist of six longer questions from which candidates will be required to answer four.
- PAPER 2 (Mechanics and Statistics)(100 marks), will contain seven questions on each of the two options.  
Answer all questions in Section A and any 5 from Section B and/or Section C.
- Section A (40 marks) it will consist of 4 compulsory questions from Section A of the syllabus.
- Section B (60 marks), it will consist of 5 questions from Section B of the syllabus, each question carrying 12 marks.
- Section C (60 marks), it will consist of 5 questions from Section C of the syllabus, each question carrying 12 marks.

### **Detailed Syllabus**

Knowledge of the content of the Council's Ordinary level Syllabus 4008/4028 is assumed.

Ordinary level material which is not repeated in the syllabus below will not be tested directly but it may be required indirectly in response to questions on other topics.

Proofs of results will not be required unless specifically mentioned in the syllabus.

Candidates will be expected to be familiar with the specific notation for the expression of compound units, e.g.  $5\text{ms}^{-1}$  for 5 meters per second.

**ADDITIONAL MATHEMATICS  
SYLLABUS FOR PAPER 1**

**SYLLABUS**

1. Rectangular Cartesian coordinates.  
Distance between two points. The gradient and the equation of a straight line. Condition for two lines to be parallel or perpendicular.

2. Functions, Inverse of a one-one function. Composition of functions.

Graphical illustrations of the relationship between a function and its inverse.

3. The quadratic function  $f(x) = ax^2 + bx + c$ , finding its maximum, sketching its graph or determining its range for a given domain. The condition for the equation  $ax^2 + bx + c = 0$  to have:  
(i) two real roots  
(ii) two equal roots  
(iii) no real roots  
and the solution of the equation for real roots.  
Solution of quadratic inequalities.

4. Simultaneous equations, at least one linear, in two unknowns.

5. The remainder and factor theorems.  
Factors of polynomials.

**NOTES**

Including  $x \rightarrow |f(x)|$ , where  $f(x)$  may be linear, quadratic or trigonometric. A function will be defined by giving its domain and rule, e.g.  
 $f: x \rightarrow Igx, (x > 0)$ . The set of values  $f(x)$  is the range (image set) of  $f$ . The notation  $f^2(x)$  will be used for  $f(f(x))$ .

The condition for a given line to  
(i) intersect a given curve,  
(ii) be a tangent to a given curve,  
(iii) not intersect a given curve.

6. Simple properties and graphs of the logarithmic and exponential functions.  
Laws of logarithms.  
Solution of  $a^x = b$ .

7. Arithmetic and geometric progressions.

Including  $\ln x$  and  $e^x$ . Their series expansions are not required.  
Change of base of logarithms will not be tested.

8. The use of expansion of  $(a+b)^n$  for positive integral  $n$ .

9. Circular measure: arc length, area of sector of a circle.

10. Determination of known constants in a relationship by plotting an appropriate straight line graph.

Including the sum to infinity of geometric series.

11. The six trigonometric functions of angles of any magnitude. The graphs of sine, cosine and tangent. Knowledge of the relationships:

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

$$\frac{\cos A}{\sin A} = \cot A,$$

$$\sin^2 A + \cos^2 A \equiv 1,$$

$$\sec^2 A \equiv 1 + \tan^2 A,$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A.$$

Solution of simple trigonometric equations involving any of the six trigonometric functions and the above relationships between them.

Simple identities.

Addition formulae,

$\sin(A+B)$ ,  $\cos(A\pm B)$ , and application to

multiple angles. Expression of  $R\cos(\theta \pm \alpha)$   
or  $R\sin(\theta \pm \alpha)$  solution of  
 $a\cos\theta + b\sin\theta = c$ .

The general solution of trigonometric equations will not be required.

General solution excluded. Knowledge of  $t$ -formulae is not required.

12. Vectors in two dimensions: magnitude of a vector, addition and subtraction of vectors, multiplication by scalars. Position vectors. Unit vectors. Scalar product and its use to determine the angle between two lines.

Question may be set using any vector notation Including the unit vectors  $\mathbf{i}$  and  $\mathbf{j}$ .

13. The idea of a derived function. Derivative of  $kx^n$  for  $n$  a positive or negative integer. Derivative for a sum and of a composite function. Applications of differentiation to gradients, tangents and normals, stationary points, velocity and acceleration, connected rates of change, small increments and approximations; practical problems involving maxima and minima.

Both  $f$  and  $\frac{dy}{dx}$  will be used.

Any method of discrimination between stationary points will be acceptable.

Derivatives of standard functions. Differentiation of product and quotient of functions and of simple functions defined implicitly or parametrically.

The derivatives of  $x^n$  (for any rational  $n$ ),  $\sin x$ ,  $\cos x$ ,  $\tan x$ ,  $e^x$ ,  $\ln x$  and composite functions of these.

14. Integration as the reverse process of differentiation.  
Integration of sums of terms in interger

powers of  $x$  excluding  $\frac{l}{n}$ . Definite integrals. Applications of integration to plane areas, volumes, displacement, velocity and acceleration.

The integrals of  $(ax+b)^n$ (including  $n=-1$ ),  $e^{ax+b}$ ,  $\sin(ax+b)$ ,  $\cos(ax+b)$ . Integration by substitution is not required.

## PAPER 2

### SECTION A. MECHANICS AND STATISTICS.

#### SYLLABUS

1. Kinematics of a particle moving in a straight line with constant acceleration.

2. Forces treated as vectors, composition and resolution of coplanar forces acting on a particle.  
Equilibrium of a particle under the action of coplanar forces.  
Friction.

3. Graphical representation of numerical data.

Measures of average; mean, median; mode; modal class.

4. Cumulative frequency tables and cumulative frequency curves.

#### NOTES

To include use of  $x - t$  and  $v - t$  graphs.

Proofs of fundamental theorems are not required.

Including pie chart, bar chart, frequency polygon and histogram.

Effect on a mean and S,D. of adding a constant to each observation and multiplying each observation by a constant.

Including estimation of median, quartiles and percentiles from a cumulative frequency curve and by linear interpolation from a cumulative frequency table.

## SECTION B.

### MECHANICS.

1. Forces treated as vectors, composition and resolution of coplanar forces acting on a particle. Equilibrium of a particle under the action of coplanar forces. Friction.

Proofs of fundamental theorems are not required.

2. Motion of a projectile.

3. Newton's law of motion. Dynamics of a particle moving in a straight line under constant forces. Simple cases of the motion of two connected particles, each moving in a straight line.

Knowledge of the range on the inclined plane and of the Cartesian equation of the trajectory is not required.

4. Energy, work and power. Principle of the conservation of energy.

5. Momentum and impulse. The principle of the conservation of linear momentum.

Questions on oblique impact will not be set. Knowledge of the coefficient of restitution is not required.

## STATISTICS.

### SYLLABUS

### NOTES

1. Elementary ideas of probability. Including the treatment of mutually exclusive and independent events. Use of tree diagrams.
2. Index numbers, composite index numbers, price relatives.
3. Probability distributions and frequency distributions for a discrete variable. Expectation. Including  $E(X)$ ,  $E(X^2)$  and variance, quartiles and percentiles, loss in simple games, idea of fair game.
4. The binomial distribution. Including knowledge, but not proof, of the mean,  $np$ , and the standard deviation,  $npq$ .
5. The normal distribution. Standardised values and the use of tables. Questions will involve continuous data only.
6. General ideas of sampling and surveys. Use of the mean and the standard error of the mean for large samples; 95% and 99% confidence limits. Including knowledge of the terms, random sample, stratified random sample, quota sample, systematic sample.
7. Permutations and combinations.