



ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Advanced Level

MATHEMATICS
PAPER 4 Statistics and Mechanics

9164/4

JUNE 2015 SESSION

3 hours

Additional materials:

- Answer paper
- Graph paper
- List of Formulae
- Electronic calculator

TIME 3 hours

INSTRUCTIONS TO CANDIDATES

Write your name, Centre number and candidate number in the spaces provided on the answer paper/answer booklet.

There is no restriction on the number of questions which you may attempt.

If a numerical answer cannot be given exactly, and the accuracy required is not specified in the question, then in the case of an angle it should be given to the nearest degree, and in other cases it should be given correct to 2 significant figures.

If a numerical value for g is necessary, take $g = 9.81 \text{ ms}^{-2}$

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question.

The total number of marks for this paper is 120.

Questions are printed in the order of their mark allocations and candidates are advised to attempt questions sequentially.

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

This question paper consists of 6 printed pages and 2 blank pages.

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Section (a): Statistics

- 1 The marks obtained by candidates in a mathematics examination were displayed as follows:

1	3
2	6
3	1
4	1 3
5	0 2 6 8
6	1 2 2 2 7
7	0 3 4 5 5 8 9
8	0 3 4 4 8
9	2 7 7 8

key 4|1 means 41 %

- (a) (i) State the name given to this display. [2]
(ii) Calculate the range of the marks. [1]
- (b) Comment on the skewness of the distribution. [1]
- (c) State any **one** advantage of this type of display of information. [1]
- 2 A continuous random variable, X , has a probability density function defined as

$$f(x) = \begin{cases} 0.1x + k, & 4 \leq x \leq 6 \\ 0.3, & 6 \leq x \leq 8 \\ 0, & \text{otherwise.} \end{cases}$$

Find

- (a) the value of constant k , [2]
(b) $P(5 \leq X \leq 7)$. [2]
- 3 The distribution table shows prizes corresponding to six values on a fair spinner used in a game. The spinner lands on only one of the six values.

value	1	2	3	4	5	6
prize in \$	2	2	6	4	10	6

- (a) Find the probability of the spinner landing on
(i) a prime value, [2]
(ii) a value that gives a prize of not less than \$4. [2]
- (b) Calculate the expected prize for a single game. [2]

- 4 The masses of letters posted by a certain school are normally distributed with mean 15 g. It is found that the masses of 92 % of the letters are within 10 g of the mean.

Find

- (a) the standard deviation of the masses of the letters, [3]
- (b) the probability that at least 2 out of a random sample of 8 letters have masses which are within 10 g of the mean. [3]

- 5 Two tetrahedral dice with faces marked 0, 1, 2, 3 are thrown and the number on which each lands on is noted. The score is the sum of the 2 numbers.

By means of an outcome table or otherwise,

find the probability that

- (i) the score is a prime number, [3]
- (ii) one die lands on a 3 given that the score is a prime number. [3]

- 6 (a) Define the term **random sample** and state any **two** methods of obtaining such a sample. [3]

(b) A school was asked to send 10 students for an exchange programme with a sister school in another country. The head of the school was asked to supply the names of the 10 students within 3 days. The head then went on to choose 10 students from those who already had valid passports.

- (i) Name the sampling method used by the head of the school.
- (ii) State, giving reasons, whether the method used would give rise to a random sample.

[3]

- 7 (a) Distinguish between a 1 tailed test and a 2 tailed test. [2]

(b) It is claimed that rural secondary school pupils travel a distance of more than 12 km to school. To test this claim, a random sample of 100 pupils were asked to keep a record of the distances they travel to school. The random sample showed an average distance of 14.5 km with a standard deviation of 4.8 km.

Test at 0.05 level of significance whether the claim is true. [6]

- 8 The number of passengers being ferried in each Eastliner bus is known to follow a normal distribution. A random sample of 50 such buses showed a mean of 70 passengers with a standard deviation of 4.

- (a) (i) Define the term confidence interval.
 (ii) Calculate a 95 % confidence interval for the mean number of passengers in each bus.

[5]

- (b) Calculate the sample size, n , that should be taken so that one is 90 % confident that the sample mean will be within 0.8 of the true mean.

[4]

- 9 An insurance company receives on average 3 claims on any given week.

Find the probability that the company receives

- (a) at least 2 claims in any given week, [3]
 (b) one claim in a day, assuming that the company works for 5 days in a week, [3]
 (c) a total of 2 claims during 3 consecutive weeks, [3]
 (d) at least 2 claims in exactly one of the 3 consecutive weeks. [3]

- 10 A survey on newspaper readership was carried out in 3 provinces.

The results are shown in the table below

Province	type of newspaper read		
	TODAY	CURRENT	NEWS
Northern	55	65	30
Central	80	48	62
Southern	75	47	98

Test at 5 % level of significance whether there is an association between the province and newspaper preference.

[12]

- 11 The amount of fuel used to cover 100 km on 10 occasions travelling at different speeds using the same car was recorded as follows:

speed (km/hr)	amount of fuel used (l)
X	Y
80	8
100	10
130	15
110	12
90	9
60	8
70	8
80	9
140	17
95	10

- (a) Find the equation of the regression line of the amount of fuel used (Y) on the speed (X). [4]
- (b) Use your equation, in (a), to estimate where possible, the amount of fuel likely to be used when travelling at
- (i) 105 km/hr,
- (ii) 50 km/hr. [4]
- (c) Find the product moment correlation coefficient and comment on the relationship between the speed and the amount of fuel used. [4]

- 12 The mass, m g, of a randomly chosen key-holder is known to follow a normal distribution with mean 20 g and a standard deviation of 4 g. The mass, M grammes of a randomly chosen key is also known to follow a normal distribution with a mean of 12 g and variance of 9 grammes.

- (a) Find the probability that the combined mass of
- (i) 2 randomly chosen key-holders and 3 randomly chosen keys is greater than 78 g,
- (ii) 3 key-holders is greater than the combined mass of 6 keys. [8]
- (b) Determine the probability that a randomly chosen key-holder is more than twice the mass of a randomly chosen key. [5]

Section (b): Mechanics

- 13 A particle of mass 4 kg resting on a rough horizontal table is acted on by two horizontal forces of magnitudes 20 N and 30 N. The angle between the two forces is 120° . The coefficient of friction between the particle and the table is $\frac{1}{4}$.

Find the acceleration of the particle. [5]

- 14 A stone is thrown vertically upwards with a speed of 15 ms^{-1} .

(a) Find

(i) the time, t , taken by the stone to reach the maximum height,

(ii) the distance, x , travelled by the stone after 3 seconds.

[5]

(b) Sketch a $(t; x)$ graph for the motion of the stone in the first 3 seconds. [3]

- 15 A particle is projected from a point O which is 5 m above the horizontal ground. The initial velocity of the particle is 30 ms^{-1} at an angle of elevation $\arctan\left(\frac{3}{4}\right)$.

(i) Calculate the speed and direction of the particle 4 seconds after projection. [5]

(ii) The particle hits the ground at point T. Find the displacement OT. [6]