



ZIMBABWE SCHOOL EXAMINATIONS COUNCIL
General Certificate of Education Advanced Level

MATHEMATICS
PAPER 4

9164/4

JUNE 2013 SESSION

3 hours

Additional materials:
Answer paper
Graph paper
List of Formulae

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.

Within each section of the paper, questions are printed in the order of their mark allocations and candidates are advised, within each section, 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 7 printed pages and 1 blank page.

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Section (a): Statistics

- 1 The table shows the number of children below the age of 15 known to have suffered from measles in 2009 in a certain village.

Age (in years)	Number of reported cases
Under 1	14
1 – 2	33
3 – 4	35
5 – 9	39
10 – 14	5

- (a) Represent the above information by means of a histogram. [2]
- (b) Calculate the mean age of children who suffered from the disease. [2]
- 2 During the 2010 World Cup in a certain city, the probability that there was electricity on any particular day was $\frac{1}{3}$. In the case that there was no electricity, a generator would be switched on. Independently, the probability that John watched a soccer match being screened live was $\frac{1}{4}$.
- (a) Represent the above information by means of a tree diagram. [1]
- (b) Given that John watched a soccer match, find the probability that there was no electricity. [3]
- 3 An ice-cream vendor records his daily takings ($\$x$) over a period of 30 days. The results are summarised by $\sum x = 900$ and $\sum x^2 = 34\,000$.
- (a) Find the unbiased estimates of
- (i) the population mean,
- (ii) the population variance. [3]
- (b) Calculate at 95% confidence interval the mean amount he receives assuming that his daily takings are normally distributed. [3]

- 4 The probability that a learner driver passes his/her test at Vehicle Inspection Department is $\frac{1}{4}$. A learner counts the number of attempts, n , until he/she passes the driving test.

- (a) State a suitable statistical distribution which can be used to model the above situation. [1]
- (b) Find the mean and variance of the distribution. [3]
- (c) Find the smallest value of n , for which there is a probability of at least 0.7, that the learner will need only n or fewer trials to pass the test. [4]

- 5 A continuous random variable X has a probability density function $f(x)$ given below

$$f(x) = \begin{cases} \frac{1}{2} & 0 \leq x < 0.5 \\ \frac{1}{5}(3-x), & 0.5 \leq x \leq 3 \\ 0, & \text{otherwise.} \end{cases}$$

- (a) Sketch the graph of $f(x)$. [2]
- (b) Find the median. [3]
- (c) Evaluate $P(x < 1.2)$. [3]
- 6 A sample of 10 items are taken from a production line to check if the machine is functioning properly. The components produced by the machine are set to have a mean diameter of 2 cm and a standard deviation of 0.03 cm. The ten items had their diameters measured and the results were:

2.17	1.93	2.02	1.97	2.00
2.01	2.02	1.89	1.99	2.01

- Test at 5% level of significance whether the components produced by the machine are of the required standard. [9]

- 7 (a) Distinguish between a 1-tailed test and a 2-tailed test. [2]
- (b) A political party claims that it commands 60% of the voters. To test this, a random sample of 300 potential voters were asked which party they would vote for. 160 confirmed that they would vote for that party.

Establish whether this sample supports the claim by the party. Test at 10% level of significance. [7]

- 8 Mangoes are boxed into cartons, each containing 500 mangoes. The probability that a mango is rotten is 0.002. Buyers of these cartons of mangoes will return any carton that contains 4 or more rotten mangoes.

- (a) (i) Find the expected number of rotten mangoes per carton, [1]
- (ii) State, giving a reason, the most appropriate statistical distribution which can be used to model the above situation, [2]

- (b) Find the probability that

- (i) a carton of mangoes is not returned,
- (ii) if two cartons of mangoes are chosen at random, they contain at least three rotten mangoes.

[7]

- 9 The following data shows the ownership of satellite dishes by different social classes in a randomly chosen sample of 150 households in a town.

social class	number of people who own satellite dishes	number of those without a satellite dish.
Executive	15	10
Managerial	23	8
Working	54	40

Test at 5% level of significance to establish if there is an association between ownership of a satellite dish and social class in the town.

[11]

- 10 Oranges are sold in small pockets which are normally distributed with mean weight μ and variance σ^2 . The probability that a randomly chosen pocket weighs more than 3.2 kg is 0.01 and that a randomly chosen pocket weighs less than 2.4 kg is 0.2.

(a) Calculate μ and show that $\sigma^2 = 0.38$ correct to 2 decimal places. [5]

(b) Potatoes are also sold in small pockets which are normally distributed with a mean weight of 5 kg and a standard deviation of 0.6 kg.

Find the probability that

(i) two randomly chosen orange pockets weigh less than one randomly chosen pocket of potatoes.

(ii) the combined weights of two randomly chosen orange pockets and one randomly chosen pocket of potatoes weigh more than 11 kg. [8]

- 11 The manager of a women clothing shop did a small survey on the amount a woman spends on clothes and her age. The findings were tabulated as follows:

woman's age (in years) X	18	21	36	45	23	53	25	37	30	32
annual expenditure on clothes (in dollars) Y	330	300	180	120	310	150	250	150	245	190

(a) Show the above information on a scatter diagram [3]

(b) (i) Calculate the equation of the regression line Y on X and fit it on the scatter diagram. [5]

(ii) Use the regression line Y on X to estimate the amount likely to be spend on clothes by a 40 year old woman. [2]

(c) (i) Calculate the product- moment correlation coefficient.

(ii) Comment on your answer in (c)(i). [4]

Section (b): Mechanics

- 12 A particle of mass 8 kg rests on a rough plane inclined at 30° to the horizontal and is about to slip.

Show that the coefficient of friction between the plane and the particle is $\frac{1}{\sqrt{3}}$. [4]

- 13 (a) A ball is projected from point O with velocity $u \text{ ms}^{-1}$ at an angle θ above the horizontal and passes through the point $(x; y)$.

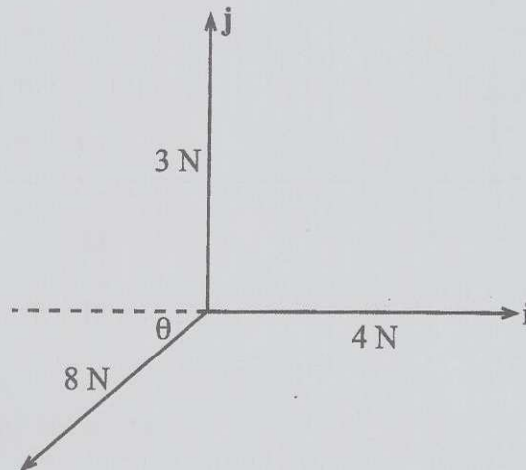
Show that the equation of the trajectory is given by

$$y = x \tan \theta - \frac{gx^2(1 + \tan^2 \theta)}{2u^2} \quad [3]$$

- (b) A ball is thrown from a height of 0.9 m above the ground at an angle of 30° to the horizontal, to clear a wall 10.5 m away horizontally and 4.5 m high.

Show that the velocity of projection must not be less than 17.1 ms^{-1} for the ball to clear the wall. [3]

14



Coplanar forces of magnitudes 3 N, 4 N and 8 N act at a point as shown in the diagram.

- (a) If the resultant force in the i -direction is $4(1 - \sqrt{3})$ N, show that $\theta = 30^\circ$. [2]
- (b) Calculate the magnitude of the resultant force and state its direction. [5]

- 15 A particle is moving in a straight line. Initially the particle has a velocity of 8 ms^{-1} and is subjected to a retardation of $\frac{3}{2} \text{ ms}^{-2}$ for 6 seconds.

- (a) Draw a velocity-time graph for the particle. [3]
- (b) Find the displacement of the particle from the starting point after the 6 seconds. [2]
- (c) Find the distance travelled by the particle in the 6 seconds. [2]

$$a = \frac{v - u}{t}$$

a