

P425/2
APPLIED MATHEMATICS
PAPER 2
JUNE 2014
3 hours

INTERNAL MOCK EXAMINATIONS 2014

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper two

3 hours

INSTRUCTIONS TO CANDIDATES

*Answer **all** the questions in sections **A** and any **five** from section **B**.*

All the working must be shown clearly.

Begin each question on a fresh page.

Silent, non-programmable scientific calculators and mathematical tables with a list of formulae may be used.

In numerical work, take g to be 9.8 ms^{-2} .

Turn over

SECTION A: (40 MARKS)*Answer all the questions in this section.*

- Two forces have magnitudes 5N and PN. If the resultant force has a magnitude 6N and acts at an angle of 40° to the 5N force, find value of P. **(05 marks)**
- Events A and B are such that $P(A) = \frac{1}{3}$, $P(B) = \frac{1}{4}$ and $P(A \text{ or } B \text{ but not both } A \text{ and } B) = \frac{5}{12}$. Calculate the;
 - $P(A \cap B)$ **(02 marks)**
 - $P(B / A')$ **(03 marks)**
- The radius and height of a cylinder was measured and found to be 5cm and 10cm with errors $\pm 0.2\text{cm}$ and $\pm 0.5\text{cm}$ respectively. Find the percentage error made in the calculation of volume of the cylinder. **(05 marks)**
- A particle of mass 0.2kg and velocity $5\mathbf{i} + 7\mathbf{j}$ collides with a particle of mass 0.3kg and velocity $2\mathbf{i} - 3\mathbf{j}$. If the particles couple together, find the;
 - common speed **(02 marks)**
 - loss in kinetic energy **(03 marks)**
- In a certain school, 40% of the students supported a candidate A for the post of Head prefect. If a random sample of 150 students is selected, find the probability that more than 55 students supported candidate A. **(05 marks)**
- The table below shows x and the function f(x)

x	50.24	48.11	46.93	44.06
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f(x)	4.116	7.621	9.043	11.163
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Use linear interpolation/extrapolation to find the value of;

- (i) x when $f(x)$ is 8.614 **(03 marks)**
 (ii) $f(51.07)$ **(02 marks)**

7. A particle of mass 5kg is placed on a smooth plane inclined at $\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)$ to the horizontal. Find the;
- (i) magnitude of the force acting horizontally required to keep the particle in equilibrium **(03 marks)**
 (ii) normal reaction **(02 marks)**

8. Nine voters in Kampala and Jinja were asked to give the government a score out of 100, on each of the nine issues. The results are shown below.

Issues	A	B	C	D	E	F	G	H	I
Kampala	62	54	46	34	54	46	36	29	14
Jinja	76	59	46	37	35	27	46	17	17

- (i) Calculate the rank correlation coefficient between the voters in the two districts. **(04 marks)**
 (ii) Comment on your result **(01 mark)**

SECTION B: (60 MARKS)

Answer **only five** questions from this section. All questions carry equal marks.

9. (a) An Urn contains 3 red, 4 white and 5 blue discs. If three discs are selected randomly one at a time without replacement, find the probability that the three discs are of different colours. **(05 marks)**
 (b) The probability that a fisherman catches fish is 0.7 on a cloudy day and 0.2 on a clear day. If the probability of a day being clear is 0.6, find the probability that the day was cloudy given that he did not catch fish. **(07 marks)**

10. (a) Use the trapezium rule with 7 ordinates to estimate the value of $\int_{0.5}^1 \frac{x^2}{1+x^2} dx$

correct to 4 decimal places

(06 marks)

(b) Calculate the percentage error in using the trapezium rule to estimate the integral in (a) above correct to 2 significant figures.

(06 marks)

11. (a) A particle is executing simple harmonic motion with amplitude 2metres and period 12 seconds. Calculate the maximum speed of the particle. **(05 marks)**

(b) If initially, the particle was moving at a maximum speed, find the;

(i) distance moved by the particle until its speed is half the maximum value

(04 marks)

(ii) time taken by the particle to travel this distance

(03 marks)

12. (a) A machine cuts poles whose lengths are normally distributed with mean 4.2m and standard deviation 1.2m. If a random sample of 100 poles is selected, find the probability that a pole selected at random has its mean length

(i) in the range 4.0m to 4.3m

(04 marks)

(ii) more than 4.1m

(03 marks)

(b) A survey of 150 households asked how many people regularly eat bread for breakfast. The results of the survey are summarized as below;

$$\sum x = 173 \qquad \sum x^2 = 355$$

Calculate the;

(i) un biased estimate of the population variance

(02 marks)

(ii) 97.51 confidence interval for the mean number of people who regularly eat bread for breakfast

(03 marks)

13. (a) Show that the Newton Raphson's formula for approximating the natural logarithm of the cube root of a number N is given by $x_{n+1} = \frac{1}{3} (3x_n - 1 + Ne^{-3x_n})$

(06 marks)

(b) Taking $x_0 = 1$, Use your formula in (a) above to find the $\ln \sqrt[3]{25}$. Correct your answer to 3 decimal places.

(06 marks)

14. At 9:00am, a fishing boat is 10km on a bearing of 110° from a traveler, travelling with a speed of 8kmh^{-1} on a bearing of 060° . If the fishing boat has a top speed of 6kmh^{-1} , find the;

(a) route of the fishing boat if it is to be as close to the traveler as possible

(05 marks)

(b) distance between the two boats at this point and the time at which it will occur

(07 marks)

15. The table below shows the distribution of marks of a group of candidates during an examination.

Marks	Frequency
0 - < 10	10
10 - < 20	25
20 - < 40	30
40 - < 60	42
60 - < 70	16
70 - < 95	15

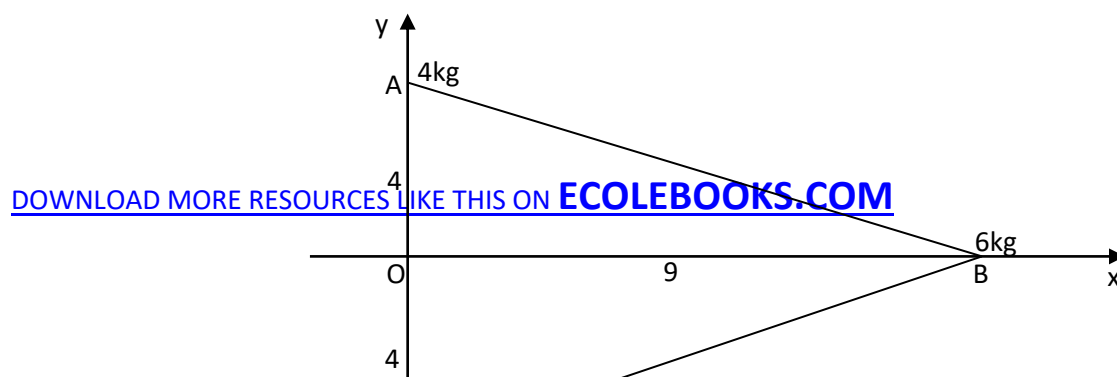
(a) Calculate the;

(i) mean mark (03 marks)

(ii) standard deviation (03 marks)

(b) Draw the histogram of the data and use it to estimate the mode. (06 marks)

16. The figure below shows a triangular lamina ABC.



The co-ordinates of A, B and C are (0, 4), (9, 0) and (0, -4) respectively. If the particles of mass 4kg, 6kg and 2kg are attached at A, B and C respectively.

- (i) Calculate the co-ordinates of the centre of mass of the three particles. **(04 marks)**
- (ii) The centre of mass of the combined system consisting of the three particles and the lamina has coordinates (4, λ). If lamina ABC is uniform and of mass m kg, calculate the value of m and λ . **(05 marks)**
- (iii) The combined system is now freely suspended from O and hangs at rest, determine the angle between AC and the vertical. **(03 marks)**

END