

P425/2
APPLIED MATHEMATICS
Paper 2
Jul. / Aug. 2017
3 hours



"Together for Mathematics"

SECONDARY MATHEMATICS TEACHERS' ASSOCIATION

SMATA JOINT MOCK EXAMINATIONS 2017

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES

Answer **all** the *eight* questions in Section **A** and **five** questions from Section **B**.

Any additional question(s) answered will **not** be marked.

All working **must** be shown clearly.

Begin each answer on a **fresh** sheet of paper.

Graph paper is provided.

Where necessary, take acceleration due to gravity, $g = 9.8 \text{ ms}^{-2}$

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

SECTION A: (40 MARKS)

Answer **all** questions in this Section.

- Forces $\mathbf{F}_1 = 2\mathbf{i} - \mathbf{j}$, $\mathbf{F}_2 = t^2\mathbf{i} - 3\mathbf{j}$ and $\mathbf{F}_3 = 3t^2\mathbf{i} + 2t\mathbf{j}$, act on a particle of unit mass. Find the magnitude of the acceleration of the resultant force after one second. (05 marks)
- The table below shows Grades in Economics and Sub-maths obtained by 8 students in a mock examinations.

Economics	A	O	E	B	C	B	F	D
Sub-maths	D ₂	F ₉	C ₄	D ₁	D ₁	C ₃	P ₈	C ₆

- Calculate the rank correlation. Comment on results. (05 marks)
- The probability that Bashir will fast tomorrow if he takes Daaku is $\frac{1}{2}$ and that he will fast without taking Daaku is $\frac{1}{4}$. If his probability of taking Daaku is $\frac{2}{5}$. Find the probability that Bashir will fast tomorrow. (05 marks)
 - A box of mass 3kg is placed on a rough horizontal surface whose coefficient of friction is 0.35. A pushing force P acting on a body at an angle 25° to the horizontal causes it to move. Find the value of P. (05 marks)
 - Given that $P = 4.8$ and $Q = 21.32$ are rounded off with percentage errors 0.2 and 0.06 respectively. Find the relative error in $\frac{P}{Q}$. (05 marks)
 - When bullets enter someone's body, the amount of blood that comes out is proportional to the number of bullets. When two bullets enter, 0.42 litres come out. For the corresponding 4, 7 and 10 bullets, blood that comes out is 0.84, 1.2 and 1.3 litres respectively. Find by using the gradient method the;
 - Blood that comes out after 13 bullets.
 - Bullets that should be fired to lose 1.02 litres of blood. (05 marks)

7. A discrete random variable T, has its cumulative mass function given by

t	1	2	3	5
P(T ≤ t)	$\frac{k}{4}$	$\frac{3k}{2}$	2k	3k

- Find (i) value of constant k
(ii) p.d.f of T and hence, P(T ≥ 3). (05 marks)
8. A uniform metallic bar of length 5 m is suspended by a light nylon string of length 13 m passing over a smooth wooden peg and rests horizontally, the string being attached to ends of the bar. Given that the bar has a mass of 10 kg, find the tension in the string. (05 marks)

SECTION B: (60 MARKS)

Attempt any *five* numbers from this section

9. (a) A continuous random variable x has its pdf given by;

$$f(x) = \begin{cases} kx \sin x & ; 0 \leq x \leq 2\pi \\ 0 & ; \text{Otherwise} \end{cases}$$

- Find (i) value of constant k
(ii) E(x) (06 marks)

- (b) Accidents on Masaka road are rectangularly distributed with minimum accidents of 4 and maximum of 9 per month.

Find (i) Expected number of accidents in a given month.

(ii) Probability that there will be more than 7 accidents in a month.

(06 marks)

10. (a) Show the N.R.M formula for finding the Fourth root of the reciprocal of a number N is given by $2X_r - NX_r^5$, $r = 0, 1, 2, \dots$

- (b) Construct a flow chart that

(i) Reads initial approximation is A, and N.

(ii) Computes and prints the reciprocal of the fourth root of N to 3 dps.

- (c) Perform a dry run for your flow chart by taking A = 0.4 to evaluate

$$\frac{1}{15.1} \text{ to 3dps.}$$

(12 marks)

11. At 1:30 pm, particle A is at point $\left(\begin{smallmatrix} 4 \\ 2 \end{smallmatrix}\right) km$ moving at $\left(\begin{smallmatrix} -6 \\ 4 \end{smallmatrix}\right) kmh^{-1}$ while at 2pm, particle B is at a point $\left(\begin{smallmatrix} -3 \\ 2 \end{smallmatrix}\right) km$ moving at $\left(\begin{smallmatrix} 1 \\ 6 \end{smallmatrix}\right) kmh^{-1}$.
Find (a) time when the particles will be close and distance of separation between them by then. (08 marks)

- (b) bearing of particle B from the origin at the instant when they are closest. (05 marks)

12. The table below shows the marks obtained in a Mathematics test by 75 candidates.

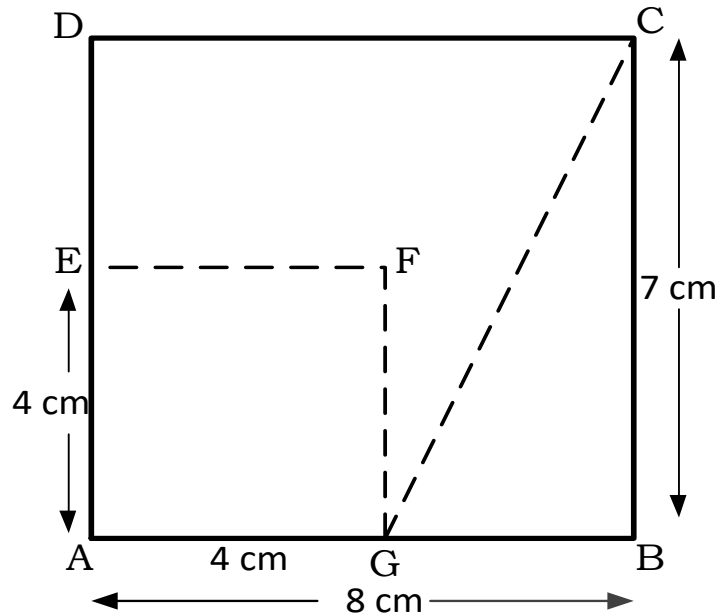
Marks	> 5	> 10	> 20	> 30	> 45	> 50	> 55
Frequency density	0.4	1.2	0.8	2.4	2	1	0

- (a) Calculate (i) mean
(ii) mode.
- (b) Draw an O'give and use it to estimate 7th decile of the marks. (12 marks)
13. (a) A car of mass M kg moves up a hill of inclination, b in c , against a Resistance of 0.2kN. If the car moves at a maximum speed of $36kmh^{-1}$. Prove that power developed is

$$\left(2000 + \frac{10Mgb}{c}\right)$$
 (07 marks)
- (b) In every minute, a pump draws $6 m^3$ of water from a well and issues it at speed of $5ms^{-1}$ from the nozzle situated 4 m above the level from which the water was drawn. Find the average rate at which the pump is working. (05 marks)
14. (a) Use trapezium rule with 6 strips to evaluate

$$\int_1^2 \log_5 3x \, dx$$
 , correct to *four* decimal places. (06 marks)
- (b) Find the exact value of $\int_1^2 \log_5 3x \, dx$. Hence find the maximum possible error in your calculations in (a) above. (06 marks)
15. (a) Masses of 4kg, 5kg, 7kg and 10kg are placed at points A, B, C and D respectively of 4cm by 3cm rectangle ABCD in a certain plane. Find the coordinates of centre of gravity of the masses. (05 marks)

- (b) The diagram below shows 8cm by 7cm rectangular plane ABCD. A triangle GBC and a square AGFE are cut off. Find the distance of centre of gravity from AD and AB of remaining lamina. **(07 marks)**



16. A random variable X is normally distributed with mean, μ and variance, σ^2 .
 Given that $P(x < 40) = 0.42$ and $P(40 < x < 65) = 0.28$.
 Find (a) value of μ and σ

(b) central 80% of the distribution. **(12 marks)**

END