P425/2

MATHEMATICS

APPLIED MATHEMATICS

PAPER 2

MOCK 2024

AUGUST

TIME:3HRS

MEBU EXAMINATIONS CONSULT

Uganda Advanced Certificate Of Education

MOCK EXAMINATIONS 2024

MATHEMATICS PAPER 2

(APPLIED MATHEMATICS)

[redacted]

TIME:3HRS

INSTRUCTIONS TO CANDIDATES

- ✓ Answer **all** the **eight** questions in **section A** and any **five** questions from **section B**.
- ✓ Any additional question(s) answered will not be marked.
- ✓ All 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.
- ✓ For numerical work, take $g=9.8ms^{-2}$.

SECTION A (40 MARKS)

1. 40 percent of the students in a certain school own personal computers. If 24 students are selected at random, find the probability that between 8 and 15 students own personal computers. (5 marks)
2. Forces of (a*i* + bj) N and (6i- 4j) N act at points having position vectors (-2i-2j) m and (3i-j) m respectively. If the forces reduce to a couple, find;
   a).a and b
   b).the moments of the couple (05 marks)

3. Two examiners Y and Z each marked the scripts of ten candidates who sat a mathematics examination. The table below shows the examiners' ranking of the candidates.

Examiners	1	2	3	4	5	6	7	8	9	10
Y	**D**	**G**	**B**	**E**	**A**	**C**	**F**	**I**	**J**	**H**
Z	**G**	**D**	**B**	**F**	**E**	**A**	**C**	**J**	**I**	**H**

Calculate the spearman's rank correlation coefficient for the two examiners and show whether the examiners were in agreement at 1% level of significance. (05marks)

4. Two particles are travelling along a straight line AB of length 20m. At the same instance, one particle starts from rest at A and travels towards B with a constant acceleration of $2ms^{-2}$ and the other particle starts from rest at B and travels towards A with a constant acceleration of $5ms^{-2}$. Find how far from A the particles will collide. (5 marks)

5. The table below shows the velocity of a particle during the course of its motion.

Time (s)	5	9	12
Velocity (ms^{-1})	10	13	17

Use linear interpolation or extrapolation to estimate the:

i).Velocity when T=7s.

ii).Time when the velocity $=19ms^{-1}$ (05 marks)

6. Use the trapezium rule with 5 stripes to find an approximate value for $\int_1^2 xe^{-2x}dx$ correct to 3 significant figures. (05 marks)

7. An object performs Simple Harmonic Motion (SHM) at a rate of 20 oscillations per second between two points A and B which are 12cm.If C is the midpoint of AB,calculate the time taken to travel directly from C to the midpoint of CB. (05 marks)

8. The price index of an article in 2020 based on 2018 was 130. The price index for the article in 2022 based on 2020 was 80. Calculate the;

i).Price index of the article in 2022 based on 2018. (03 marks)

ii).Price of the article in 2018 if the price of the article was 45,000 in 2022. (02 marks)

SECTION B: (60 MARKS)

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

9. A school took a survey of the ages of its employees. The results are shown in the frequency table below:

Ages (yrs)	18-	20-	30-	40-	50-
Frequency	8	22	15	7	2

(a) .Calculate the:

(i) .Mean age (03 marks)

(ii).Modal age (03 marks)

(iii).Standard deviation (02 marks)

(b) .Draw a cummulative frequency curve and use it to estimate the middle 60% age range. (04 marks)

10. At 10:00am, ship A and ship B are 16km apart. Ship A is on a bearing $N35^0E$ from ship B. Ship A is travelling at $14kmh^{-1}$ on a bearing $S29^0E$.Ship B is travelling at 17 kmh^{-1} on a bearing $N50^0E$. Determine the;

(a).Velocity of ship B relative to ship A. (05 marks)

(b). Closest distance between the two ships and the time when it occurs. (07 marks)

11. (a). Two sides of a triangle PQR are p and q such that <PRQ=α

(i) Find the maximum possible error in the area of this triangle. (02 marks)

(ii) Hence, find the percentage error made in the area if p=4.5cm, q=8.4cm and $\alpha = 30^0$. (06 marks)

(b).Find the range with in which $\frac{3.679}{2} - \frac{7.0}{5.48}$ lies. (04 marks)

12. The continuous random variable x is distributed between the values x=0 and x=2 and has a probability density function $mx^2 + nx$ with the mean of 1.25. Find;

(i).The value of m and n and hence f(x). (08 marks)

(ii).The mode of x. (04 marks)

13(a). At time, t, the position vector of a particle of mass 2kg is $(\text{Cost}\,\underline{i} + t^2\underline{j})$ m.Show that the force acting on the particle when $t=\pi$ seconds is of magnitude $2\sqrt{5}$N. (07 marks)

(b) A particle is moving such that at any instant, its velocity vector $\underline{v}$, is given by $\underline{v}= (3t\underline{i} +4\underline{j} + t^2\underline{k})$ ms^{-1}.When t=0, it is at the point (1, 0, 1). Show that the magnitude of its acceleration at t=2 seconds is $5ms^{-2}$. (05 marks)

14(a).Show that the Newton Raphson formula for approximating the root of the equation

e^x-2x-1=0 is given by $X_{n+1} = \dfrac{e^{xn}(xn-1) +1}{e^{xn}-2}$ (03 marks)

(b)(i) .Show that root of the equation e^x-2x-1=0 lies between 1 and 1.5. (04 marks)

(ii).Use linear interpolation to find the first approximation and hence find the root of the equation, correct to 3 s.f. (05 marks)

15. The weights of goats sold at a certain market are normally distributed with a mean of 26kg.Given that 8 of every 12 goats picked at random weighed more than 20kg.

(a) .Calculate the standard deviation of the masses of the goats, correct to the nearest whole number. (06 marks)

(b) .A random sample of 25 goats is picked, calculate the probability that their mean weight exceeds 15kg. (06 marks)

16(a).A practicle is projected from a point on a horizontal plane and has an initial speed of $42ms^{-1}$. If the particle passes through a point above the plane, 70m vertically and 60m horizontally from the point of projection.

(a).Find the possible angles of projection. (06 marks)

(b).A particle is projected at an angle of 30^0 to the horizontal with a speed of $21ms^{-1}$. If the point of projection is 5m above the horizontal ground, find the horizontal distance that the particle travels before hitting the ground. (06 marks)

END