

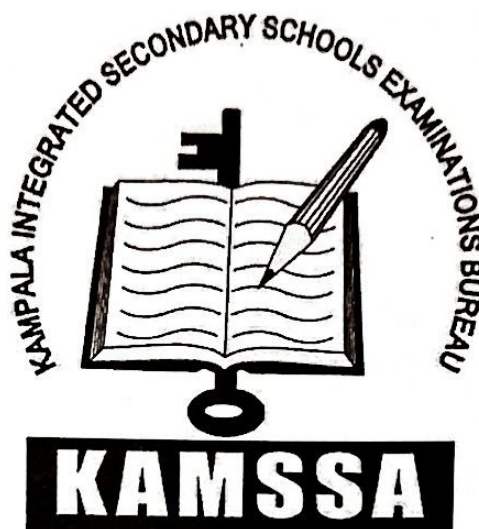
P425/2

Applied mathematics

Paper 2

3 hours

July/Aug 2025



KAMSSA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 hours.

Instructions to candidates:

- Answer all the questions in section A and any five from section B.
- *All the working must be shown clearly.*
- *Begin each question on a fresh page.*
- *Silent non-programable calculators and mathematical tables with a list of formulae may be used*
- *In numerical work, take g to be 9.8ms^{-2}*

SECTION A

1. Events X and Y are such that $P(X) = \frac{1}{3}$, $P(Y/X) = 0.25$

$$P(Y^c/X^c) = 0.8$$

Find;

(i) $P(Y)$

(ii) $P(X \cup Y)$

(5 marks)

2. The resultant of forces $M = (i - 2j + 2xk)N$

$$N = (2i + j + 4k)N$$

$$P = (yi + 2j)N \text{ is } (8i + zj + 14k)N$$

Find;

(i) The values of x, y and z

(ii) The magnitude of M

(5 marks)

3. A car of mass 1.2 tones travelling along a straight horizontal and accelerates uniformly from 10ms^{-1} to 15ms^{-1} in a distance of 200m. If the thrust of the engine is 500. Find the resistance to motion.

(5 marks)

4. The price in shillings of commodities P, Q and R in 2023 and 2024 are given in the table below.

Commodity	2023	2024
P	500	750
Q	1,500	2,100
R	10,000	12,000

Using 2023 as the base year, find the;

a) Price relative for each commodity

b) Average price index.

(5 marks)

5. A straight, uniform beam measuring 12 metres in length and weighing 50kg has two masses, 30kg and 40kg hanging from its ends. At what position along the beam should a support be placed so that the beam stays leveled and balanced in a horizontal position.

(5 marks)

6. A swimming pool is 60metres wide. Water in the pool is being pumped gently from one side at a speed of 2.5m/s . A swimmer wants to cross directly to the opposite side in a straight line. The swimmer's speed relative to the water is 5m/s .

a) At what velocity should the swimmer start swimming in order to reach directly across?

b) How much time will it take the swimmer to cross the pool?

(5 marks)

7. The amount of time, measured in hours that Ms. Nakimera a resident of Mityana spends listening to the radio on any given day is a continuous random variable T , with cumulative distribution function (CDF) given by

$$F(t) = \begin{cases} 0 & t \leq 0 \\ 1 - K(12 - t), & 0 < t \leq 12 \\ 1 & t > 12 \end{cases}$$

Where K is a constant.

a) Find the value of the constant K.

(5 marks)

8. The table below shows delivery charges by a carrier company.

Mass(gm)	200	400	600
Charges (shs)	700	1,200	3,000

Using linear interpolation or extrapolation; find the

- Delivery charge on a parcel weighing 352gm,
- Mass of a parcel whose charge is Shs 3,300

(5 marks)

SECTION B

9. The table below shows the weight of the portions from a certain circle.

Weight	$-\leq 10$	$-\leq 20$	$-\leq 30$	$-\leq 40$	$-\leq 45$	$-\leq 55$	$-\leq 60$	$-\leq 70$
Frequency	2	6	15	32	27	15	8	3

a) Calculate;

- The mean
- The standard deviation

b) Draw a histogram and use it to obtain the mode.

(12 marks)

10. An object A moves with a velocity given by the vector $V_A = (4i + 6j - 5k) \text{ m/s}$, while another object B moves with a velocity $V_B = (-10i - 2j + 6k) \text{ m/s}$.

- Calculate the velocity of object A relative to object B. (05 marks)
- A cyclist travels due to south at a speed of 20km/hr. Under this condition, a steady wind appears to blow from south 60° west. When the cyclist reduces his speed to 15km/hr, still heading due south, the wind now appears to come from the south 30° west. Find the velocity of the wind. (07 marks)

11. Use the trapezium rule with 7 coordinates to find the value of $\int_0^\pi (1 + \sin x)^{1/2} dx$ correct to two decimal places.

- What is the percentage error in the trapezium rule.
- Suggest any possible way of improving on your answer.

(12 marks)

12a)(i). Show that the equation $f(x) = x^3 + 3x - 9$ has a root between $x = 1$ and $x = 2$.

(ii) Use the Newton Raphason formula once estimate the root of the equation round two significant figures. (04 marks)

c) Show that the iterative formula based on Newton Rahason's method for approximating the root of the equation $2\ln X - X + 1 = 0$ is given by $X_{n+1} = X_n \left(\frac{2\ln X_n - 1}{X_n - 2} \right), n = 0, 1, 2$ (03 marks)

c) Draw a flow chart that;

(i) Read the initial approximation X_0 of the root

(ii) Compute and print the root correct to two decimal places using the formula in (a) taking $X_0 = 3.4$, perform a dry run to find the root of the equation. (5 marks)

13. A light, uniform wire is bent to form two sides, AB and AC of a triangle ABC such that $AB = AC = 5\text{cm}$. The third side, BC which is a 6cm long, is made from a different uniform wire that has twice the density of the wire used for AB and AC.

a) Determine the position of the centre of the gravity of the triangular frame ABC. (5 marks)

b) A quadrilateral ABCD is a trapezium with AB and CD as the parallel sides, having lengths a and b respectively. If the height (vertical distance) between these parallel sides is h , show that the distance of the centre of mass of the trapezium from the side AB is $\frac{1h(a+2b)}{3(a+b)}$. (7 marks)

14. A man travels to work on a motorcycle or by taxi. The probability of using the motorcycle is $\frac{1}{4}$ and the probability that he arrives late for work when he uses a motorcycle is $\frac{2}{3}$ otherwise it is $\frac{1}{3}$.

a) (i) What is the probability that he is late for work on Monday?

(ii) If he is late for work what is the probability that he travelled by taxi?

(iii) What is the probability that he is early for work on Tuesday and Wednesday. (6 marks)

b) The mean and standard deviation of a random sample size 144 is 900 and 60 respectively. Given that population is normally distribution, find a 95% confidence interval of the population mean. (6 marks)

15a). Given that $x = 3.81$ and $y = 2.53$, and both are rounded off, find;

i) Maximum possible error in x and y respectively.

ii) Maximum absolute error in xy and

iii) Percentage error in xy

(6 marks)

b) A number x is approximated by A with an error a and a number y is approximated by B with error b . Show that the absolute relative error in calculations $\frac{x}{y}$ is given by $\left|\frac{a}{A}\right| + \left|\frac{b}{B}\right|$

Hence calculate $\frac{4.61}{1.813}$ with error bounds or range.

(6 marks)

16. An engine and a train weigh 203mg and the engine can exert a pull equal to the weight of 3.77mg. The resistance to the motion of the train is $\frac{1}{100}$ of its weight and the brake power equals to one fifth of its weight.

The train starts from rest and moves uniformly, until it acquires a velocity of 40km/hr^{-1} . Steam is then shut off and the brakes are put hard on.

Find the total distance the train will have run before it comes to rest and the whole time taken. (12 marks)

END