P425/2
Applied mathematics
Paper 2
3 hours
July/Aug 2022

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 (40 MARKS)

Answer all the questions in this section

1. The probability that a person vaccinated against COVID-19 falls sick is 0.4. If a group of 25 persons are checked at random, find the probability that not more than 20 patients are found to have been vaccinated. **(05 marks)**

2. A body of mass 500kg accelerates uniformly from rest at $(2i - 3j)$ ms^{-2}. Find the power developed after 4 seconds. **(05 marks)**

3. The table shows the values of x and y.

X	0	10	20	30
Y	6.6	2.9	-0.1	-2.9

Use linear interpolation or extrapolation to find

(a) Y when x =15 **(03 marks)**

(b) X when y=-3.2 **(02 marks)**

4. The sides AB and BC of triangle ABC are of length 120cm and 50 cm respectively. The triangle is right- angled at B and BD is an altitude of triangle ABC. Two forces act at B with 20N along DB and Q force acts along BC. If the forces are in equilibrium, find the value of Q. **(05 marks)**

5. The table below shows the speeds in ms^{-1} for the vehicles crossing a certain bridge.

Speed	$20-<30$	$30-<40$	$40-<60$	$60-<80$	$80-<100$
frequency	2	7	20	16	5

Calculate the

(i) 40th percentile speed **(03 marks)**

(ii) Number of vehicles whose speed exceeds the 40th percentile speed. **(02 marks)**

6. A projected particle achieves the greatest range of 0.12km. Find the

(a) Speed of projection **(03 marks)**

(b) Greatest height attained **(02 marks)**

7. Find the maximum possible error made in the expression

$6.23 - 3.1 - \frac{2.5 \times 4.1}{5}$ correct to three significant figures. **(05 marks)**

8. Two events M and N are such that $P(M' \, n \, N) = 2y$, $P(M \, n \, N') = y$ and $P(M) = \frac{6}{7}$. Use a Venn diagram to find

(a) Value of Y **(03 marks)**

(b) $P(M \, n \, N)$ **(02 marks)**

SECTION B (60 MARKS)

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

9. A tourist vehicle is on a bearing of 050^0 from a lion. The vehicle is travelling at a constant speed of $10ms^{-1}$ due south. The lion runs after the vehicle at a constant speed of $6ms^{-1}$.

(a) In which direction should the lion run to get as close to the vehicle as possible? **(05 marks)**

(b) What will be the least distance between the lion and the vehicle? **(02 marks)**

(c) How long will the lion take to achieve the least distance? **(05 marks)**

10. (a) Use trapezium rule with five strips to estimate $\int_0^4 3^{2x}\,dx$, correct to two decimal places. **(05 marks)**

(b) Find the exact value of $\int_0^4 3^{2x}\,dx$ correct to two decimal places. **(03 marks)**

(c) Calculate the relative error made in (a) above and state how you can reduce on such a relative error. **(04 marks)**

11. A pile driver machine of mass 8 tonnes falls from a height of 500cm onto a pile of mass 2 tonnes. Given that average resistance of the ground is 10^6N and that $g=10ms^{-2}$, find the

(a) Speed at which the pile driver strikes the pile **(03 marks)**

(b) Common speed of the pile and the driver **(04 marks)**

(c) Distance penetrate into the ground. **(05 marks)**

12. Packets of poultry drug one normally distributed. If 63% of the packets are found to be above 200g while 54% of the packets are below 250g. Find the

(a) Mean and standard deviation **(08 marks)**

(b) Percentage of packets exceeding 195g. **(04 marks)**

13. A body of mass m kg is placed on a rough inclined plane inclined at an angle of 30^0 to the horizontal. Given that the angle of friction, $\boldsymbol{\lambda}$ exceeds 30^0,

(a) Show that the minimum force P, needed to move the body up the plane is

$0.5\,mg(cos\,\boldsymbol{\lambda} + \sqrt{\boldsymbol{3}}\,\boldsymbol{sin}\,\boldsymbol{\lambda})$,

where g is acceleration due to gravity. **(07 marks)**

(b) Show also that the minimum force P_1, required to cause the body to slide down the plane is $0.5mg(\sqrt{3}\,sin\,\boldsymbol{\lambda} - cos\boldsymbol{\lambda})$ **(05 marks)**

14. The table below shows the scores in two subjects Biology (x) and chemistry (y) for ten students.

x	82	78	86	72	91	80	95	72	89	74
y	75	80	93	65	87	71	98	68	84	77

(a) Plot a scatter diagram. Draw the line of best fit and find its equation in the form $y = \alpha x + \beta$ where α and β are constants. **(06 marks)**

(b) Calculate the coefficient of rank correlation between x and y. comment on the significance of Biology on Chemistry (Spearman's rank correlation coefficient $|\rho| = 0.79$ based on ten observations at 1% level of significance.)

(06 marks)

15. (a) show that there is a real root of the equation $x^3 + 2x - 1 = 0$ between $x = 0$ and $x = 1$ **(04 marks)**

(b) Use linear interpolation once to find the first estimate of the root of the equation, correct to two decimal places. **(02 marks)**

(c) using Newton Raphson iterative formula and your approximate root in (b) above as the initial value, calculate the root of the given equation correct to two decimal places. **(06 marks)**

16. The random variable X has a probability distribution density function given by

$$f(x) = \begin{cases} Kx(1-x^2), & 0 < x < 1 \\ 0, & elsewhere \end{cases}$$ Where K is a constant.

(a) Find the cumulative distribution function, $F(x)$ **(03 marks)**

(b) Using your answer in (a) above, find the

(i) Value of K **(02 marks)**

(ii) Median of x **(05 marks)**

(c) Calculate the mean of x **(02 marks)**

END