P425/2

APPLIED MATHEMATICS

Paper 2

JULY- AUGUST 2024

3 hours

UGANDA ADVANCED CERTIFICATE OF EDUCATION

QUEEN OF PEACE HIGH SCHOOL

END OF TERM TWO EXAMINATIONS

APPLIED MATHEMATICS

3 hours

Instructions to candidates:

Answer all the eight questions in section A and only five questions in section B

Any additional questions answered will not be marked.

All working must be clearly shown

Where necessary take acceleration due to gravity, g=10ms-²

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

SECTION A (40marks)

(Attempt all questions in this section)

1. Forces of magnitude 10N, 15N, and 12N act in the direction 040^0, $W30^0N$ and North East respectively, find the magnitude and direction of the resultant force. **05marks**
2. The following grades were obtained by 8 students in Mathematics and general paper

Mathematics	A	O	B	F	E	C	D	B
General paper	C3	D2	D1	P8	P8	D2	C3	D2

Given that A is the highest score;

a) Calculate the rank correlation coefficient for the grades. **04marks**

b) Comment on your result at 1% level of significance. **01mark**

3. Events A and B are independent such that P(A)= $\frac{3}{8}$ and $P(A'UB^{\square}) = \frac{3}{4}$

   Find the;

   (I) P(B). **03marks**

   (II) P(AUB) **02marks**

4. A particle P moves through a displacement of 2m when acted upon by two forces $\mathbf{F_1}$ and $\mathbf{F_2}$. Find the work done by the resultant force, if $\mathbf{F_1}$ = i – j and $\mathbf{F_2}$ = 10N and act in the direction 4i + 3j. **05marks**

5. Of the 30 drivers interviewed, 9 have been involved in a car accident at some time, of those who have been involved in an accident, 5 wear glasses, the probability of wearing glasses given that the driver has not had a car accident is $\frac{1}{3}$. Find the probanilty that;

   (I) a person chosen at random wears glasses. **03marks**

   (II) glasses' wearer has been a crash victim. **02marks**

6. A random variable x has a pdf given by

x	1	2	3	4	5
P(X=x)	0.2	0.25	0.4	0.1	a

Find;

(I) Valve of a. **02marks**

(II) Var (3x-2). **03marks**

7. The table below shows the expenditure of a certain family for 2018and 2019

	Expenditure		Weight
Items	2018	2019	
Food	300,000	325,000	5
Accommodation	260,000	362,000	3
Electricity	150,000	160,000	1
Miscellaneous	620,000	725000	2

Taking 2018 as the base year, determine the:

(a) Price index for each item (**03marks**)

(b) Hence the average weighted price index (**02marks**)

8. Four forces 2i + j, -i+3j, 4i-2j and (-5i-2j)N acts on a particle at (1,1), (2,0),(2,3) and (-1,1) respectively; show that the forces reduce to a couple. **05marks**

SECTION B. (60Marks)

Attempt only five questions.

9. The following are the final examination scores which 12 students in Mathematics (x) and Physics (y).

X	35	56	65	78	49	82	22	90	77	53	52	93
Y	57	72	63	76	53	100	38	82	82	19	43	79

(b) Plot a scatter diagram for the above data and comment between your results. Estimate x when y = 90 **07marks**

(c) Compute spearman's rank correlation coefficient. **05marks**

10. Given that P(A) = $\frac{3}{5}$ P(A/B) = $\frac{5}{7}$ and P(B/A) = $\frac{2}{3}$.

(a) Find;

(I) P(AnB) **03marks**

(II) P(B). **03marks**

(III) P(A/B'). **03marks**

(b) State with reasons whether A and B are;

(I) Independent events **02marks**

(II) Mutually exclusive events **1mark**

11. A bag contains two red and eight black marbles, a sample of four marbles is to be drawn at random from the bag without replacement:

(a) Show that the probability of obtaining exactly one and two red marbles in the sample is 8/15 and 2/15 respectively. **7marks**

(b) Calculate the expected number of red marbles that will be drawn. **5marks**

12. (a) Four forces (ai – j), (3i + 3aj), (5i-6j) and (-i-2j) N act on a particle. The resultant of the forces make an angle of 45^0 with the horizontal. Show that a=8 and the magnitude of the resultant is $5\sqrt{3}$N. **6marks**

(c) Two forces F_1 and F_2 have magnitude ***T***N and ***B***N and act in the direction i - 2j and 4i + 3j respectively. Given that the resultant of F_1 and F_2 is (48i + 14j). Show that ***T*= 8$\sqrt{5}$N** and ***B***=50N. **6marks**

13. The table below shows the marks obtained by students in a physics test

Marks(%)	Frequency density
10-19	0.7
20-29	2.6
30-34	4.2
35-44	3.8
45-54	4.6
-64	2.8
65-69	2.6

(a) Draw a histogram and use it to estimate the modal mark **4marks**

(b) Calculate the:

(I) median mark **3marks**

(II) standard deviation **5marks**

14. Two points A and B are 256m apart along a straight road. A car moving along a road passes a point A with a constant speed of $25ms^{-1}$. The car maintains this speed for 10seconds and decelerates uniformly for 8 seconds until it attains a speed Vms^{-1}. The car maintains this speed until it passes point B. The time taken by the car to move from point A to B in 30 seconds.

(a) Sketch a velocity time graph for the motion of the car **06marks**

(b) Determine;

(I) Valve of V **04marks**

(II) Deceleration of the car **02marks**

15. Three forces F_1=(2,-3), F_2=(5,2) and F_3=(-2,-11)N act at points (2,3),(-2,3) and (3,-3) respectively, Find the:

(a) Magnitude of the resultant force **04marks**

(b) Equation of line action of the resultant force **02marks**

(c) Distance from origin where the resultant force cuts x-axis. **04marks**

(d) Force that should be added to form a couple. **02marks**

16. The table below shows the number of red and green balls put in three identical boxes A, B and C.

Boxes	A	B	C
Red balls	4	6	3
Green balls	2	7	5

A box is chosen at random and then two balls are drawn from it successively without replacement, if the random variable X is the number of green balls drawn.

(a) Draw a probability distribution function table for X **07marks**

(b) Calculate the mean and variance of X. **05marks**

Excuses yield no success