P425/2
APPLIED MATHEMATICS
PAPER 2
3 hours

Uganda Advanced Certificate of Education
S.6 RESOURCEFUL MOCK 2024
APPLIED MATHEMATICS
P425/2
Time: 3 hours
Paper 2

INSTRUCTIONS TO CANDIDATES:

Answer all the eight questions in section A and any five from section B.

In numerical work take g = 9.8ms^{-2} unless otherwise stated.

Indicate **tab** when mathematical tables are used and **cal** for calculators

SECTION A (40 marks)

1. The table below shows the values of a certain polynomial f(x) tabulated at some values of x.

X	1	2	3
f(x)	− 2	7	20

   Use linear interpolation and or exploration to find,
   (i)   f(x) when x = 1.5
   (ii)   x when f(x) = 3.7

2. The table below shows the distribution of tax levied on 500 employs in a certain motor industry per year.

Interest (&)	25 –	30 –	40 –	60–	80–	110–	120 –<130
Number of employs	17	55	142	153	93	20	20

     (i)   Draw a histogram to illustrate this data,   (02 marks)
     (ii)   Estimate the mode from your histogram.   (03 marks)

3. Use the trapezium rule with 7 ordinates to estimate $\int_0^\pi x\sqrt{\sin x}\, dx$ correct to 3 decimal places.   (05 marks)

4. Find the magnitude and direction of the resultant force of the system of forces acting on the square of side a metres below:
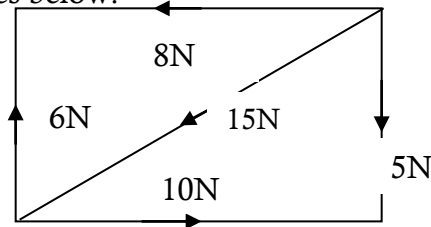
5. Find the centre of gravity of a uniform lamina whose shape is the area bounded by $y = x^2,$ the $x - axis$ and $x = 4$.

6. A particle of mass 9kg hangs from a point on a light inextensible string. It is pulled by a horizontal force of $3\sqrt{3}$gN so that it is in equilibrium with the string inclined at an angle θ with the downward vertical. Find θ and the tension in the string.   (5 marks)

7. The table below shows the cost of ingredients used for making Chapats for two different birthday parties for 2015 and 2017.

Ingredients	Cost	
	2015	2017
Salt	200	350
Baking flour	3800	4600
Cooking oil	1500	1800

    By taking 2015 as a base year, calculate the price relative for each ingredient and hence, obtain the average index number.   ***(05 marks)***

8. A box of mass 0.5kg is at rest on an inclined plane at an angle of 25^0 to the horizontal, the coefficient of friction between the box and the plane is 0.4. What minimum force applied parallel to the plane would move the box up the plane.

SECTION B (60 marks)

9. The heights of 250 S.P.C recruits were recorded in a survey during the training as shown below.

Heights (cm)	170 –	175–	180–	185–	190–	195– <200
No of recruits	19	36	70	64	39	22

(a)   (i) Plot a cumulative frequency curve to represent the data.
      (ii) Use your curve in (i) above to estimate the median and standard deviation for the data.

(b)   Calculate the mean and variance for the data.   (12 marks)

10.   Annet stays in Kenya and Bob stays in Uganda. The probability that Annet will go to china in December this year is $\frac{3}{5}$ and that of Bob is $\frac{3}{8}$.

(a) Find the probability that they are likely to be in different countries next year

(b) The probability that patience passes Biology, Chemistry and Mathematics is 0.7, 0.8 and 0.65 respectively.

     (i)   Find the probability that she passes at most one subject
     (ii)   If we know that she passed at most one subject. What is the probability that she passed Mathematics.

11. (i) Show that the root of the equation $e^{\frac{1}{x}} = x$ lies between 1.7 and 1.8.

(ii) Use linear interpolation to find the first approximation to the root of the equation
(iii) Prove that the Newton –Raphson formula for approximating the root of the equation above is $X_{n+1} = \frac{1+X_n}{1+lnX_n}$, n=0,1,2,...

Hence construct a flow chart for finding the root correct to 3 decimal places

(iv) Perform a dry run for your flow chart using the first approximation obtained in step (ii) above.   (12 marks)

12. (a) A car moves a distance dm in Ts. It starts from rest, and travels in a straight line accelerating at a constant rate, f_1, until the brakes are applied and the engine stopped. It is then subjected to a constant retardation f_2 until it comes to rest.

Show that $T^2 = \frac{2d(f_1+f_2)}{f_1f_2}$ and the maximum speed attained is $V = \sqrt{\left(\frac{2df_1f_2}{f_1+f_2}\right)}$ (6 marks)

(b) Two bodies A and B of mass 6kg and x kg (x < 6kg) respectively are connected by a light inextensible string which passes over a smooth fixed pulley. The system is released from rest so as to be set into motion. After descending 8m from rest, A strikes the floor which is inelastic and B continues to rise a further 4m. Find x.   (6 marks)

13.   A random variable X has its p.d.f given by

$$P(x = x) = \begin{cases} \dfrac{k}{x} & ; x = 1, 2, 3. \\ 0, & otherwise \end{cases}$$

Find   (i)   value of Constant k
         (ii)   E $(x + 1)^2$
         (iii)   Median
         (iv)   3rd decile

14. (a) Given that X and Y are values measured with possible errors, E_1 and E_2 respectively to give x and y. Show that the maximum possible relative error in the expression $y\sqrt{x}$ is $\left[\dfrac{1}{2}\left|\dfrac{E1}{x}\right| + \left|\dfrac{E2}{y}\right|\right]$

Given that x = 0.35 and y = 7.6. Find the percentage error in evaluating $7.6\sqrt{0.35}$

(b) Find the maximum and minimum values in the expression $\dfrac{6.3(8.24-1.2455)}{2.567}$ (12 marks)

15. (a) Initially a particle is projected with a velocity $\begin{pmatrix} 2 \\ 0 \end{pmatrix}$ms^{-1} from a point with position vector $\begin{pmatrix} 10 \\ 90 \end{pmatrix}$m. Find the distance of the particle from the origin after 4 seconds.
(5 marks)

(b) A footballer kicks a ball with a velocity of 5.2ms^{-1} at an angle of $\tan^{-1}\left(\dfrac{5}{12}\right)$ with the horizontal. Determine the;
(i)   time for which the ball is at least 15m above the level of projection, (4 marks)
(ii)   Maximum height and time taken to reach this instant.   (3 marks)

16. The table below shows height in centimetres of 25 students in

a certain school.

Height (cm)	< 10	< 20	< 25	< 30	< 50	<55	< 65
Number of students	0	3	7	15	17	23	25

Calculate
     (i)   Mean height
     (ii)   Variance
     (iii)   Mode
     iv) Middle 70% of the height   **END**