P425/2
APPLIED MATHEMATICS
PAPER 2
July/August 2017
3hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

APPLIED MATHEMATICS

Paper 2

3 hours

INSTRUCTIONS TO CANDIDATES:

- *Attempt* all *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 answer on a fresh sheet of paper.*
- *Silent non programmable scientific calculators and mathematical tables with a list of formulae may be used.*
- *In numerical work, take g to be* $9.8ms^{-2}$.
- *State the degree of accuracy at the end of the answer to each question attempted using a calculator or table and indicate Cal for calculator, or Tab for mathematical tables.*

SECTION A (40 MARKS)

Answer all questions in this section.

SECTION A

1. Events A and B are such that $P(A) = \frac{2}{5}$ and $P(\overline{B}/A) = \frac{1}{2}$. Find $P(A \cup B)$.

(5marks)

2. The table below shows the values of x and $f(x)$.

x	75.01	75.22	75.40	75.60
$f(x)$	1.8751	1.8762	1.8774	1.8785

Use linear interpolation or linear extrapolation to find

(i) $f(75.70)$, (3 marks)

(ii) x when $f(x) = 1.8768$. (2 marks)

3. A particle moving in a straight line with constant acceleration has an initial velocity of $18kmh^{-1}$. After 4 seconds, its velocity was $15ms^{-1}$.
Calculate the distance covered by the particle in the fourth second. (5 marks)

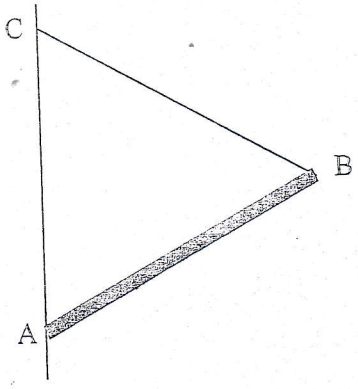
4. The table below shows the marks awarded to eight competitors by two judges during a competition.

	A	B	C	D	E	F	G	H
Judge I	63	65	55	63	63	55	60	58
Judge II	77	70	60	75	68	58	54	68

(a) Calculate the rank correlation coefficient between the two judges. (4 marks)

(b) Comment on the relationship between the two judges at 5% level of significance. (1 mark)

5. The figure below shows a uniform rod AB of weight 5N and length 4m freely hinged at A to a vertical wall.



The rod is maintained in equilibrium by a string attached at B to a point C on the wall vertically above A. If AC = BC = 6m, calculate the

(i) tension in the string, (3 marks)

(ii) magnitude of normal reaction at A. (2 marks)

6. Use trapezium rule with 6-ordinates to estimate the value of $\int_0^{\pi/4} (t + \sin t)\,dt$ correct

(5 marks)

7. For every 20 glasses produced by a machine, 11 are non-defective. If a random sample of 15 glasses are selected, find the probability that;
   (i) exactly 8 glasses are defective, (2 marks)
   (ii) at most 7 glasses are defective. (3 marks)

8. A particle of weight 78.4N is released from rest at the top of a plane inclined at 30° to the horizontal. If the coefficient of friction between the particle and the plane is 0.2. Find the acceleration of the particle. (5 marks)

SECTION B

Answer any five questions from this section.

9. A train moving between two cities departs every day at 8:28am. The table below shows the distribution of time taken for the train to travel between the cities.

Time (min)	Frequency
80 – < 85	6
85 – < 90	12
90 – < 95	22
95 – < 100	31
100 – < 105	15
105 – < 110	7
110 – < 115	4
115 – < 120	2
120 – < 125	1

   (a) Calculate the average arrival time for the train, (6 marks)
   (b) Draw a cumulative frequency curve and use it to estimate the median arrival time. (6 marks)

10. (a) Derive the simplest iterative formula based on Newton-Raphson method that can be used to find a better approximation to the root of the equation $e^{3x} - 3 = 0$. (3 marks)

   (b) Draw a flow chart that;
      (i) reads the initial approximation x_0,
      (ii) computes and prints the root of the equation correct to 3 decimal places. (5 marks)

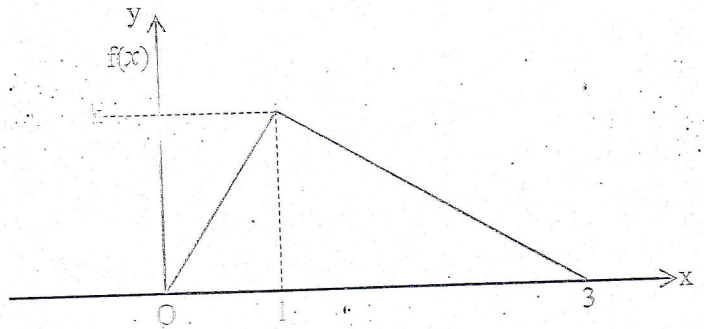
   (c) Taking 0.3 as an initial approximation, perform a dry run of the flow chart. (4 marks)

11. A cyclist and his machine together weighing 800N have maximum speed of $5ms^{-1}$ when working at a constant rate of 75W along a level road. If the resistance to motion is proportional to the speed, find the;
   (i) expression of the resistance in terms of speed, (4 marks)
   (ii) maximum speed of the cyclist when moving down a hill of 1 in 40 with power output of 25W. (8 marks)

12. In a jumping competition, the probability that a player can jump above a point at least 1.68m high is 0.2 and the probability that a player can jump above a point at least 1.52m high is 0.9. If the height jumped is normally distributed,
(i) find the mean and standard deviation of the heights jumped, (8 marks)
(ii) If x is the height jumped find $P(1.6 < x < 1.72)$. (4 marks)

13. At 11:45am, a ship A was located at a point with position vector $(-2\mathbf{i} + 3\mathbf{j})$km while moving with velocity $(12\mathbf{i} - 4\mathbf{j})$kmh^{-1} and at 12:00pm, another ship moving with velocity $(2\mathbf{i} - 14\mathbf{j})$kmh^{-1}was located at a point with position vector $(8\mathbf{i} + 7\mathbf{j})$km.
If the ships maintained their velocities, Find the:-
(a) least distance between the ships in the subsequent motion, (8 marks)
(b) length of time that elapsed when the ships are within 2km from each other. (4 marks)

14. The probability distribution function $f(x)$ of a continuous random variable X is represented graphically as shown.



Find the;
(a) value of the constant k, (3 marks)
(b) equations of $f(x)$, (6 marks)
(c) mean of X (3 marks)

15. (a) The quantities X and Y have been estimated using x and y with errors Δx and ΔY respectively. Show that the relative error in using $x\sqrt{y}$ to approximate $x\sqrt{Y}$ is given by

$$\left|\frac{\Delta x}{x}\right| + \frac{1}{2}\left|\frac{\Delta Y}{y}\right|.$$ (7 marks)

(b) Given that $x = 2.5$ and $y = 4.6$ have been rounded off with corresponding percentage error of 4 and 5, calculate the percentage error in $x\sqrt{y}$ correct to 2 significant figures. (5 marks)

16. (a) Particles of masses 3kg, 2kg, 5kg and 1kg are placed at points with coordinates (2, -1), (3, 5), (-2, -1) and (1, -3) respectively. Find the position vector of center of mass of the system of particle. (6 marks)

(b) A uniform square lamina ABCD of side 2m has a triangular lamina CDE cut off. If DE = 0.5m find the distance of center of gravity of the remaining laminar (6 marks)