

MOCK SET I EXAMINATIONS 2019

Uganda Advanced Certificate of Education

PURE MATHEMATICS

P425/2

2 Hours 30 Minutes

Instructions to Candidate:

- ✓ Attempt all questions in section A and any five questions from section B.
- ✓ Any additional questions(s) answered will not be marked.
- ✓ All working must be shown clearly.
- ✓ Begin each question/answer on a fresh sheet of paper.
- ✓ Silent non programmable scientific calculator 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.

1. A car of mass 200kg is traveling horizontally at 72Kmh^{-1} . If the car experiences a resistance of 700N and its engine develops a power of 30kw at this speed, calculate the maximum acceleration of the car. (5marks)
2. Two decimal numbers $x = 4$ and $y = 8.5$ were all rounded off. Find the absolute error in $xy - \frac{y}{x}$, hence deduce the percentage error. (5marks)
3. The table below shows the values of $\cos x$.

X	80.0	80.5	81.0	81.5
Cosx	0.1736	0.1650	0.1564	0.1478

Find using linear approximations, the value of

- a) $\cos 78.5$ (5marks)
- b) $\cos^{-1}(0.1589)$ (3marks)

4. A light inextensible string of length 40cm has its upper end fixed at a point A, and carries a mass of 2kg at its lower end. A horizontal force applied to the mass keeps it in equilibrium, 20cm from the vertical through A. find the magnitude of this horizontal force and the tension in the string. (5marks)
5. A discrete random variable, X has a probability density function (P.d.f) given by;
$$F(x) f(x) = \begin{cases} Kx^2; & |x| < 3 \\ 0; & \text{otherwise} \end{cases}$$

Find the value of K and show that the mean is symmetrical about the line $x = 0$. (5marks)

6. Nine voters in Kampala and Jinja were asked to give to the government a score out of 100, on each of the nine issues. The results are shown below.

Issues	A	B	C	D	E	F	G	H	I
Kampala	62	54	46	34	54	46	36	29	14
Jinja	76	59	46	37	35	27	46	17	17

- Calculate the rank correction coefficient between the voters in the two districts.
 - Comment on your results. (5marks)
7. In a survey, 200 people were asked the length of time that they spent in the shower, the last time that they took one. The results were as follows.
 $\sum x = 909, \sum x^2 = 4555$
- Find an unbiased estimate of the population variance
 - Determine the 97.5% confidence interval for the mean time spent in the shower. (5marks)
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 (3marks)
 - Velocity after covering 10m. (2marks)

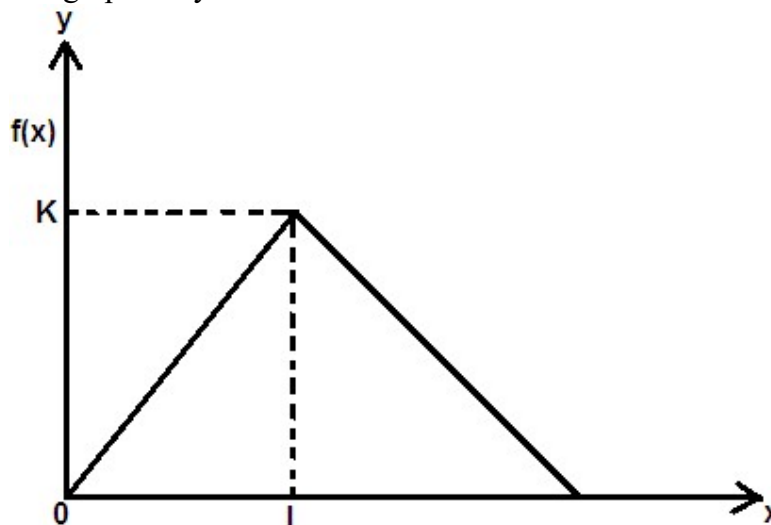
SECTION B (60 MARKS)

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

9. a) Use the trapezoidal rule with five ordinates to evaluate
 $\int_0^{\frac{\pi}{4}} \frac{2}{\sqrt{1-x^2}} dx$ to 3 decimal places.
- b) Find the exact value of $\int_0^{\frac{\pi}{4}} \frac{2}{\sqrt{1-x^2}} dx$ to 3 decimal points.
- c) Find the absolute error in the function and state how this error can be reduced. (12marks)
10. Two equal forces each of magnitude PN have an angle between them 2α , if their resultant is twice that when the same forces have an angle between them as 2β ,
- prove that $8\cos^2\beta - \cos 2\alpha - 1 = 0$
 - if $\alpha \pm \frac{\pi}{4}$, find β . (12marks)
11. The table below shows the distribution of a random sample of marks of a group of candidates during an examination.

Marks	Cumulative frequency
0 - < 10	10
10 - < 20	35
20 - < 40	65
40 - < 60	107
60 - < 70	123
70 - < 95	138

- a) Calculate the;
- Modal mark (3marks)
 - Standard deviation (3marks)
- b) If the sample was taken from a population which is approximately normally distributed, determine the 99.5% Confidence limits for the population mean mark, correct to two decimal places. (6marks)
12. a) Show that the root of the function $\ln x = 2 + \sin x$ lies between 3 and 4. (3marks)
- b) Derive the formula based on Newton Raphson method (N.R.m) to solve the root of the function in (a) above. (3marks)
- c) Construct a flow chart that;
- reads the initial approximately, x_0
 - Computes the root
 - Prints The root to 3 dps, for the equation above, hence perform a dry run for the flow chart constructed. (6marks)
13. A uniform ladder AB is of weight $2WN$ and length 10metres. It rests with end A on a rough horizontal floor and end B against a rough vertical wall. The coefficient of friction at the wall and at the floor is $\frac{1}{3}$ and the ladder makes an angle θ with the horizontal, such that $\tan\theta = \frac{16}{7}$ A man of weight $5WN$ starts to climb the ladder.
- How far up the ladder can the man climb before slipping occurs?
 - When a boy of XN stands on the bottom rung of the ladder, ie at A, the man is just able to climb to the top safely. Find x in terms of W . (12marks)
14. The probability distribution function $f(x)$ of a continuous random variable x is represented graphically as shown.



Find the

- Value of the constant K . (3marks)
- Equations of $f(x)$ (6marks)
- Mean of x (3marks)

15. a) A body of mass 3kg initially at rest is acted upon by three forces
 $F_1 = (i - j + 2k)N$, $F_2 = (2i + 3j + 2k)N$ and $F_3 = (4i + j - k)N$. Find the work done by the forces in a time of three seconds. (5marks)
- b) A tractor of mass 500kg tows a caravan of mass 300kg up a hill inclined at 30° to the horizontal. The resistances to motion of the car and the van are 200N and 180N respectively. If the power output of the car is 196Kw, find the acceleration of the vehicles and the tension in the tow rope at the instant when the speed of the car is 40ms^{-1} . (7marks)
16. The table below shows the number of apples put in boxes A, B and C

Apples	BOXES		
	A	B	C
Green	4	7	3
Red	7	5	11

A box is randomly selected and two apples are randomly selected from it without replacement. Box A is twice as likely to be picked as B. while A and C have the same chance of being picked.

- a) Determine the probability that both apples are
- Of the same colour
 - From box B given that they are of the same colour.
- b) If x is the number of green apples taken, draw a probability distribution table for x , hence calculate the mean and standard deviation of x . (12marks)

END