

P425/2

MATHEMATICS

Paper 2

June 2017

2½ hours

RESOURCE MOCK EXAMINATIONS, 2017

Uganda Advanced Certificate of Education

S.6

MATHEMATICS

Paper 2

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES

*Answer **all** questions in section **A** and any **five** in section **B**.*

Write in blue or black ink only. You may use pencil for diagrams or graphs only.

***All** the necessary working must be clearly shown.*

Silent non-programmable scientific calculators may be used.

Where necessary, take acceleration due to gravity, $g = 9.8ms^{-2}$

SECTION A (40 marks)

Attempt **all** questions in this section.

1. Events A and B are such that $P(B/A) = \frac{1}{3}$, $P(B/A^1) = \frac{5}{8}$ and $P(A^1 \cap B^1) = \frac{3}{20}$. Find ;

(a) $P(A \cap B^1)$

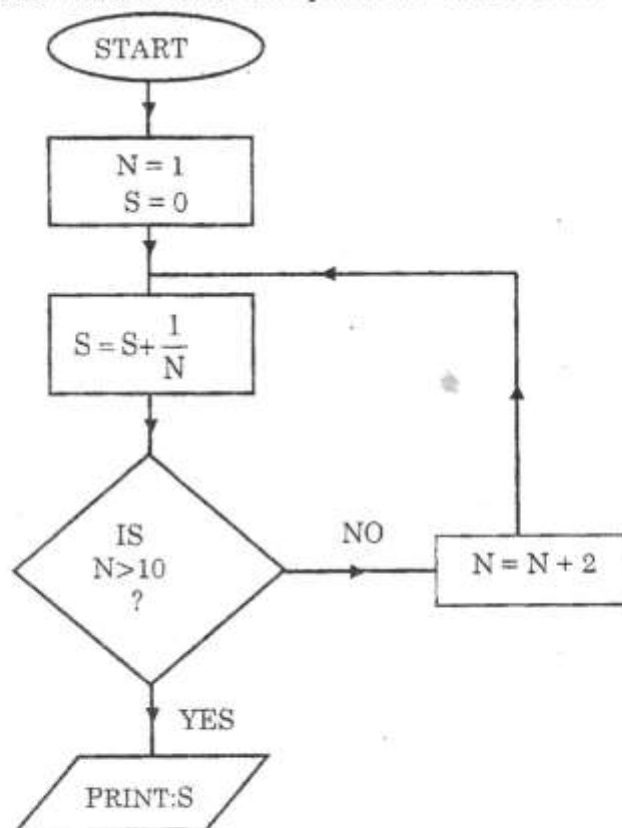
(b) $P(A/B)$.

(5marks)

2. From the top of a building 45m high, a stone is projected upwards with a speed $V \text{ ms}^{-1}$ at an angle of 30° to the horizontal. Two seconds later another stone is dropped from the same point. If the stones reach the ground at the same time. Find the value of V.

(5marks)

3. Study the flow chart below and answer the questions that follow.



- (i) Perform a dry run for the flow chart above
 (ii) State the purpose of the flow chart.

(4marks)

(1mark)

4. In a certain clan the probability of a family having a girl child is 0.75. If there are 8 children in a family, determine;
- (i) the expected number of girls. (2marks)
- (ii) the probability that there are more boys than girls. (3marks)
5. Two forces have magnitudes 5N and FN. If the resultant force has magnitude 6N, acting at an angle of 40° to the 5N force, Calculate the value of F and the angle it makes with the 5N force. (5marks)
6. Show that the equation $x - \pi \sin x = 0$ has a root between $\frac{\pi}{2}$ and π . Hence use linear interpolation **once** to estimate the root correct to three decimal places. (5marks)
7. The table below shows the scores in mathematics paper1 and paper 2 by eight students.

Paper1	40	90	60	35	55	82	40	35
Paper2	37	68	76	50	44	68	40	44

Calculate the rank correlation coefficient between the two papers and comment on your result. (5marks)

8. A particle describes simple harmonic motion about point O as centre and amplitude a metres. Given that the period of the motion is $\frac{\pi}{4}$ seconds and maximum speed of the particle is 16ms^{-1} . Find :
- (i) the speed of the particle at a point B, a distance $\frac{3}{4}a$ metres from O.
- (ii) the time taken to travel directly from O to B. (5marks)

SECTION: B (60MARKS)

9. The table below shows the time in minutes spent on phone each day by a group of people.

Time (min)	0-<5	5-<10	10-<20	20-<30	30-<40	40-<60
No. of people	11	12	32	18	10	6

- (a) Calculate the;
- (i) Mean
- (ii) Variance

- (b) Draw a histogram for the data and use it to estimate the mode. (12marks)

10. Two particles P and Q of mass 2kg and 3kg respectively, are joined by a light inextensible string. Initially the particles are at rest on a rough horizontal plane with the string taut. A constant force F of magnitude 30N is applied to Q in the direction PQ. The force is applied for 3s and during this time Q travels a distance of 6m. The coefficient of friction between each particle and the plane is μ .

- (a) Find ;
- (i) the acceleration of Q (3marks)
 - (ii) the value of μ . (3marks)
 - (iii) the tension in the string (3marks)
- (b) When the particles have moved for 3 seconds, the force F is removed. Find the time between the instant force F is removed and the instant Q comes to rest. (3marks).

11. A continuous random variable X has a probability density function, $f(x)$;

$$f(x) = \begin{cases} \frac{1}{3}(x-2) & 2 \leq x \leq 3 \\ \alpha & 3 \leq x \leq 5 \\ \frac{1}{3}(3\beta - x) & 5 \leq x \leq 6 \\ 0 & \text{elsewhere} \end{cases}$$

- (a) Find the values of the constants α and β (4marks)
- (b) Calculate the mean of X (2marks)
- (c) Determine the cumulative distribution function, $F(x)$. (6marks)

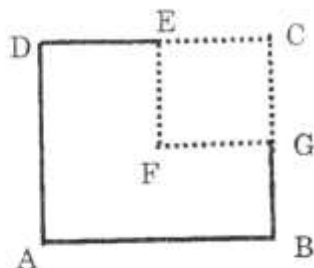
12. (a) Use trapezium rule with 6-ordinates to estimate the value of $\int_0^1 xe^{-x} dx$. Give your answer correct to **three** decimal places. (6marks)

- (b) (i) Find the exact value of $\int_0^1 xe^{-x} dx$. (3marks)
- (ii) Determine the percentage error made in (a) above give you answer correct to **two** decimal places. (3marks)

13. A particle is projected from a point 2m above the ground level with a velocity of 40ms^{-1} at an angle of 60° to the horizontal. Find;

- (a) the time it takes to hit the ground,
- (b) the horizontal distance from the point of projection when it hits the ground
- (c) the speed with which it hits the ground. (12marks)

14. (a) Three particles of masses 3kg, 5kg, and λ kg are placed at points with position vectors $\begin{pmatrix} 4 \\ 0 \end{pmatrix}m$, $\begin{pmatrix} 0 \\ -3 \end{pmatrix}m$, $\begin{pmatrix} 4 \\ 2 \end{pmatrix}m$ respectively. If the centre of mass of the system is $(2, \beta)$, find the values of λ and β . (4marks)
- (b) A uniform square lamina ABCD of side $2l$ has a square CEFG of length l removed from it as shown below.



- (i) Find the distance of the centre of gravity of the remaining lamina from AB and AD.
- (ii) if the remaining lamina is suspended from B, find the angle AB will make with the vertical. (8marks)

15. (a) Show that the Newton Raphson formula for finding the root of the equation $x = \cos^2 x$ is given by;
- $$x_{n+1} = \frac{2x_n \sin(2x_n) + \cos(2x_n) + 1}{2(1 + \sin(2x_n))}$$

- (b) Use the formula in (a) above with the initial approximation of $x_0 = 0.45$, to find the root of the given equation correct to **three** decimal places. (12marks)

16. (a) A random sample of 81 mangoes is taken from a large consignment of mangoes and their masses (in grams); $x_1, x_2, x_3, \dots, x_{81}$ measured

such that $\sum_{i=1}^{81} x_i = 176.70$ and $\sum_{i=1}^{81} x_i^2 = 424.51$

- (i) calculate the unbiased estimate for the variance of the masses of mangoes in the consignment.
- (ii) determine the 98% confidence interval for the mean mass of mangoes in the consignment. (8marks)
- (b) The weights of ball bearings manufactured by a certain industry are normally distributed with mean 25 grams and standard deviation 4 grams. If a random sample of 16 ball bearings is taken, find the probability that the mean of the sample lies between 24.12 grams and 26.73 grams.

(4marks)

END