S475/1
SUBSID. MATHEMATICS
Paper 1
Nov./ Dec. 2019
2 ⅔ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

SUBSIDIARY MATHEMATICS

Paper 1

2 hours 40 minutes

INSTRUCTIONS TO CANDIDATES:

Answer **all** *the* **eight** *questions in section* **A** *and only* **four** *questions in section* **B**.

Any additional question(s) answered will **not** *be marked.*

Each question in section **A** *carries* **5** *marks while each question in section* **B** *carries* **15** *marks.*

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

Begin each answer on a fresh sheet of paper.

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

Squared paper is provided.

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

SECTION A: (40 MARKS)

Answer **all** *the questions in this section.*

1. Show that $\sqrt{\frac{25^3+5^6}{5^7-5^6}}=\frac{\sqrt{2}}{2}$. *(05 marks)*

2. Two events A and B are such that $P(A)=\frac{19}{30}$, $P(B)=\frac{2}{5}$ and $P(A\cap\overline{B})=\frac{2}{5}$.

   Find:

   (a) $P(A\cap B)$. *(03 marks)*

   (b) $P(A\cup B)$. *(02 marks)*

3. Determine the possible values of a for which the equation $2x^2+(a+2)x+(a+2)=0$ has equal roots. *(05 marks)*

4. A random variable X has the probability distribution shown in the table below.

x	0	1	2	3	4	5
$P(X=x)$	0.01	0.15	$2b$	0.20	b	0.10

   Calculate the;

   (a) value of b. *(02 marks)*

   (b) expectation of X, $E(X)$. *(03 marks)*

5. Evaluate $\int_1^2 \frac{x^4-1}{x^2}\,dx$. *(05 marks)*

6. The ages of eight students in a class are: 12, 13, 14, 15, 12, 17, 13, 16.

   Find the;

   (a) mean age. *(02 marks)*

   (b) variance. *(03 marks)*

7. Solve the equation $\cos\theta=\sin 2\theta$ for values of θ from 0° to 360°. *(05 marks)*

8. A particle of mass 5 kg rests in limiting equilibrium on a rough plane inclined at 20° to the horizontal.

   Calculate the;

   (a) normal reaction. *(03 marks)*

   (b) coefficient of friction between the particle and the plane. *(02 marks)*

SECTION B: (60 MARKS)

Answer only **four** *questions from this section.*

9. The table below shows the tax collection of a town council in millions of shillings for six consecutive months.

Month	Jan	Feb	Mar	Apr	May	June
Tax (in millions)	21.5	24.3	21.8	26.2	22.7	28.9

(a) Construct the 3-month moving averages for the given data. *(06 marks)*

(b) Plot the 3-month moving averages and the original data on the same axes. *(06 marks)*

(c) Use your graphs to estimate the town council's tax collection for the month of July. *(03 marks)*

10. The equation of a curve is $y = 3 + 2x - x^2$.

(a) Determine the;

(i) coordinates and nature of the turning point of the curve. *(06 marks)*

(ii) y– and x– intercept of the curve. *(04 marks)*

(b) (i) Sketch the curve. *(02 marks)*

(ii) Find the area enclosed by the curve and the x– axis. *(03 marks)*

11. The marks scored by candidates in an examination are normally distributed with a mean score of μ and standard deviation of δ. Given that 37.5% of the candidates scored below 40 and that 12.5% scored above 60, find the;

(a) values of μ and δ. *(09 marks)*

(b) probability that a candidate scored between 46 and 55. *(06 marks)*

12. If $\boldsymbol{OA} = \begin{pmatrix} 6 \\ 5 \end{pmatrix}$, $\boldsymbol{OB} = \begin{pmatrix} 9 \\ 2 \end{pmatrix}$ and $\boldsymbol{OC} = \begin{pmatrix} 7 \\ 0 \end{pmatrix}$,

(a) find the vectors;

(i) $\boldsymbol{BC}$.

(ii) $\boldsymbol{AB}$. *(06 marks)*

(b) show that the vectors $\boldsymbol{AB}$ and $\boldsymbol{BC}$ are perpendicular. *(03 marks)*

(c) determine the magnitude of the vector $2\boldsymbol{BC} - 3\boldsymbol{AB}$. *(06 marks)*

13. The table below shows the heights to the nearest cm and masses to the nearest kg of 10 students, *A* to *J*.

Student	***A***	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***
Mass (kg)	53	68	57	52	66	64	63	58	57	68
Height (cm)	148	172	156	139	163	158	168	151	144	170

(a) (i) Plot the given data on a scatter diagram.

(ii) Draw a line of best fit on the scatter diagram.

(iii) Estimate the height of a student whose mass is 60 kg.

(*08 marks*)

(b) Calculate the rank correlation coefficient for the data. Comment on your result. (*07 marks*)

14. A car of mass 1200 kg has a maximum speed of 180 kmh^{-1} on a level road when the power of the engine is 50 kw. When the car ascends an incline of 1 in 5 with the same engine power, the resultant force is 1648 N.

Determine the;

(a) resistance force along the level road. (*05 marks*)

(b) maximum speed of the car up the incline. (*06 marks*)

(c) acceleration of the car up the plane when its speed is 8 ms^{-1}. (*04 marks*)