456/1
MATHEMATICS
Paper 1
Oct. / Nov. 2020
2½ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

MATHEMATICS

Paper 1

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

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

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

All *necessary calculations must be done in the answer booklet(s) provided. Therefore, no paper should be given for rough work.*

Graph 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. The sum of three consecutive odd numbers is 69. If the first number is n, find the three numbers. *(04 marks)*

2. Solve the simultaneous equations:

$$2x - 3y = 12$$
$$7x + 5y = 11$$

(04 marks)

3. Given that $\tan\theta = \frac{12}{5}$, find the value of $\sin\theta$ without using mathematical tables or a calculator. *(04 marks)*

4. The ages of students who were treated in a day at a school clinic are shown in the table below.

Age (years)	12	13	14	15
Number of students	1	2	4	n

Their mean age was 13.9 years. Find the value of n. *(04 marks)*

5. Determine the value of x in the equation

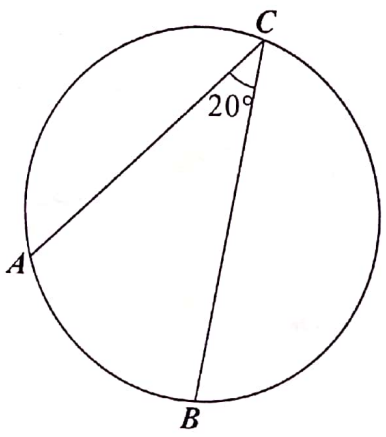
$$16^x = 8^{4x-2}$$

(04 marks)

6. Solve the equation: $x^2 + 10x - 24 = 0$ *(04 marks)*

7. If $\begin{pmatrix} 3 & x \\ 5 & 6 \end{pmatrix}\begin{pmatrix} 2 \\ -1 \end{pmatrix} = \begin{pmatrix} 2 \\ y \end{pmatrix}$, find the values of x and y. *(04 marks)*

8. In the diagram below, the minor arc AB subtends an angle of 20° at the circumference of the circle.



If the radius of the circle is 7 cm, find the length of the minor arc AB. (Give your answer to **1** decimal place) *(04 marks)*

9. A rectangle whose area is 16 cm^2 is given a transformation represented by the matrix $\begin{pmatrix} 3 & 6 \\ 2 & 5 \end{pmatrix}$. Find the area of the image of the rectangle. *(04 marks)*

10. The table below shows the weights of 35 students.

Weight (Kg)	25-29	30-34	35-39	40-44	45-49
Number of students	5	8	12	6	4

(a) Draw a histogram for the data.

(b) Use the histogram to estimate the modal weight of the students. *(04 marks)*

SECTION B: (60 MARKS)

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

11. Town *A* is at a distance of 400 km and on a bearing of 076° from town *C*. Town *B* is at a distance of 250 km and on a bearing of 045° from town *C*.

(a) Draw an accurate diagram showing the positions of the three towns. Use a scale of 1 cm to represent 50 km. *(05 marks)*

(b) Determine the distance and bearing of town *B* from town *A* using your diagram. *(03 marks)*

(c) Jane leaves town *C* for town *B* and drives at an average speed of 80km/h. At the same time, Rose leaves town *A* for town *B* and drives at 75km/h. Who arrived at town *B* earlier? *(04 marks)*

12. (a) Given that $R = 1.21 \times 10^{-4}$ and $S = 4.4 \times 10^{-6}$, without using mathematical tables or a calculator, find in standard form the value of $\frac{2\sqrt{R}}{S}$. *(04 marks)*

(b) Simplify $\sqrt{2^x \times 5^{2x} \times 2^x}$ *(04 marks)*

(c) Factorise completely : $27x^2 - 12y^2$. *(04 marks)*

13. Three companies *A*, *B* and *C* bought vehicles for sale as follows:
Company *A* bought 4 buses, 8 taxis and 6 saloon cars.
Company *B* bought 10 buses, 2 taxis and 8 saloon cars.
Company *C* bought 5 buses, 3 taxis and 9 saloon cars.
Each bus was bought at 200 million shillings, a taxi at 64 million shillings and a saloon car at 18 million shillings.
The buses are to be sold at 240 million shillings each, taxis at 72 million shillings each while each saloon car at 20 million shillings.

(a) Write down a;

(i) 3×3 matrix for vehicles bought by the three companies. *(03 marks)*

(ii) 3 ×2 matrix for the cost prices and selling prices. *(02 marks)*

(b) Use the matrices you have written in (a) to calculate the total profit for each company. *(07 marks)*

14. (a) Copy and complete the table below:

θ	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°
$\sin\theta$			0.77			0.98		0.98		0.87		0.64	
$y = 2\sin\theta$			1.54			1.96		1.96		1.74		1.28	

(03 marks)

(b) Use your completed table to draw the graph of $y = 2\sin\theta$. Use a scale of 1cm to represent 10° and 1 cm to represent 0.10 units. *(04 marks)*

(c) On the same axes, draw the line $y = 1.2$
Hence obtain the values of θ when $y = 1.2$ *(03 marks)*

(d) Use the graph to find the value of y when $\theta = 56°$. Hence determine sin 56°. *(02 marks)*

15. A basket contains 5 mangoes and 7 oranges. A fruit is picked at random from the basket and not replaced. A second fruit is then picked. Determine the probability that:

(a) both fruits picked are oranges. *(05 marks)*

(b) one fruit is an orange and the other a mango. *(04 marks)*

(c) the two fruits picked are the same. *(03 marks)*

16. A triangle PQR has vertices P (2, 1), Q (6, 4) and R (4, 5). PQR is mapped onto triangle $P'Q'R'$ with vertices at P' (10,3), Q' (6,0) and R' (8, –1) under a rotation. $P'Q'R'$ is then mapped onto $P''Q''R''$ after a translation of $\begin{pmatrix} -2 \\ 1 \end{pmatrix}$.

Find the;

(a) (i) centre of rotation.
(ii) angle of rotation. *(08 marks)*

(b) coordinates of P'', Q'' and R''. *(04 marks)*

17. A television assembly plant assembles at least 10 coloured televisions and over 35 black and white televisions daily. The total number of coloured televisions and black and white televisions assembled in a single day is less than 50.

(a) If x is the number of coloured televisions and y the number of black and white televisions assembled daily, write down three inequalities representing the above information.

(03 marks)

(b) Represent the inequalities on a graph taking 2 cm to represent 5 units on both the x-axis and y-axis. *(06 marks)*

(c) Use your graph to determine the greatest possible total number of televisions that can be assembled in one day. *(03 marks)*